Appendix C

Phytotoxicity and Vegetation Community Study

Freeport-McMoRan Chino Mines Company

PHYTOTOXICITY AND VEGETATION COMMUNITY STUDY

Smelter Tailings Soils Investigation Unit

September 2018

,

PHYTOTOXICITY AND VEGETATION COMMUNITY STUDY

Smelter Tailings Soils Investigation Unit

Prepared for:

Freeport-McMoRan Chino Mines Company

Vanadium, New Mexico

Prepared by:
Arcadis U.S., Inc.
11001 W. 120th Avenue
Suite 200
Broomfield
Colorado 80021
Tel +1 303 544 0043
Fax +1 720 887 6051

Our Ref.:

B0063543.0014

Date:

September 2018

CONTENTS

TABLES

FIGURES

APPENDICES

ACRONYMS AND ABBREVIATIONS

AICc	corrected Akaike information criterion
AOC	Administrative Order on Consent
AOSA	Association of Official Seed Analysis
ASTM	ASTM International
bgs	below ground surface
$CaCl_2$	calcium chloride
Chino	Freeport-McMoRan Chino Mines Company
DEL	*de minimis* effects level
EC	effects concentration
ECx	effects concentration that reduces plant viability by x%
ERA	Ecological Risk Assessment
FS	Feasibility Study
IA	Investigation Area
LTL	lower tolerance limit
mg/kg	milligrams per kilogram
mm	millimeter
NDVI	Normalized Difference Vegetation Index
NLIN	non-linear regression
NMED	New Mexico Environment Department
NRCS	Natural Resources Conservation Service
OAT	observed apparent trend
OECD	Organization for Economic Cooperation and Development
pCu	cupric ion activity
PEL	probable effects level
PLS	pure live seed
QAPP	Quality Assurance Project Plan
RAC	Remedial Action Criterion
RI	Remedial Investigation
ROD	Record of Decision

RPD	relative percent difference
Site	Chino Mine
SOP	Standard Operating Procedure
STSIU	Smelter and Tailing Soils Investigation Unit
Study	Phytotoxicity and Vegetation Community Study
USEPA	United States Environmental Protection Agency
Work Plan	Phytotoxicity and Vegetation Community Study Work Plan

EXECUTIVE SUMMARY

This Technical Report on the Phytotoxicity and Vegetation Community Study (Study) for the Smelter and Tailing Soils Investigation Unit (STSIU) at the Chino Mine Investigation Area, Grant County, New Mexico (the Site) has been prepared in accordance with the Administrative Order on Consent (AOC) between Freeport-McMoRan Chino Mines Company (Chino) and the New Mexico Environment Department (NMED). Based on site-specific greenhouse phytotoxicity studies and plant community surveys conducted in the field in 1999 (Schafer and Associates 1999), the site-wide and STSIU-specific Ecological Risk Assessments (ERAs, NewFields 2005, 2008) linked the mobilization and bioavailability of total copper detected in shallow soil to cupric ion activity, quantified as pCu[1]. Because the field and laboratory effects were best correlated with pCu, risk criteria for remedies based on pCu were proposed. NMED issued a pre-Feasibility Study (FS) Remedial Action Criterion (RAC) for shallow soil within STSIU of pCu ≥ 5, where the total copper concentration in soil is > 327 milligrams per kilogram (mg/kg), to reduce soil toxicity to plants from copper. In setting the pre-FS RAC, NMED (2011) noted:

> *New information can be used to refine RACs and selection of alternatives, if sufficient information becomes available that all parties agree upon. This is supported by the NCP in §300.430(e)(2)(i) which states "establish remedial action objectives specifying contaminants and media of concern, potential exposure pathways, and remediation goals. Initially, preliminary remediation goals are developed based on readily available information….and should be modified, as necessary, as more information becomes available during the RI/FS."*

This report provides new information that may be useful for interpreting the pCu RAC and selecting remedial alternatives.

Consistent with the Phytotoxicity and Vegetation Community Study Work Plan (Arcadis 2014), Chino implemented greenhouse phytotoxicity and field vegetation community studies to address limitations and uncertainties identified in similar studies conducted in 1999 for the ERAs, as well as changes in site conditions since 1999. The objective of both studies is to refine the ERA estimates of site-specific *de minimis* effects level (DEL) and probable effects level (PEL) thresholds for pCu. The specific objective of the greenhouse phytotoxicity study is to identify thresholds for adverse effects of pCu on ecologically relevant plant emergence, survival, and growth endpoints after accounting for any confounding physical and chemical factors in the soils. The objective of the field community study is to evaluate the adverse effects thresholds of pCu on plant species richness (hereafter called richness), cover, and rangeland conditions in the field after accounting for confounding environmental factors.

The greenhouse phytotoxicity study design was improved from 1999 by including larger sample sizes and native, locally adapted plant species rather than agricultural species. The native grass and forb species used in the greenhouse experiment were sideoats grama (*Bouteloua curtipendula*) and tansyleaf tansyaster (*Machaeranthera tanacetifolia*), respectively. To evaluate the effect of local adaptation, seeds for these species were collected from the Site and purchased from a nursery that cultivated these

---

[1] pCu = -log{Cu^{2+}}. Note that pCu is negatively correlated to cupric ion activity {Cu^{2+}}.

species' seeds. The results from the locally adapted seeds were compared to the results from nursery seeds not adapted to the area. Alfalfa was also included to test the repeatability of the alfalfa test in the 1999 study. Overall, five seed types were evaluated: alfalfa seeds, sideoats grama site seeds, sideoats grama nursery seeds, tansyaster site seeds, and tansyaster nursery seeds. The greenhouse and community study designs were also improved by including more representative (1) reference locations not impacted by the smelter and windblown tailings, (2) *de minimis* locations defined as locations with background copper concentrations that are far from or upwind of the smelter and tailings, and (3) locations exhibiting the variety of habitats with elevated copper and depressed pH on the STSIU. The reference locations represent background conditions for both pH and copper concentrations, and the *de minimis* locations represent background conditions for copper concentrations.

Dose-response curves for pCu were developed in both the laboratory and field studies to identify the DEL and PEL of measured plant and community endpoints (i.e., emergence, survival, shoot height, shoot weight, and root length). The DEL is the pCu where effects on endpoints are detectable relative to background effects. The PEL is the pCu associated with a 50% reduction (EC50) of endpoint values relative to background effects. The DEL and PEL were identified using two methods. The DEL and PEL for each endpoint first were selected to be the EC10 and EC50, respectively, of the dose-response curve. Because some reference locations showed pCu effects greater than the EC10 level, the DEL was also estimated as the predicted pCu of the minimum of the background endpoints, and the PEL was estimated as the predicted pCu at half the minimum of these background endpoints. Though this minimum represents background conditions, and therefore is technically higher and more conservative than the point at which effects are detectable (definition of DEL), it was used to predict the DEL to be conservative. The first approach for identifying the DEL and PEL is referred to as the ECx method, while the second approach is referred to as the minimum reference method. Sets of DELs and PELs were developed and ranges of these estimates reported using both methods.

Though analyzed, the tansyaster results were not included in the final estimate of the greenhouse study PEL and DEL because the performance of the control plants fell far short of success criteria and the results were highly variable. Similarly, the root length dose-response curves for alfalfa were greatly different from the curves for alfalfa in 1999, and were not included in the final interpretation because of their unreliability. The other greenhouse endpoints were included because they produced alfalfa dose-response curves similar to those observed in the 1999 study.

The results for the greenhouse study are summarized from all analyses and methods as follows:

- The non-linear S-shaped dose-response model that combined all five seed types fit the data well ($R^2 \geq 0.74$).
- The DEL for pCu ranged from 3.8 to 7.7 across endpoints and seed types.
- The PEL for pCu ranged from 3.7 to 5.7 across endpoints and seed types.
- Site-collected seeds of native species were no more tolerant of low pCu than agricultural or nursery-acquired seeds when PELs were compared.
- Site-collected and nursery seeds of native species performed similarly.

For the plant community data, dose-response curves on pCu were developed for species richness, percent cover, and the rangeland condition (via observed apparent trend [OAT] score; Arcadis 2011), the three endpoints measured in the field. These curves fit the data best with multiple linear regressions that accounted for soil category (steep slopes, relatively flat rocky areas, relatively flat granular areas, and bedrock areas). Soil category was more related to richness and rangeland condition (OAT) than pCu. An EC10 and EC50 could not be calculated from a linear regression (no threshold); therefore, the DEL and PEL pCu of the community endpoints were based on the predicted pCu of the minimum of the reference and half the minimum of the reference endpoints, respectively. The DEL and PELs were estimated only from regressions that were significant, where significance is defined as $p \leq 0.05$.

The results for the community study were:

- The linear model fit the pCu and richness data well for all soil categories ($R^2 = 0.83$).
- The linear model fit the pCu and cover data well only for bedrock and flat granular soils with $R^2 = 0.84$.
- The linear model fit the pCu and OAT score data poorly and only for bedrock with $R^2 = 0.47$.
- The DEL ranged from 5.6 (based on cover) to 7.5 (based on richness) for flat granular soils.
- The PEL ranged from 2.1 (based on richness) to 3.4 (based on cover) for flat granular soils.

No DEL or PEL is available for the other soil categories because the *de minimis* areas sampled that were far or upwind from the smelter and tailings in other categories appeared to have lower pH than background and could not be used as reference soils needed for the analysis. When restricted to the flat granular soil category, the results for the PEL were generally consistent between the greenhouse phytotoxicity and field community studies conducted in 2013 and 2014. The PEL ranged from about 2 to 3.5 for both studies in the flat granular category.

The results show that several plant community parameters in the STSIU appear to respond to pCu. At the individual plant scale, plant emergence, survival, and growth appear to respond to different levels of pCu. At the community scale, pCu is correlated to richness and, for some soil type categories, to cover (bedrock and flat granular soils) and rangeland condition (bedrock locations). Cupric ion activity is not correlated to plant cover or rangeland condition for steeper slopes and flat rocky areas. Because pCu reflects the interactions among hydrogen ions, soil solution ionic strength, ligand availability, and total copper, it is a better predictor of plant response than pH or copper alone.

The findings from this study further show that the DEL and PEL for smelter and windblown tailing effects are highly variable, depending on the soil category, plant species, endpoint, and soil properties, including the pH of its parent material and buffering capacity of the soil. Selection of remedial options in the FS should consider the site-specific conditions for these factors when evaluating cleanup criteria based on pCu.

Information from both studies will help inform decisions on remedial goals for pCu and remedial technologies useful for the STSIU. This study and its conclusions will be reported in the STSIU FS as a line of evidence to assist the NMED and stakeholders in making final decisions for the STSIU, which will ultimately be documented in the record of decision (ROD).

1 INTRODUCTION

This Technical Report on the Phytotoxicity and Vegetation Community Study (Study) for the Smelter and Tailing Soils Investigation Unit (STSIU) at the Chino Mine Investigation Area, Grant County, New Mexico (the Site) has been prepared in accordance with the Administrative Order on Consent (AOC) between Freeport-McMoRan Chino Mines Company (Chino) and the New Mexico Environment Department (NMED). An approved Remedial Investigation (RI) Report for STSIU summarized results for investigations showing depressed pH and elevated copper concentrations in shallow (0- to 6-inch depth) soils in parts of the STSIU (Chino 1995, SRK 2008).

The Site is one of the Investigation Units identified within the Investigation Area (IA) of the AOC. The IA includes all areas in which environmental media may have been affected by historical operations at Chino's copper mining and processing facilities. The STSIU is located approximately 12 miles southeast of Silver City, and includes historical smelting facilities, mineral processing facilities, tailing impoundments, and surrounding areas. The STSIU is located east of the Town of Hurley, New Mexico (which contained the Hurley Smelter), and has previously been defined as all areas containing and proximal to Chino's former copper smelter and ancillary facilities, including the tailings disposal facility.

Studies in the literature have shown that copper has a toxic effect on plants at high concentrations (Loneragan et al. 1981, Paschke and Redente 2002, Kopittke et al. 2010), though it has beneficial effects at low concentrations, as it is an essential plant nutrient. Based on site-specific greenhouse phytotoxicity studies and plant community surveys conducted in 1999 (Schafer and Associates 1999), the site-wide and STSIU-specific Ecological Risk Assessments (ERAs) stated that elevated concentrations of copper and other metals, combined with depressed soil pH, have led to a risk of phytotoxicity for some areas of the Site (NewFields 2005, 2008). For plants, these ERAs linked the mobilization and bioavailability of total copper in the shallow surface layer of the soil to cupric ion activity, quantified as pCu[2]. Because the field and laboratory effects were best correlated with pCu, risk criteria for remedies based on pCu were proposed. NMED issued a pre-Feasibility Study (FS) Remedial Action Criterion (RAC) for shallow soil within the STSIU of pCu ≥ 5, where total copper in soil is > 327 milligrams per kilogram (mg/kg) to reduce soil toxicity to plants from copper (327 mg/kg is background threshold for copper). In setting the pre-FS RAC, NMED (2011) noted:

> *New information can be used to refine RACs and selection of alternatives, if sufficient information becomes available that all parties agree upon. This is supported by the NCP in §300.430(e)(2)(i) which states "establish remedial action objectives specifying contaminants and media of concern, potential exposure pathways, and remediation goals. Initially, preliminary remediation goals are developed based on readily available information….and should be modified, as necessary, as more information becomes available during the RI/FS."*

This report provides new information that may be useful for interpreting the pCu RAC and selecting remedial alternatives. Though the pre-FS RAC was established using 1999 results in the site-wide ERA, those 1999 studies had low sample sizes of representative locations and plant species. The studies were

---

[2] pCu = –log{Cu^{2+}}. Note that pCu is inversely correlated to cupric ion activity {Cu^{2+}}.

repeated in 2013 and 2014 to improve upon the associated knowledge base for decision-making. Repeating the studies with improvements addresses concerns that the 1999 greenhouse phytotoxicity studies, which used agricultural species, did not adequately identify cause-and-effect relationships at the Site (MFG 2004). Limitations and uncertainties associated with the 1999 greenhouse tests and vegetation community study include the following:

- For the phytotoxicity greenhouse study of pCu effects:
  - The greenhouse phytotoxicity tests were conducted using non-native, naïve plant species that may not be representative of species present at the Site.
  - Physical and chemical factors that vary among site soils and between the Site and reference (unimpacted) soils used in the study were not fully considered. If correlated to pCu, these factors could be confounding the interpretation of the phytotoxicity results with respect to pCu.
  - The reference soils collected at the Grant County Airport on the west side of the STSIU were not representative of most site soils.
  - Sample size was limited for low pCu (i.e., high cupric ion activity) treatments and reference locations (e.g., only one reference location was used for the alfalfa test).
- For the vegetation community study of pCu effects:
  - ERA sample locations for soils and vegetation did not represent some of the areas with low pCu, such as bedrock, slopes, and tops of ridges, nor did they account for the effect of such substrate or topographic differences.
  - The vegetation communities of reference locations with background copper concentrations at the Grant County Airport were not representative of communities on the east side of the STSIU.

Specifically, more representative species in the greenhouse study are required because plant species can adapt and thrive in unique ecosystems, such as high-altitude, semi-arid environments, as well as in soils with naturally elevated metals concentrations (Chino 2004, 2007). Such adapted plants are expected to be more resilient than the naïve plants or agricultural species used in 1999, both of which are generally not adapted to the local environmental conditions. As such, plant toxicity tests on naïve species are unlikely to represent the potential phytotoxic effects experienced by locally adapted plants (Loneragan et al. 1981, Bradshaw et al. 1990, MacNair 1990, Paschke and Redente 2002, MFG 2004, Haque 2008). Genetic strains of native plant species growing at the Site may be more tolerant of local conditions than nursery strains (MacNair 1990, Haque 2008) and agricultural species (Paschke and Redente 2002) because natural unexposed populations often have a low frequency of plants with tolerant genes; natural selection can increase the frequency of these alleles when the plant population is exposed to high metal concentrations (MacNair 1997, MacNair et al. 2000). Native species are known to develop this increased tolerance over a relatively short time frame (< 50 years [Bradshaw et al. 1990]; 70 years for copper [Bondada and Qiyingma 2003]).

More representative soils and communities in reference locations for the respective greenhouse and community field studies also are required because the reference sample locations in the original 1999 studies were near the Grant County airport; they are not truly representative of most of the vegetation types and soils present in Chino investigation units (i.e., STSIU and Hanover/Whitewater Creek). The reference locations near the airport are flat grassland areas representative only of the small western portion of the STSIU that falls within the Gila Conglomerate Formation/Plack soil type. They do not represent steep areas, eroded areas, or areas with a high percentage of bedrock found on the Site. Such areas are expected to exhibit different soil chemistry and plant communities. Arcadis (2017a) found that plant communities on the STSIU respond strongly to soil conditions and grazing, which was not considered. Representative soils with background copper concentrations in diverse topographic locations with different grazing histories that are located far from or upwind of past and present contaminant sources need to be included as reference areas.

The 1999 phytotoxicity and community studies also did not explicitly account for potentially confounding physical and chemical factors in the soils evaluated, which may need to be incorporated into the dose-response curves. The 1999 study evaluated potential confounding variables affecting the greenhouse endpoints separately (each variable independently tested for correlation to pCu), but did not use them to adjust the dose-response curves. However, to meet the purpose of the ERA, site soils were selected in 1999 that had similar slope and elevation, which is one way to reduce potential confounding factors. Subsequently, areas of potential concern have been found to occur across soils of varying topography and soil development, and the objective for the new studies is to evaluate plant emergence and growth across a range of soils, rather than to focus on a subset with similar conditions. Ideally, physical and chemical factors other than pCu should be held constant in the phytotoxicity study, but this is not possible when soils from such a broad heterogeneous area are of concern. The alternative approach is to account for physical and chemical factors that vary by incorporating covariates in dose-response curves (Larcher 1995, Plaster 2009). Further, sample sizes in the Site and reference areas of the STSIU must be larger than that of the 1999 study to statistically detect more accurate thresholds for toxic effects.

Additionally, the 1999 studies were repeated because site conditions have changed since the 1999 soil sampling, resulting in the potential reduction in bioavailable copper in site soils. The two historical smelter stacks have since been shut down and demolished. The smelter stacks historically emitted sulfuric acid and trace copper concentrations. During the 1970s, in compliance with new Clean Air Act amendments, the stacks were permitted, controls were implemented to reduce emissions, and the stacks finally ceased operating in 2002. The other historical source (windblown dust) has also been mitigated through the reclamation of Lake One and older tailing dams. Additionally, a significant upward shift in soil pH was observed at STSIU following a “white rain” precipitation event on January 7, 2008. During the event, a milky alkaline rain was deposited on the Site. The change in soil pH due to the white rain event has lowered cupric ion activity of the soil (Arcadis 2017b) and, more importantly, possibly changed the complex soil geochemistry (e.g., cation exchange capacity) in a manner that could shift the relationship between pCu and plant and community endpoints.

For these various reasons, greenhouse and community studies were initiated with the following improvements to the 1999 studies:

1. The study was conducted on ecosystems exposed to current conditions after the white rain and smelter closure.

2. More representative plant species and sample locations were incorporated.

3. Confounding physical and chemical factors were considered.

4. The sample size was increased.

The results will provide additional empirical information to evaluate the FS alternatives in relation to the pCu pre-FS RAC for plants. The information, which is new to the administrative record, will inform decisions on how to apply the current pre-FS RAC when evaluating remediation alternatives that may affect plant emergence, survival, growth, and plant community cover and diversity. The effect of pCu on the STSIU habitat and rangeland will be emphasized because any remediation is intended to protect wildlife habitat and rangeland generally, not individual plant species.

After discussing these issues with NMED, Chino submitted a Phytotoxicity and Vegetation Community Study Work Plan (Work Plan) in September 2013 for a study designed to evaluate the effects of cupric ion activity on plant germination and growth in a greenhouse laboratory and on vegetation community endpoints in the field. NMED commented on the Work Plan in October 2013, December 2013, and February 2014, and approved the Work Plan in March 2014 (Arcadis 2014).

2 OBJECTIVES AND HYPOTHESES

This report provides the results of two studies: a greenhouse phytotoxicity study and a field vegetation community study. The objective of both studies is to refine the estimate of site-specific thresholds for effects of pCu. The Work Plan states, “Similar to the approach used in the 1999 study, a DEL and PEL will be estimated from concentration/stressor-response curves developed from this study and through comparison with soils that likely have *de minimis* effects because they are far or upwind from past and present contaminant sources.”

Linear and non-linear regression analysis was used to quantify pCu values associated with a range of effects levels (the dose-response curve) and then to identify a *de minimis* effects level (DEL) and probable effects level (PEL), which are defined below.

1. The DEL is the lowest soil pCu above which statistically demonstrable effects from copper are unlikely. It is often the effects concentration (EC) that reduces plant viability by 10 to 20% (i.e., EC10 or EC20). This reduction can be evaluated relative to background plant viability parameters.

2. The PEL is the pCu at which effects are probable. It is defined for this study as the pCu at which effects are observed for approximately 50% of the test population. The 50% reduction in plant viability represented by the PEL can be evaluated relative to background viability.

Background viability can be defined as the plant endpoint values at the asymptote of a pCu dose-response curve or by endpoint values of reference soils. Both definitions are used in this report. The background concentration using reference soils is defined by locations with minimal exposure to the smelter or windblown tailings (far or upwind from these areas). These reference locations must meet the criteria of exhibiting copper concentrations lower than background (327 mg/kg) and should not exhibit impacts caused by smelter acidification. When potential reference locations at a far distance or upwind from the smelter and tailings were found to exhibit lower pH from the smelter but are below background copper concentrations, they were designated “*de minimis*” locations. *De minimis* locations were included in the dose-response curves (as were reference locations) but are not considered reference locations representing background conditions.

Consistent with the Work Plan, the specific objective of the greenhouse phytotoxicity study is to identify thresholds for adverse effects of pCu on ecologically relevant plant emergence, survival, and growth endpoints after accounting for any confounding physical and chemical factors in the soil. The Work Plan states that the greenhouse study will include nursery and site-collected seeds of a native grass and forb as well as alfalfa, an agricultural species. Alfalfa was included to test the repeatability of the alfalfa test in the 1999 study and to test the hypothesis that native plant species collected from the Site will demonstrate higher tolerance to low pCu than agricultural species and nursery seeds of native plant species. This assumes that agricultural species and nursery species are not as well adapted to local environmental conditions. More specifically, the dose-response curve of vegetation endpoints of native species plotted against pCu is expected to shift left from the same response curve for alfalfa developed in 1999 (S-shaped curve for the greenhouse study). The largest shift in this direction is expected to occur for the site-collected seeds. **Figure 1** illustrates the hypothesized relationship using made-up data with the hypothesized dose-response curves. This hypothesized shift is predicted to produce a lower DEL and PEL for site-collected seeds than those observed in 1999 for agricultural seeds. The new alfalfa DEL and PEL are also expected to differ from the 1999 alfalfa study when including more representative reference locations as background exposure[3]. These hypotheses can only be tested if the greenhouse staff are able to successfully germinate and grow seeds of native species on uncontaminated soils in a greenhouse setting.

The objective of the field community study is to evaluate the effects of pCu on plant species richness, cover, and rangeland conditions (via observed apparent trend [OAT] score; Arcadis 2011), after accounting for confounding environmental factors. This study is similar to the 1999 community study, except that it includes more of the habitats potentially impacted. The hypothesis is that the DEL and PEL will differ across different physical habitats and from the 1999 community study PEL and DEL when compared to more representative reference locations.

Information from both studies will help inform decisions on remedial goals for pCu and remedial technologies useful for the STSIU. The study and its conclusions will be reported in the STSIU FS as a line of evidence to assist the NMED and stakeholders in making final decisions for the STSIU, which will ultimately be documented in the record of decision (ROD).

3 METHODS

NMED requested that Chino evaluate effects of pCu on both a native grass and a native forb in the greenhouse study. The greenhouse results then could be compared to effects of pCu on species in the natural community in the field. The native grass species selected for the greenhouse experiment in the Work Plan was sideoats grama (*Bouteloua curtipendula*), and the selected native forb species was scarlet globemallow (*Sphaeralcea coccinea*). As discussed below, however, scarlet globemallow failed to adequately germinate in the control soil. Tansyleaf tansyaster (*Machaeranthera tanacetifolia*) replaced the globemallow, but it also failed to germinate in the control soil to the criteria in the approved Work Plan, though enough plants germinated to report the results. Alfalfa was included as a test species to identify if test conditions in this new study are similar to the performance of alfalfa in the 1999 greenhouse conditions. Alfalfa is an agricultural non-native species, but it provided results for another forb species, which was needed because native forb species often perform poorly in greenhouse experiments.

---

[3] Different methods for estimating the PEL are shown on Figure 1 depending on the background definition, which will be explained under Dose-Response Curve, Section 3.1.5.2.

3.1 Greenhouse Phytotoxicity Study

The greenhouse experiment was implemented in five steps:

1. Collection of 33 soils from the Site and potential reference locations for chemical analysis and for planting seeds (36 total samples were collected, but only 33 analyzed)

2. Collection of seeds from the Site

3. Purchase of nursery seeds from vendors

4. Planting of seeds in pots of the collected soils and control soil in the greenhouse

5. Measurement of desired plant endpoints in each pot at the end of the experiment.

These steps provided data needed to develop dose-response curves and site-specific pCu thresholds for plant emergence, growth, and survival endpoints.

3.1.1 Soil Collection

To develop dose-response curves, the greenhouse phytotoxicity study required four types of soil:

1. Impacted site soils (site soils) as identified in the STSIU remedial investigations

2. “*De minimis”* soils with background copper concentrations (< 327 mg/kg) far from or upwind of the smelter and tailings that did not qualify as reference soils.

3. Reference soils, which are the *de minimis* soils whose chemistry characterize the media as unimpacted by the smelter and/or windblown tailings

4. A control soil that is manufactured with no contaminants.

Locations sampled for the Site, *de minimis*, and reference soils are shown on **Figure 2**. All four types of soils are described in detail below.

Site Soils

To capture the pCu values required in a useful dose-response curve for each plant endpoint, site soils representing a range of pCu from 2 to >8 were obtained, using locations discussed in the Work Plan (Arcadis 2014) and shown on **Figure 2**. Chino focused on collecting an adequate number of samples in the pCu range most likely to represent the threshold for PEL effects, between pCu of 3.5 and 5.5. Soils from a total of 28 site locations, three more than proposed in the Work Plan, were initially collected. The three surplus soils collected from site locations STS-PT-2013-18, -33, and -34 were discarded from the greenhouse experiment to fit the planned greenhouse space available, resulting in 25 site locations.

De Minimis and Reference Soils

As identified in the Work Plan, eight locations upwind or far from the smelter and tailings were identified as possible reference locations and were sampled. Before designating locations as “reference,” the soil chemistry of each area was investigated to identify if the location was likely impacted by the smelter. Four of the locations were identified as possibly impacted and were retained in the dataset but are referred to as *“de minimis*” soils rather than as reference soils. *De minimis* locations are assumed to have some, but minimal acidic impact from the smelter. Both *de minimis* and reference locations refer to areas with background copper concentrations < 327 mg/kg far from or upwind of the smelter and tailings.

The relationship between soluble sulfate and paste pH was used to identify soil and/or bedrock locations that probably have been impacted by smelter activities (**Figure 3**). The potential reference locations were compared to their expected range in background pH from data provided in the Natural Resource Conservation Service (NRCS) Grant County Soil Survey for the area (USDA 1983; pH = 6.6 to 8.4)[4] or to the pH range for rhyolite bedrock sampled in the Chino area (pH = 5.2 to 7.5, see bedrock chemistry in Appendix A). Bedrock chemistry was included to compare to the three bedrock potential reference locations: STS-PT-2013-21, 22, and 23 (**Figure 2**). The expected pH range of site soils before being impacted by the mine, using the same NRCS database, was similar to the potential reference locations at 6.1 to 8.4[5]. All but three of the 25 site soils, all three of the potential reference locations in bedrock, and one other potential reference location not in bedrock exhibited pH values below their respective background ranges (**Figure 3**). They fall within the range where pH is controlled by either hydrogen ion (H^+) acidity (location STS-PT-2013-22) or residual aluminum (Al3+) acidity (locations STS-PT-2013-21, 23, and 27). Such acidity may be from the smelter. Soluble sulfate helps evaluate if the acidity was from the smelter because the smelter produced sulfuric acid, which dissociates into hydrogen and sulfate ions in the soil (Arcadis 2017b).

The acidity in the soils appears to be a result of the smelter activity because samples with pH < 5 contained higher sulfate concentrations than samples with pH > 5. Soils generally only attain a pH < 4 when there are free acids present (e.g., sulfuric acid) or a predominance of exchangeable H^+. When the free acid acidity is partially neutralized, acidity from Al^{3+} hydrolysis contributes residual acidity up to a pH of about 5.5 (Thomas 1996). Therefore, partial neutralization was occurring except at one bedrock location (STS-PT-2013-22). Whether partially neutralized or not, the low pH and elevated sulfate concentrations of the three bedrock locations and one soil location evaluated as potential reference areas indicates that they should be categorized as *de minimis* and are not suitable as reference locations. However, the remaining four potential reference locations (STS-PT-2013-24, 25, 26, and 28) exhibited low sulfate concentrations, high pH, and were retained as reference locations unimpacted by the smelter.

---

[4] Soils of potential reference areas and their background pH were Lonti Gravelly clay loam (6.6 to 7.8), Stellar-Mohave Association (6.6 to 8.4), Manzano loam (6.6 to 8.4), Rock Outcrop-Muzzler cobbly loam (6.6 to 7.3), and Mimbres-Arizo Riverwash Association (pH =6.6 to 8.4).

[5] Site soil background pH was as follows: Abrazo (6.6 to 7.3), Dagflat (6.1 to 7.3), Encierro (6.6 to 7.8), Lonti (25,26), Manzano (6.6 to 8.4), Oro Grande (6.6 to 8.4), Plack (7.9 to 8.4), Plack variant (7.9 to 8.4), Sampson (6.6 to 7.3), and Santana (6.1 to 7.8).

The four reference soils have copper and pH concentrations within the defined background values, resulting in a high pCu (8 to 9). The four *de minimis* soils have background copper concentrations and pH lower than defined background values, resulting in lower pCu (4 to 5). NMED and Chino selected three of the *de minimis* locations (STS-PT-2013-21 to 23) as representative of reference bedrock locations in 2012 for the STSIU FS; bedrock represents about 25% of the site locations, and representative reference areas should be included for the Site. However, due to characteristic low buffering capacity of the different rhyolite formations none were found. All three locations, although outside of the identified COC gradient and distal from the smelter (**Figure 2**), were eliminated as reference, but can be evaluated for comparison to site locations in the STSIU FS as *de minimis* locations with some acidity and no copper impacts. *De minimis* location STS-PT-2013-27 and reference locations STS-PT-2013-25, -26, and -28 are representative of relatively flat, non-bedrock areas with flat granular soil located in the eastern portion of the STSIU. In contrast, the single reference location STS-PT-2013-24 is representative of the conditions in the western portion of the STSIU (also in the flat granular soil category) that represents about 8% of the site area. The flat granular soil category is over-represented in the reference locations, which could be rectified by identifying more reference locations far off site in other soil categories.

At each soil sampling location, one approximately 60-centimeter-diameter hole was dug from 0 to 6 inches below ground surface (bgs; except where bedrock or point of refusal was encountered) to obtain 1 gallon of soil for analysis and at least 8.3 gallons of soil needed for the greenhouse experiment (**Table 1**). The soil samples were homogenized and split into one 1-gallon plastic bag and six 2-gallon canvas bags. The 1-gallon bag of soil was sent to Energy Laboratories for chemical, physical, and pCu analyses (**Table 2**). The six 2-gallon canvas bags were sent to Wildlife International Laboratory for the greenhouse phytotoxicity testing. Rocks were removed in the field, and the soil was sieved to 2 millimeters (mm) before potting in the laboratory. The soil for the globemallow experiment was re-used for the tansyaster experiment. It was re-used only after testing confirmed that pCu had not changed during the 3 weeks of watering the pots planted with the globemallow seeds (**Appendix A, Tables A-1 and A-3**).

Control Soil

The laboratory manufactured a control soil consistent with Association of Official Seed Analysis (AOSA) guidance (AOSA 2009) that was closest to the soil characteristics of the average soils in the region. The control soil was a sandy loam, with its characteristics described in **Table 3**. The control soil was included to test and compare viability of the different seed types sown on the same soil. This soil had no harmful substances added, and thus was a negative control.

3.1.2 Seed Collection

As mentioned above, seeds of representative native forb and grass species were used in the greenhouse phytotoxicity study. Species selected met the criteria of being common, obtainable as nursery seed, and potentially sensitive to pCu (i.e., not overabundant in high pCu areas based on the site-wide ERA [NewFields 2005]). Initially, a perennial grass (sideoats grama) and a winter annual forb (tansyleaf tansyaster) were selected for the experiment. When tansyaster was not found on site in 2013, the perennial forb scarlet globemallow was identified as a replacement and included in the final Work Plan. However, as discussed below, scarlet globemallow failed to adequately germinate in the greenhouse (germination rate in negative control was 0% for nursery seeds and 2% for field seeds after 35 days).

Therefore tansyaster, which returned in abundance on site the following year in 2014, was ultimately used as the representative forb.

In early 2013, Chino fenced a 10-acre area off from cattle grazing to increase availability of seed for collection. The sideoats grama and globemallow seed came from this area, an area estimated to have a pCu of about 5.5 (based on STS-PT-2013-13 data). Tansyaster was uncommon in this fenced area and was collected mostly south of the fenced area (**Figure 2**). The timing of collection, collection methods and locations, and seed processing procedures are described in detail in **Appendix B**.

Alfalfa seeds of the same cultivar (NitroPlus) used in the 1999 study were purchased from Territorial Seed Company in Cottage Grove, Oregon, with an expected germination rate of 87% (**Appendix B**). Cultivated sideoats grama seeds with a pure live seed (PLS) rating of 85% were purchased from Bamert Seed in Muleshoe, Texas. Scarlet globemallow seeds collected from the southwest corner of South Dakota with a PLS rating of 71.25% were purchased from Prairie Moon Nursery in Winona, Minnestoa. When scarlet globemallow failed to germinate in the greenhouse, cultivated tansyaster seeds with a PLS rating of 85.52% were purchased from Granite Seed and Erosion Control in Denver, Colorado. The viability of these tansyaster seeds was reported to be 68% (**Appendix B**).

3.1.3 Greenhouse Experiment

Wildlife International Laboratory in Maryland conducted the greenhouse phytotoxicity tests (**Appendix C**). The tests evaluated the following five endpoints assessed at the end of the test:

1. Seedling emergence (i.e., germination/emergence success)

2. Shoot height

3. Shoot weight (dry weight)

4. Root length

5. Seedling survival.

Rhizobium root nodules, which were tested in 1999, were not included because the native species evaluated do not have such nodules. Root weight was also not included because the greenhouse laboratory indicated that it is difficult to measure accurately, which reduces the ability to detect differences. In the 1999 study, root weight produced results similar to root length results (in the DEL and PEL), and was correlated to shoot weight (Pearson r = 0.92 and 0.82 for alfalfa and ryegrass, respectively). Thus, root length appears to be a good surrogate for root weight. Moreover, root measurements are not required by the Organization for Economic Cooperation and Development (OECD) testing guidance (OECD 2006).

The greenhouse phytotoxicity test consisted of ten 4.3-inch-diameter pot replicates for each species and each of the 33 soil samples. Following the 1999 phytotoxicity study (NewFields 2005), each replicate included 12 seeds of the selected species. Seeds were planted in site, *de minimis*, reference, and control soils. The greenhouse staff measured soil pH for each location with a Kelway probe before filling each pot and for each pot at the end of the test period to evaluate if pH changed.[6] Pots were manually watered from above using tap water from a well water source (**Appendix C**). The high pH of the well water was decreased to approximately 6 using dilute hydrogen chloride to mimic rainfall pH on the STSIU soils (Arcadis 2017b).

Tests for alfalfa were initiated March 6, 2014. Following the 1999 phytotoxicity study approach (Schafer and Associates 1999), alfalfa tests were conducted for 14 days past the time when more than 50% of plants in control soils had germinated. Tests for sideoats grama were initiated March 20, 2014 and were conducted for 21 days past the time when more than 50% of plants in control soils had germinated. Tests for scarlet globemallow were initiated on June 17, 2014 for nursery globemallow seeds and July 10, 2014 for field globemallow seeds. Despite demonstrating some successful germination in trials conducted on wet paper towels for the field seeds, both nursery and field globemallow showed poor germination (<2%) in control soils and were discontinued from the test.[7] The following year, tansyaster was selected as a representative forb to replace scarlet globemallow. Prior to planting, mycorrhizal fungi inoculum was added to the tansyaster seeds to aid growth under laboratory conditions.[8] Tests for tansyaster were initiated January 30, 2015 and were conducted for 21 days past the time when emergence rate of plants in control soils had reached a plateau. Greenhouse conditions and protocols followed by the laboratory are described in detail in **Appendix C**.

When the tests ended and endpoints were measured (raw data in **Appendix C**, summarized data in **Appendix D**), the greenhouse staff also recorded condition of the seedlings (**Appendix C**). If none of the seeds in a pot emerged, no other endpoints were reported. If none of the seedlings in a pot survived to the end of the test, no growth endpoints were reported. Percent survival was calculated as the number of surviving seedlings in each pot divided by the number of emerged seedlings. This differs from the 1999 study, which calculated survival as the number of surviving seedlings divided by the 12 seeds planted per pot. The revised calculation method ensures that survival is a measure independent of emergence. Shoot height and weight were reported as the average across all surviving seedlings in each pot, and root length was reported as the longest root of all seedlings in the pot.

Quality of the greenhouse experiment data was evaluated by comparing the germination and survival rates of seeds grown in control soil to OECD and ASTM International (ASTM) success criteria for standard test species. Specifically, the test for the field seeds was considered successful if their germination and survival in the negative control soil met the following minimum requirements:

- Alfalfa: 80% germination for crop species with a 90% survival rate for the negative control (OECD 2006)

---

[6] Because the Kelway probe produced variable and uncertain results, Wildlife International Laboratory sent the soils for the globemallow experiment to Energy Laboratories after the experiment to determine whether the pH had changed. Energy Laboratories assessed paste pH with a Ross pH meter and determined it had not substantially changed (**Appendix A**).

[7] Field globemallow showed 50% germination on paper towels, though nursery globemallow showed close to 0% germination on paper towels. When grown in control soil, the average germination rate was 0.02% and 0% for field and nursery seeds, respectively.

[8] The AM120 Basin & High Plains Suite mycorrhizal inoculum product, purchased from Granite Seed and Erosion Control and added to the tansyaster seeds, includes 50% *Glomus intraradices* (Utah), 25% *Glomus intraradices* (Arizona), and 25% *Glomus etunicatum* (Nevada).

- Sideoats grama: 65% germination for non-crop species with a 90% survival rate for the negative control (OECD 2006)
- Scarlet globemallow and tansyaster: 55% germination with 80% seedling survival for the negative control (standards for the carrot; ASTM 2009).

The native species in the greenhouse experiment are not standard test species. Because these criteria were developed on standard test species, these criteria were used as guidelines rather than absolute standards for success on the native species.

3.1.4 Soil Chemistry Analysis

Energy Laboratories performed the chemical and physical analyses of the soil (**Table 2)**, which are similar to those used in the 1999 study, but with some additional tests to better understand the soil chemistry. These soil parameters plus soil type categories (described in Section 3.2.3) were included as potential covariates with pCu. Soil pCu was estimated with an ion-selective electrode in calcium chloride ($CaCl_2$) solution (**Appendix E**). This estimated pCu for the greenhouse study is referred to herein as measured pCu to distinguish it from calculated pCu derived from soil pH and total copper using the upland plus reference equation in the site-wide ERA. All analyses with the greenhouse data used measured pCu, which follows the approach used in the site-wide ERA.

3.1.5 Data Analysis

Before plotting dose-response curves, all plant endpoint data were control-normalized (i.e., divided by average in control soil for same seed type); this facilitated comparison across seed types that demonstrate different rates of success in the negative control (Motulsky and Christopoulos 2003). Duplicate soil chemistry results were used to evaluate data variability, but only the primary soil chemistry results were used in the analysis.

3.1.5.1 Dose-Response Curves

Non-linear, S-shaped dose-response curves were fit to data using SAS statistical software to determine if plant endpoint values for the 33 locations are related to the soil's pCu. To test the hypothesis that seed type significantly affects this relationship, the significance and effect of seed type were evaluated as a categorical factor in the non-linear regression. Differences in the endpoint curves in the uncertain effects region (e.g., between IC5 and IC95; Environment Canada 2007) were considered biologically meaningful if they showed at least a 10% change relative to the alfalfa curve at $p < 0.05$. Differences of less than 10% are generally not considered biologically relevant, even if statistical significance is demonstrated (ASTM 2009). The following equation was used in the SAS non-linear regression (NLIN) procedure to evaluate the relationship between endpoint (R) values and pCu for each seed type category:

$$R = \left(\frac{R_{max}}{1 + 10^{slope(-pCu+EC50)}}\right) \quad \text{(Equation 1)}$$

Three parameter coefficients are estimated in this equation: R_{max}, slope, and EC50. R_{max} is the threshold or maximum endpoint at the top of the S-shaped curve, slope is the steepness of the S-shaped curve, and EC50 is the pCu halfway between the top and bottom of the curve. This equation is based on an

EC50 of pCu rather than an EC50 of cupric ion activity because the study is designed to capture the range of 1-unit pCu intervals relatively evenly, and cupric ion activity is lognormally distributed (Motulsky and Christopoulos 2003). Models with up to 15 parameters were evaluated using different R_{max}, slope, and EC50 for each seed type. The simplest models with shared R_{max}, slope, and EC50 among seed types were compared to models with unshared parameters to select the best most parsimonious model with the lowest corrected Akaike Information Criterion (AICc; Motulsky and Christopoulos 2003, see **Appendix G**). If there was high bias and skewness in the parameters, or a model did not converge, the model was not used. Both three-seed models (including alfalfa, nursery sideoats, and field sideoats) and five-seed models (including all seed types) were evaluated (**Appendix G**). If the best multi-seed model for an endpoint produces significantly different EC50s for the different seed types (by at least 10%), the hypothesis of seed type being significant and important is supported.

The pCu for any endpoint value on the dose-response curve can be calculated using the following equation:

$$pCu = EC50 - \left(\frac{log10\left(\frac{R_{max}}{R} - 1\right)}{slope} \right)$$

(Equation 2)

This equation was used to calculate EC10, EC20, and minimum reference-based DEL and PEL pCu values (the minimum reference is the second method to calculate the PEL shown on **Figure 1**, discussed in Section 3.1.5.2). For example, the endpoint value (R) at 10% reduction from the maximum (R_{max}) entered into this equation provided the EC10 pCu.

To account for potential confounding factors in the test soils that might have affected plant growth, covariates were identified to include in the dose-response curve. Detailed methods for the covariate analysis are described in **Appendix G**.

The plant endpoints were also plotted against pH and total copper individually to confirm whether pCu was better than pH or total copper alone in predicting plant emergence, growth, and survival.

3.1.5.2 DEL and PEL

Two methods were used to identify a DEL and PEL for pCu in the greenhouse phytotoxicity study: an ECx-based method and a minimum reference method. For the first method, as indicated in the Work Plan, the EC10 (or possibly the EC20 if the EC10 is not significantly different from "no effect") of the dose-response curve was identified as a potential DEL, and the EC50 as a potential PEL for the germination, survival, and growth endpoints. The percent reduction is relative to the background defined as the asymptote of the dose-response curve. The Work Plan also states: "Results from phytotoxicity tests using *de minimis* soils will be compared to site soils to evaluate the DEL" and "Differences of less than 10% are generally not considered biologically relevant even if statistical significance is demonstrated (ASTM 2009)." The eight *de minimis* soils referred to in the Work Plan have since been split into: (1) reference soils and (2) *de minimis* soils, and this statement now applies to the four reference soils that met the criteria for representing background conditions. If some reference locations demonstrated pCu effects greater than the EC10 level (endpoints lower than the EC10), indicating that such background locations naturally exhibit some pCu effects compared to threshold of "no effects" (asymptote background), then the results using the second method were also presented, where the DEL and PEL were calculated based on the minimum of the reference locations, following U.S. Environmental Protection Agency (USEPA [USEPA 2002, 2013]) guidance on background and tolerance thresholds. This method is the same as the minimum of the reference envelope method in MacDonald et al. (2014). For this second method, Chino identified the pCu that corresponds to the minimum endpoint value of reference locations on the predictive dose-response curve and called it the minimum reference-based DEL. The minimum reference-based PEL was identified as the predicted pCu of the endpoint value that is half of the minimum reference endpoint value[9] (**Figure 1**). The minimum reference-based DEL and PEL were calculated because each reference location did demonstrate effects greater than the EC10 level for one or more endpoints.

Though the lowest reference endpoint value is not technically the point at which effects are first detectable (definition of DEL), this minimum reference endpoint value was conservatively used to predict the DEL. **Figure 1** shows the process of the selection of the PEL using the ECx method (top graph) and the minimum reference method (bottom graph) using a hypothetical example.

In addition to the EC10, an EC20 was estimated for the first ECx-based method because the 95% confidence interval of the negative control endpoint overlapped some of the EC10 endpoint values (OECD 2012), indicating that the EC10 is not detectable as significantly different from “no effect” in those cases. However, some of the five endpoints for the various seed types had significant EC5 to EC15 values, and EC20 would not be conservative for those endpoints. Therefore, the EC10 was decided to be the ECx-derived DEL for all endpoints in order to use a consistent ECx and to be conservative.

The following generalized equation for the dose-response curve was programmed in SAS to estimate endpoints (R) for any ECx and the ECx 95% confidence intervals using the Wald method. The confidence intervals of EC10 and EC20 were estimated in SAS using the following equation:

$$R = \left(\frac{R_{max}}{1 + 10^{slope\left(-pCu + ECx - \left(\frac{log10\left(\frac{100-x}{x}\right)}{slope} \right) \right)}} \right) \qquad \text{(Equation 3)}$$

3.1.5.3 Comparison to 1999 Alfalfa Results

To compare the results from this study to those from the 1999 study, the 1999 alfalfa data were re-analyzed with the methods outlined above using Equation 1. Dose-response curves were fit to the 1999 plant endpoint data (standardized to the negative control), and DELs and PELs were identified following

---

[9] When sample size for reference locations is small (≤ 8), calculation of the background threshold value in ProUCL defaults to the minimum reference value, rather than a lower tolerance limit (LTL), following USEPA guidance (USEPA 2002). This minimum reference envelope method was applied by McDonald et al. (2014) to compare background endpoint values to site values. The site-wide ERA also compares site soils to background in the greenhouse study, except that the 1999 ERA used a *t*-test to compare means. The minimum reference method was used instead of the *t*-test because *t*-tests using background means are currently not recommended for location-by-location comparisons to background; therefore, the method in the Work Plan was updated.

the same approach used in the 2014 study. NewFields (2005) estimated the DEL and PEL qualitatively (visually from graphs of plotted data points) as 6 to 7 and 5, respectively, using the 1999 data. This qualitative estimation method was replaced with the quantitative dose-response models described in Section 3.1.5.2, and then new DELs and PELs were calculated from the 1999 data for each endpoint. Though the one reference soil in 1999 did not show effects greater than the EC10, and therefore the minimum reference method is not needed, the minimum reference-based DELs and PELs were nevertheless calculated to compare to the 2014 DELs and PELs. The sample size of reference soils for the 1999 alfalfa test, however, was equal to one location (n = 1), which is insufficient for estimating the DEL using the minimum reference method. It is insufficient particularly for emergence, shoot height, and root length because the reference endpoint values were higher than the respective fitted curves for those endpoints (the DEL could not be calculated for these three endpoints). The minimum reference method was nonetheless used to estimate the DEL for other endpoints and the PEL for all endpoints by simply assuming that the single reference soil for alfalfa represents the minimum endpoint value for all reference soils in the area. This assumption is unlikely and conservative.

The quantitative approach using the dose-response curve to predict pCu of the minimum reference for the current study is possible due to the large sample size but is more questionable for the 1999 data. The 1999 greenhouse study plotted site and reference data without fitting curves and compared each site soil endpoint to the mean of reference soil endpoints using a *t*-test to help qualitatively identify the pCu at which significant differences begin to be identifiable (DEL). A subjective point below the DEL was then chosen for the PEL. This approach was used because of the small sample size especially in the critical region where the slope of the curve is steepest. Dose-response curves have now been fit to the 1999 data but carry more uncertainty because they are dependent on one or two points in the critical region.

To further facilitate comparisons, survival using the 1999 data was re-calculated as the percent of emerged seedlings surviving, rather than the method used in the site-wide ERA of calculating the percent of the 12 seeds planted that survived. Survival was then averaged over the five pot replicates. Of note, root length per replicate in the 1999 study was estimated slightly differently in 1999 than in the current study. The greenhouse laboratory for the 1999 study (Ecological Planning and Toxicology) calculated it as the average root length of surviving seedlings in a pot at the end of the 1999 study (Appendix B in NewFields 2005) rather than as the longest root of all seedlings in a pot. No adjustment could be made for this difference.

3.2 Community Study

The community study was implemented in three steps:

1. Community endpoint data (i.e., cover, richness, OAT score) were measured at representative site, *de minimis*, and reference locations.

2. Sampled soil pCu was determined from those same locations.

3. Environmental factors other than pCu that might affect community parameters were identified and measured.

These steps are described in greater detail below, along with the methods used to determine site-specific thresholds for community-level effects (DEL and PEL) of pCu.

3.2.1 Vegetation Data Collection

The three community endpoints—cover, richness, and rangeland condition (rangeland as an observed apparent trend, OAT)[10]—were selected for sampling because they are related to wildlife habitat and rangeland, and the site-wide ERA found that richness and cover had the strongest relationship to pCu (NewFields 2005). These vegetation parameters were sampled at 19 STSIU locations in September 2011 to calibrate remote sensing image data and ground-truth vegetation maps during the STSIU FS sampling effort (**Figure 4**). These 19 locations were sampled following the general protocol outlined in the FS Proposal (Arcadis 2011) and the Arcadis Vegetation Sampling Standard Operating Procedure (SOP) included in **Appendix F**. Slope position and aspect were also recorded. Three additional bedrock locations were sampled for the same three parameters on August 30, 2012. The 22 locations sampled in total in 2011 and 2012 were included in the community study dataset as specified in the approved Work Plan.

Five of the 22 locations sampled in 2011 and 2012 were considered as potential reference locations. Two of the locations were called Wildlife Reference Plot North and Wildlife Reference Plot South (**Figure 4**). The other three were the bedrock locations sampled in 2012. Subsequently, the soil chemistry of the three bedrock locations and the Wildlife Reference Plot South location indicated that they should be classified as *de minimis* locations, rather than reference locations[11] (though Wildlife Reference Plot South retains its name). Wildlife Reference North did not have sulfate data[12], but its pH was 6.6, which was in the background range for bedrock soils (**Figure 3**) and it was retained as a reference location. The *de minimis* bedrock locations were originally sampled in 2011 to provide bedrock community data far from the smelter to compare to the bedrock site locations for the STSIU FS, and they were included in the dose-response curves to provide additional soil data from bedrock areas for this community study.

Additional field sampling was conducted in 2014 to: (1) increase the community study sample size and (2) collect additional samples co-located with the greenhouse phytotoxicity study. NMED requested sampling some of the same locations for both studies to facilitate comparisons between the results of the two studies. To supplement the 22 locations, an additional 10 locations identified for the greenhouse phytotoxicity study[13] were visited in September 2014 to collect community data using methods similar to those for the other locations (**Appendix F**), bringing the total sample size to 32. One of these added locations (STS-PT-2013-26) was a phytotoxicity study reference location. The final dataset for the community study included 26 site locations, four *de minimis* locations, and two reference locations (**Figure 4**).

---

[10] Two of the locations (Wildlife Reference Plot North and Wildlife Reference Plot South) were not sampled for OAT scores.

[11] They are *de minimis* because the three bedrock locations of STS-RWU-2012-B1, B2, and B3 on Figure 2 are the same locations as STS-PT-2013-21, 22, and 23 on Figure 4 called *de minimis*. Also, the Wildlife Reference South location on Figure 4 is the same location as STS-PT-2013-27 on Figure 2 and is *de minimis*.

[12] Soil chemistry data were unavailable for the soils collected for the community study in 2011 and 2012 except pH, copper, and conductivity.

[13] One of the 10 sites (STS-PT-2013-33) had very low pCu due to the copper concentrate being spilled in the soil, and ultimately its soil was not used in the greenhouse phytotoxicity study. It had no vegetation cover and was originally needed in the community study to test if the lower bound of pCu predicted from the linear regression without that site was reasonable.

The weather during 2011 and 2012 was very different from 2014 because 2011 and 2012 were drought years (see precipitation graphs in **Appendix F**). Two of the original 22 locations (Wildlife Reference Plot North and South) were re-sampled for richness and cover to quantify community differences between years. Community measures were then adjusted to account for differences in weather effects on vegetation among years using the Normalized Difference Vegetation Index (NDVI; **Appendix F**), and the adjustment was validated with the two re-sampled locations. NDVI[14] for 2011 and 2014 was calculated from 30-meter pixel Landsat imagery collected on cloud-free days of September 4, 2011 and August 29, 2014, dates near the time of sampling for those years. For locations with only 2014 cover data, the cover values were adjusted by the proportional change in NDVI to estimate the cover value in 2011 and standardize all data to 2011. The NDVI adjustment was validated by comparing the percent increase on Wildlife Reference North and South in the field to the NDVI proportional increase in percent cover between years, which showed that they were very similar (Wildlife Reference South = 83% and 89% increase for NDVI and field, respectively; Wildlife Reference North = 1% and 2% increase for NDVI and field, respectively). Cover was quite different for Wildlife Reference South between years (20% and 37% for 2011 and 2014, respectively), though not for Wildlife Reference North (30% in both years of 2011 and 2014). It was assumed that no adjustment to 2011 cover conditions was needed for the three bedrock reference sites sampled in 2012 because the low precipitation in September 2012 (0.9 inch) at Hurley was similar to the dry weather that month in 2011 (1.6 inches), more so than in 2014 (3.6 inches).

Richness could not be adjusted to 2011 values because richness estimation requires high-resolution IKONOS imagery in both years (see Appendix A in the STSIU FS Work Plan), and such imagery was unavailable in fall 2014. Richness was somewhat similar between 2011 and 2014 for both Wildlife Reference North (10 and 13 species for 2011 and 2014, respectively) and Wildlife Reference South (11 and 14 species for 2011 and 2014, respectively). Not adjusting richness may increase variability or bias in the richness estimates by about 30% based on the two Wildlife Reference Plots.

The adjustment for precipitation differences among years was not necessary for the OAT score because it was already adjusted in the field. Field staff adjusted their OAT score scale relative to reference locations in the field each year (see SOP in **Appendix F**).

3.2.2 Soil Collection

As discussed in the Work Plan (Arcadis 2014), soil was collected at the first set of 22 locations in July 2013. Soil was sampled at 0- to 6-inch depths in the corners and centers of each 100 x 100 foot plot (five grab samples) in which vegetation had been sampled in 2011 and then composited. The composited soil was submitted to ACZ Laboratories for total copper (mg/kg) and pH (saturated paste) analysis. These same soil samples were submitted to Energy Laboratory to measure pCu and electrical conductivity because of concerns that salinity may be causing poor growth. Soils were collected at the second set of 10 locations; sampled later in October 2013 for the greenhouse phytotoxicity study (following that study's protocols); and sent to Energy Laboratories to measure pCu, total copper, pH, and electrical conductivity (**Section 3.1.1**).

To be consistent with the site-wide ERA approach of using calculated pCu for the community analysis, copper and pH results were used to calculate pCu for the community dataset, applying the "upland with

---

[14] NDVI is usually correlated to percent vegetation cover (Shank 2008).

reference" equation in the site-wide ERA (pCu = 7.34+0.93pH-1.15[lnCu]; NewFields 2005). Dose-response curves with measured pCu were also produced, but the final results relied on calculated pCu. This is particularly important because the FS will base decisions on the more extensive calculated pCu dataset for the STSIU.

3.2.3 Environmental Factors

Environmental factors that were covariates in the community analysis included slope, aspect, soil category, soil complex, vegetation alliance, ecotype, and electrical conductivity. Digital elevation models provided slope (in degrees) and aspect (north or south-facing slope). Soil categories were based on four visually distinct substrates in the STSIU that appeared to affect vegetation composition differently:

1. Bedrock (> 60% bedrock, referred to as Bedrock)
2. Rocky with eroded surface soil in relatively flat areas (referred to as Flat Rocky)
3. Steep, rocky slopes (> 14% slope, referred to as Slope)
4. Relatively flat areas with granular soil structure at the surface (referred to as Flat Granular).

Examples of these four substrate types are illustrated on **Figure 5**. Soil complexes in the STSIU included 11 soil associations/complexes (**Appendix F, Table F-4, Figure F-3**) grouped into three categories that separated communities well:

1. Manzano loam (1 to 3% slopes), Muzzler-Rock outcrop association (25 to 65% slopes), Plack gravelly loam (0 to 8% slopes)
2. Santana-Rock outcrop complex (1 to 25% slopes)
3. All other soils, complexes, and associations.

The five vegetation alliances were also included (mountain mahogany/shrub, fluvial forest/shrub, mesquite/mixed grama, mixed grama/herbaceous, juniper-oak; Newfields 2005) and the historic ecotype (Hills, Breaks, Loamy, Shallow, Gravelly[15]).

3.2.4 Data Analysis

The dose-response relationship between calculated pCu with each of the three community endpoints – cover, richness, and OAT score – was examined with and without covariates. Covariates were screened using the same method applied to the greenhouse study (see **Appendix G**), with the best modeled relationship being the one with the lowest AICc. The results were also compared to 1999 community data to assess how adding covariates and more appropriate reference locations affected the dose-response

---

[15] Soil complexes and ecotypes for the area are available for Grant County soils in the Natural Resources Conservation Service (NRCS) web soil survey portal at: http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/survey/

curves. As was done in NewFields (2005), the 1999 community upland data were plotted against calculated pCu, applying the “all locations” equation in the site-wide ERA to soil pH and total copper to predict pCu of each point sampled on the 50 m transect and averaging the resultant pCu of the points to obtain pCu for each location.[16]

To identify the DEL and PEL from these relationships, the data analysis approach for the community study was the same as that for the greenhouse phytotoxicity study initially, with an attempt to apply both the ECx and minimum reference methods. However, as was found during the 1999 community study, the dose-response relationship was linear rather than S-shaped, particularly after adding the covariate of soil category. The relationship that best fit the data was a general linear model (multiple regression with continuous and categorical variables). A linear model will not identify an EC10, EC20, or EC50 because no maximum threshold is reached. Therefore, only the minimum reference method was applied to identify the PEL and DEL. The minimum reference method also does a good job of approximating the DEL and PEL qualitatively obtained from 1999 community graphs in the site-wide ERA (see first graph on Figure 2.5-2 in NewFields 2005).

If a covariate is significantly affecting a community endpoint, reference locations ideally should be available for each categorical value or range of the covariate to identify DELs and PELs associated with those values. When a reference location was unavailable for a covariate value (e.g., a soil category), the PEL and DEL could not be calculated.

4 RESULTS

4.1 Greenhouse Phytotoxicity Study

The greenhouse phytotoxicity experiment was conducted between March 6, 2014 (starting with alfalfa) and March 23, 2015 (ending with tansyaster). The results of the greenhouse experiment and subsequent data analysis are discussed below.

4.1.1 Data Quality

Quality of the greenhouse experimental data was evaluated by comparing the germination and survival rates of seeds grown in control soil to OECD and ASTM success criteria (**Table 4**). Despite field scarlet globemallow seeds demonstrating successful germination (50%) in trials conducted on paper towels, both field and nursery globemallow showed poor germination (0.02% and 0% for field and nursery seeds, respectively) in control soils and were discontinued from the test. Both field and nursery tansyaster seeds also performed poorly in control soils, with germination (28% and 45% for field and nursery seeds, respectively) and survival rates (30% and 38% for field and nursery seeds, respectively) more than 10% below minimum criteria thresholds in absolute units. NMED requested that the tansyaster results be reported despite the poor performance of both field and nursery seeds in control soils. While tansyaster results are included in this report, they are considered unreliable and are therefore not used for selecting final DEL and PEL values for pCu.

---

[16] The site-wide ERA used the “all locations” pCu equation in its vegetation community analyses. This current study uses the “upland study with reference” pCu equation because it is the equation applicable to the STSIU uplands and also had the highest R^2 in the site-wide ERA. Therefore, to compare the same pCu, the 1999 data were plotted with the upland with reference equation, and little difference was observed (Figure 11).

Duplicates for the soil samples that Energy Laboratories analyzed were within 1 to 6% relative percent difference (RPD) for pH, within 3 to 31% RPD for copper, and 3 to 13% RPD for pCu. This variability is within the acceptable limits set forth in the AOC Quality Assurance Project Plan for Chino (QAPP, SRK 1997), which is an RPD of +/- 50% for soil if results are greater than five times the reporting limits.

4.1.2 Dose-Response Curves

Modelling the five-seed non-linear dose-response curves with pCu as the continuous independent predictor produced good results, with pseudo R^2 for the five-seed models ranging from 0.74 to 0.87 across the five plant endpoints. **Figure 6** shows the curves and associated ECx-based DEL (EC10) and PEL (EC50). **Figure 7** shows the same curves but with the minimum-reference-based DEL and PEL The number of parameters in each five-seed model ranged from five at the low end (for shoot height) to 12 at the high end (for survival, see **Appendix G** for details). One outlier for nursery sideoats grama seeds grown in soil collected from reference location STS-PT-2013-25 (studentized residual > 6) was excluded from the shoot height model, improving the pseudo R^2 from 0.74 to 0.79 (see shoot height on **Figures 6 and 7** for the sideoats outlier). Because the results for tansyaster are less than optimal, three-seed non-linear dose-response curves were also modeled, and the resulting models were found to be comparable to the five-seed models that included tansyaster (**Appendix G**).

It was hypothesized that native plant seeds collected from the Site would demonstrate higher tolerance to low pCu than the other seeds, which would be shown by shifting the dose-response curves for these seed types further to the left[17]. This was not found to be the case. Based on the curves alone, field-collected seeds of native species performed similar to nursery seeds, and native species did not perform better than alfalfa (the agricultural species) for all endpoints (lower DEL and PEL on **Figures 6 and 7**). Native species performed better than alfalfa only for the root length endpoint. For the other endpoints, alfalfa was more tolerant of low pCu for emergence and survival and about the same for shoot weight and height.

To account for potential confounding factors in the test soils that might also have affected plant viability and growth, soil variables were evaluated for significance as covariates in the dose-response curves. The list of soil covariates evaluated (**Table G-3**) and those that were significantly related to pCu and added to the five-seed models for each of the five endpoints are presented and discussed in **Appendix G**. The covariates that significantly affected the dose-response relationship were granular soil, extractable iron, and clay content. These covariates can shift the dose-response curve, depending on their value, as shown in the example for sideoats grama on **Figure 8**. The curves on **Figure 8** show that locations with granular soils are more tolerant of low pCu than locations without flat granular soil (results and graphs for all seed types are in **Appendix G**).

The other two significant covariates, extractable iron and clay, are continuous covariates. High extractable iron concentrations are protective (compete with copper ions), while high clay content is unfavorable for the plant communities (may slow root growth or reduce water extraction from soil) at a given pCu. The effect of the minimum, mean, and maximum values of these two continuous covariates on the Site on the dose-response curves are shown on **Figure G-1** in **Appendix G** and on the DEL and PEL

---

[17] Higher tolerance to pCu is demonstrated when the curve shifts left if the asymptote (R_{max}) of the curve does not change. If R_{max} changes, then PEL and DEL comparisons are best to illustrate which is more tolerant (lower DEL or PEL is more tolerant)

are shown in **Table G-5.** However, the minimum and maximum do not represent typical soils on site because they are the extreme ends of the range on site. Because interpretation of the continuous covariate effects is dependent on the soil properties of the site-specific locations that will be considered for remediation, yet to be determined in the STSIU FS, the continuous covariate effects of the greenhouse dose-response curves are not discussed further in this report. They can be considered in the FS.

When pH and total copper were plotted against the plant endpoints, scatter in the data increased, showing a weaker relationship than that observed when pCu was plotted against the data points (**Appendix H**). This, and the finding that pCu was the best predictor of greenhouse plant endpoints, performing better than of all the covariates evaluated in **Appendix G** (including pH and total copper), supports that pCu is the most important variable for predicting the greenhouse results. Cupric ion activity, as represented by pCu, probably best integrates the factors affecting plants including the interactions among hydrogen ions, soil solution ionic strength, ligand availability, and total copper.

4.1.3 DEL and PEL

EC10s and EC50s derived from the five-seed dose-response curves, along with their 95% confidence intervals, are shown in **Table 5**. The EC10 could represent a DEL and the EC50 a PEL. However, by definition in the Work Plan, the DEL is the lowest soil pCu above which statistically demonstrable effects from the mine’s copper are unlikely. The smallest ECx that is first statistically detectable was identified for each seed type and endpoint (**Table 6**), which showed that, for the majority of seed types and endpoints, the EC10 is too low to distinguish from the negative control. Therefore, the EC20 and its confidence intervals are also reported as a potential candidate for the DEL in **Table 5**. Depending on the endpoint, the minimum detectable ECx ranges from EC4 to EC71, indicating that even using 20 for the x in ECx (EC20) is too low for some endpoints. Ignoring tansyaster, most endpoints exhibit detectable effects at an EC35 or less (**Table 6**). The highest minimum detectable ECxs are seen for tansyaster, demonstrating that the tansyaster results are not reliable for many endpoints. For the purposes of this report, the EC10 nonetheless was planned to be conservatively used as the ECx-based DEL. The EC50 is the ECx-based PEL.

Tansyaster performed poorly in low impact *de minimis* areas as well as in control soils. Tansyaster had 0% emergence or survival in 25% of the control soil pots and only 12.5% of the seeds emerged and survived on average (**Appendices C and D**). Tansyaster had no seeds emerge and survive in 44% of the *de minimis* and reference soils combined. It is not surprising that no seeds emerged or survived in 42% of the site soils. These results, along with the wide confidence intervals for shoot weight (**Table 5**) and high variability of the negative control (**Table 6**), further demonstrate the unreliability of the tansyaster data. Due to the unreliability of the tansyaster results, the DEL and PEL based on tansyaster in **Table 5** were ignored. The conclusions of this report focus instead on alfalfa as the forb species and sideoats grama as the representative grass species. Alfalfa is used as the forb species because no other forb with reliable results is available. Alfalfa has either lower or similar tolerance (growth endpoints) or better tolerance for low pCu than the native species. Use of this non-native species as a forb in FS decisions is discussed in the uncertainty section.

The ECx-based results in **Table 5** (also **on Figure 9**), excluding tansyaster, are summarized as:

- The DEL ranged from 3.8 to 7.7 across endpoints and seed types.

- The PEL ranged from 3.7 to 6.5 across endpoints and seed types

Some of the soils of the reference sites demonstrated pCu effects on some endpoints that were greater than the EC10 level in the greenhouse phytotoxicity study, and some were not as optimum as the control soil for plant growth (standardized endpoint < 1). NewFields (2005, p. 2-17) also reported for the 1999 greenhouse study that some reference soils were significantly more toxic than laboratory controls. Therefore, the DEL was also calculated as the pCu at the endpoint value of the minimum reference, and the PEL as the pCu at half of the endpoint value of the minimum reference. This approach ensures that impacts evaluated are only attributable to the mine operations.

The DELs and PELs using the minimum reference method are summarized in **Table 7.** The results, excluding tansyaster, have the following ranges:

- The DEL ranged from 4.3 to 8.0 across endpoints and seed types.
- The PEL ranged from 3.7 to 6.4 across endpoints and seed types.

The DELs and PELs based on both the ECx and minimum reference method are shown together for comparison in **Table 8** for alfalfa and sideoats grama and **Table 9** for tansyaster. Because tansyaster results are not reliable, **Table 8** provides the summary of the final DELs and PELs for the greenhouse study.

4.1.4 Comparison to 1999 Results

The 1999 greenhouse phytotoxicity study dose-response curves for alfalfa were comparable to the 2014 results described in this report for all plant endpoints except root length (**Figure 10**). The curves are very different for root length. This inconsistency suggests that root length results were not repeatable, and that the 2014 root results may be less suitable for decision-making than the other plant endpoints. The results for root length may have differed between the two studies for a number of possible reasons, including but not limited to:

- The sample size was too small in 1999.
- Different metric was measured. The 2014 study is based on longest root of all surviving seedlings in pot, while the 1999 study measured the average length of all roots.
- Measuring the longest root in 2014 did not require washing the dirt thoroughly from the roots, whereas the 1999 study washed the roots to be able to weigh them as well as measure them. Separation of roots from dirt in 2014 may have resulted in more root breakage in soils that stick to the roots that may also have had only moderately low pCu (mid-range pCu soils tend to have more clay).

Though sample size is smaller for the 1999 study, the four locations between pCu of 4.9 and 6.9 had root length values around the asymptote of the 1999 curve (**Figure 10**), whereas most locations in the same pCu region were below the asymptote in the 2014 study. This suggests that the difference is not due to the small sample size in 1999. In 1999, root weight was also measured and produced EC50 similar to root length, which supports that the 1999 root length results may be reliable. For the 1999 study, the researchers washed and measured every root, whereas the laboratory conducting the 2014 study did not; the latter did not need to wash because they did not measure root weight. A root weight curve and EC50 were not available in 2014 to help validate the root length results in 2014. For this reason, the 2014 data are more suspect than the 1999 data.

For the survival and emergence endpoints, the 1999 results (when re-analyzed for this report) had data gaps when compared to the 2014 results. Survival and emergence dose-response curves in 1999 were very unstable due to a lack of data points in the steep part of the curve. Because a slope of 1.0 appeared to fit the data visually, the slope term was forced to be 1.0 for these two endpoints to have the 1999 model converge. The larger sample size in the 2014 study prevented this problem. The pseudo R^2 values for the 1999 dose-response curves were also weaker (poorer fit to data) than the 2014 dose-response curves for emergence and root length. However, the fit was similar for the other endpoints.

The most sensitive endpoints based on EC50 differed between the two studies. Shoot weight was the most sensitive endpoint in 1999, while shoot height was the most sensitive endpoint in 2014 (excluding 2014 root length results; **Table 10**). However, the DEL and PELs for shoot height and weight are similar. The results support that shoot growth may be most sensitive to pCu. Conversely, the least sensitive endpoints based on the EC50 were survival and emergence in both studies.

Excluding root length, the EC10 and EC50 ranges between the two studies were somewhat similar at the high end of the range of the values of the different endpoints, though more variable at the lower end. The EC10-based DEL for alfalfa in the 1999 study ranged from 5.2 to 7.5, while this DEL for alfalfa in the 2014 study ranged from 3.8 to 7.4 (**Table 10**). The EC50 PEL for the 1999 alfalfa study ranged from 4.2 to 5.2 and for the 2014 study from 3.7 to 5.7. The lower values in 2014 may be because a greater variety of site types was evaluated.

For the minimum reference method, the lower end of the DEL and PEL range was generally lower in the 2014 study, also (excluding root length, DEL: 4.0 to 7.1 vs. 5.3 to 10.8; PEL: 3.7 to 5.4 vs. 4.2 to 5.2, **Table 10**), as aforementioned, the single reference location in 1999 was inadequate for deriving reliable DEL results using this minimum reference method. In some cases, a DEL was incalculable using the minimum reference method because the reference endpoint value was higher than the modeled curve. In such cases, the top of the modelled curve (the Rmax) was used. These results support the hypothesis that the DEL and PEL are generally lower than shown in the 1999 study when more and different reference sites (east and west of the smelter) are included. These results may have differed more substantially if the reference areas in both years were not all in the same flat granular soil category.

4.2 Community Study

4.2.1 Dose-Response Curves

The field sampling methods used in the 1999 community study differed substantially from the methods of the current study[18] (**Appendix F**); therefore, it is not possible to directly compare the 1999 dose-response results to the 2011-2014 results for the community study. The methods used in 1999 (two perpendicular 50 m x 2 m transect belts [0.05 acre]) covered areas for sampling richness similar in size to those for the current study's method but may have extended across a more variable landscape because they were less compact (current study used average richness of five compact 20-foot x 20-foot blocks [0.05 acre] in a 100-foot x 100-foot area, see **Appendix F** SOP). The data were collected in 1999 using the point-

---

[18] NMED requested that the sampling for the amendment study (Arcadis 2017a) and STSIU FS (their original purpose) be similar to the reclamation monitoring methods on Chino Tailings Ponds, which differed from the site-wide ERA methods.

intercept method, whereas the current study used the Daubenmire quadrat method. Also, 1999 was a much wetter year than 2011 (see **Appendix F, Figure F-5** precipitation graph for Hurley, New Mexico). The 1999 study sampled more cover and richness at similar pCu values than the study in 2011 to 2014 (**Figure 11**). This difference may not be only from differing methodological and meteorological conditions, but also possibly because the 1999 study did not sample the sparse bedrock locations. Therefore, this report compares only the fit and direction of the dose-response relationships between the two studies, rather than comparing the absolute slope of the curves. Also, note that the 1999 community study did not evaluate rangeland condition (has no comparable OAT score).

Relationships between pCu and the three community endpoints (richness, cover, and OAT score) on the Site without any covariates were weak using the 2011 data, which included the 2014 data adjusted to 2011. A stronger modeled relationship was found for cover and richness in 1999, possibly because that study focused only on relatively level areas on the Site (**Figure 11**). Soil category, the only covariate that significantly contributed to the model (lowered the AICc), greatly improved the current overall model fit for some categories (**Figure 12**, R^2 increased from 0.16 - 0.29 to 0.66 - 0.86). The improvement resulted in a stronger relationship to pCu than for the 1999 study, most consistently for richness (1999 R^2 = 0.65 vs.2011 R^2 = 0.83), though some soil categories also showed an improved fit for cover and OAT score, as discussed below. Other soil categories showed no effect of pCu on cover or rangeland condition.

The 1999 data included six reference locations near the airport with high grass cover characteristic of the mixed grama herbaceous alliance (NewFields 2005). These locations exhibited high pCu due to high calcium carbonate concentrations in the west-side soils (Arcadis 2017b). They also exhibited high richness and cover because they were in the flat granular soil category. These reference locations were not representative of the other soil category in the 1999 study (flat rocky), a category that typically exhibits lower richness or cover, and thus probably creates some bias in the 1999 results. The 1999 results are not applicable to the soil categories not included in that study (slopes and bedrock).

Unlike the greenhouse study, two of the community study covariates were more predictive of plant community endpoints than pCu. Soil complex was the most predictive single variable of plant community endpoints (R^2 = 0.50 to 0.73), followed by soil category (R^2 = 0.36 to 0.47, **Appendix F, Figure F-3)**. Both of these categorical variables were more predictive than pCu alone (R^2 = 0.27). Because soil complex was highly correlated to pCu[19], it was screened out from consideration in models that combined covariates with pCu. Soil category was not highly correlated to pCu, however, and could be included (**Appendix F, Figure F-3**).

When combined with pCu in the regression models, pCu with soil category as the covariate provided the most predictive model. **Table 11** shows the output for these general linear regression models. Other covariates did not significantly affect the community endpoints once pCu was in the model or else they were highly correlated to pCu and screened out from consideration. Details concerning these relationships for each endpoint are discussed below.

Richness

As pCu increased, species richness linearly increased. Of the soil categories, this dose-response relationship for richness was shifted left and upward on the pCu axis (plants performed better at same

---

[19] High correlation creates multicollinearity and unstable coefficients (see Appendix G).

pCu) in stable flat granular locations, followed by the slope locations; it shifted to the right and downward (representing the poorest performance) in bedrock locations, followed by flat rocky locations (**Figure 12(a)**).This best richness model met the linear regression assumptions of normality and homogeneity of variance only after removing two outliers (**Table 11**), which produced a good fit to the data (adjusted R^2 = 0.83). It was appropriate to remove the outliers because they were not typical. One outlier was STS-RWU-2011-8, the only plot in the juniper-oak vegetation alliance. This alliance exhibited much higher richness than the other vegetation alliances at this location. The second outlier was STS-RWU-2011-13, a flat site that was unusually heavily overgrazed; even the mesquite was trampled (see photograph of this site in **Appendix I**).

Percent Cover

To meet regression assumptions, percent cover was square-root transformed. With or without the two outliers (data points on **Figure 12(b)** include outliers but regression lines do not), pCu did not predict cover of flat rocky and slope locations, only the flat granular and bedrock locations. When the general linear regression model was fit to all locations irrespective of soil category, it violated assumptions of the regression due to these differences among soil categories (heterogenous variances). The best model that met assumptions and produced a significant effect of soil category and pCu was the model with only the flat granular and bedrock locations included (**Table 11**, R^2 = 0.84). This fitted model (**Figure 12(b)**) was back-transformed and plotted on **Figure 12(c)** showing that, as pCu increased, percent cover increased in a non-linear fashion in the flat granular and bedrock locations.

OAT Score

A general linear model for OAT score with soil category as a covariate produced heterogenous variances (violating test assumptions), requiring each soil category to have a separate regression. Only the bedrock soil category showed a significant relationship between OAT score and pCu (**Table 11**, **Figure 12(d)**, R^2 = 0.57). The two outliers for richness were also outliers for the OAT score and were removed. If the outliers were included, the other three categories still did not exhibit a predictive relationship between pCu and OAT score.

Notably, the “slope” soil category demonstrates the least amount of support for strong effects of pCu on plant communities, with no relationship to pCu for cover and OAT score, and a relationship with pCu for richness only if an outlier is removed.

4.2.2 DEL and PEL

Reference locations needed to calculate the DEL were only available for the flat granular soil category (no sampled areas at bedrock, flat rocky, or slope locations qualified as “reference”). Therefore, the DEL and PEL could be calculated only for the flat granular category, and only with the two reference locations that met the criteria for being reference locations. **Table 11** shows the minimum reference-based DEL and PEL for the flat granular soil category for the community dose-response curves that were significant.

The PEL of 5 and DEL of 6 to 7 that NewFields (2005) estimated from the 1999 site-wide community data in the ERA were higher than or similar to the PEL and DEL estimated from the current community data, depending on the endpoint and soil category. Specifically, the current study data indicate no adverse effects of pCu on cover or OAT score for some soil categories (flat rocky and slope for cover and flat granular, flat rocky, and slope for OAT), which was not reported in 1999. For the flat granular category, the range of effects levels is 2.1 to 3.4 for PEL, lower than 1999, and from 5.6 to 7.5 for DEL, which is more similar to 1999 (**Table 11**). When measured pCu was substituted for calculated pCu in the community analysis (**Appendix J, Figure J-2**), the range of the PEL and DEL for flat granular soils ranged from 1.3 to 3.6 and 5.5 to 7.8, respectively (**Appendix J, Table J-1**)[20].

4.3 Final Range of DEL and PEL from Both Studies

To identify the range of the final DEL and PEL estimated from the combined ECx and minimum reference methods for the recent greenhouse phytotoxicity studies, only the most unequivocal results were included. The tansyaster test fell far short of the greenhouse quality standards and was not included. Root length dose-response curves were highly inconsistent between the 1999 and 2014 alfalfa tests, and were not included. Alfalfa was included to replace tansyaster as the forb because alfalfa did not show an overall greater sensitivity in its endpoints to pCu than the native species based on the dose-response curve; its EC50 was about the same, or lower than the native species (depending on the endpoint, **Table 5**). As was done in 1999, the alfalfa data were included to represent a forb, given that no native forb test succeeded.

All other endpoints were included for the final range of the DEL and PEL. Because field and nursery sideoats grama EC50 results were not significantly different for all endpoints, the PEL and DEL for the field and nursery seeds was averaged when identifying the final range of the PEL and DEL (**Table 8**). The final greenhouse ranges for the average condition that does not consider the effect of covariates (**Table 8**) are as follows[21]:

- The greenhouse DEL ranged from 3.8 to 7.7.
- The greenhouse PEL ranged from 3.7 to 5.7

For the community studies, a PEL and DEL could only be identified for the flat granular soil category for richness and cover. The other three soil categories without estimates were not included in the final range because their DEL and PEL are unknown. The final ranges for the flat granular soil category for the community study are 2.1 to 3.4 for the PEL and 5.6 to 7.5 for the DEL (**Table 11**).

Combining both the greenhouse and community study results (latter representing only one of the four types of soil category), the final range of estimates are:

- The DEL across both studies ranged from 3.8 to 7.7.
- The PEL across both studies ranged from 2.1 to 5.7.

The value within the range depends on the endpoint, seed type, or soil category, which should be considered in the STSIU FS. These values exhibit more variability than the PEL of 5 and DEL of 6 to 7 derived from the 1999 greenhouse phytotoxicity and community studies, probably because of the greater variability in soil types and categories.

---

[20] Measured pCu DEL and PEL are provided but not used in the interpretation of the community data, as explained in Section 3.2.2.

[21] Unlike the community study, pCu is the most important predictor for the greenhouse results, and covariate results for the greenhouse study are less important for summarizing the PEL and DEL. Covariate effects on these thresholds can be evaluated in the STSIU FS.

5 DISCUSSION

5.1 Effect of Cupric Ion Activity on Native Plants in the STSIU

The results show that one or more plant community parameters appear to respond to pCu in the STSIU, and that adverse effects relative to background may occur at different pCu values, depending on the species and soil category of the location. Soil pCu was related at the individual plant scale to plant emergence, survival, and growth and, if soil category is considered, at the community scale for plant species richness and to a lesser extent cover and rangeland condition (OAT score). Rangeland condition and cover are probably more strongly influenced by grazing history than pCu in the soil categories with no significant relationship of these endpoints to pCu (e.g., rocky flat areas and steep slopes). As was found in the site-wide ERA, cupric ion activity integrates the toxic effect of pH and copper, and is a better predictor of copper effects from mine operations on individual plants and community richness than pH or total copper alone. The current results suggest that selection of remedial options in the FS should also consider the soil category of a location (flat granular, flat rocky, slope, or bedrock) and rangeland condition (OAT score) when applying cleanup criteria based on pCu. Arcadis (2017a) also discusses that the rangeland condition, geology, and pH of the parent material and buffering capacity of the soil strongly influence the community endpoints evaluated and should be considered when selecting the cleanup criteria. If an area naturally has low background pH (e.g., rhyolite bedrock areas on **Figure 3**), the threshold for effects from the smelter and tailings could be adjusted to account for this natural variability.

Some of the study hypotheses on tolerance of species on **Figure 1** were rejected (hypotheses numbered as H# in **Table 12**). Overall, native species (sideoats grama) were not more acclimated to low pCu than agricultural species (alfalfa) in terms of their EC50-based PEL (see H1a in **Table 12**, root length being an exception) or their minimum reference-based PEL (see H1b in **Table 12**, root length and shoot height being exceptions). Paschke and Redente (2002) found that native species were less sensitive to copper than agricultural species, but they did not evaluate sensitivity to pCu, which is strongly affected by pH. This is the first greenhouse study comparing the response to pCu of native species relative to agricultural species. The hypothesis that field-collected seeds would be more adapted to low pCu conditions than nursery-cultivated seeds of the same species also was rejected in terms of the EC50-based PEL (H2a). When compared to reference locations using the minimum reference method, most endpoints for field-collected seeds had lower PELs for sideoats grama but higher for tansyaster (H2b). The endpoint exceptions tended to be less reliable (e.g., root length, **Table 12**). The latter result from the minimum reference method is not because the field-collected sideoats grama seeds are more tolerant of low pCu than nursery seeds. The result is because field-collected seeds did not perform quite as well in reference areas as the nursery-cultivated seeds, though they had higher emergence in the manufactured control soil (but lower survival, **Table 4**). If sample sizes had been large enough to conduct a statistical comparison, likely the differences, which are slight, would not be statistically or biologically significant. Overall, whether the seeds were collected in the field or cultivated in the nursery, the results were similar.

These results suggest that the nursery seed results may be substituted for site-collected seeds when evaluating cupric ion activity effects. However, study results are inconclusive as to how well alfalfa, the only forb that met the successful test standards, represents a native forb on the Site. The tansyaster experiment fell far below desired success standards for the negative control, and it failed to germinate on *de minimis* soils from bedrock areas. Without this native forb experiment, no recommendations are possible on whether alfalfa is a good replacement for a native forb, though this report includes alfalfa results in the final broad ranges reported for the DEL and PEL.

The current studies show that the range for the final DEL and PEL is different than in 1999 due to the inclusion of more representative reference and variable site locations, as hypothesized (H3 in **Table 12**). The final range of DEL and PEL estimates for alfalfa in the greenhouse study was generally less than estimates in 1999 for the greenhouse study for emergence, survival, and shoot weight, but greater for shoot height and root length (root length is unreliable, however) (H3 in **Table 12**). For the community data, the hypothesis was supported that by including physical habitat (soil categories) and more representative reference locations would alter the PEL (H4 in **Table 12**). The PEL ranged from 2 to 3 for the flat granular soils compared to 5 reported for the 1999 community study. However, the DEL of 6 to 7.5 for the flat granular soils in the community study was similar to the 1999 DEL of 6 to 7, which did not support the hypothesis of a difference (H4 in **Table 12**). The 1999 studies derived a PEL of 5 and DEL of 6 to 7 based on results for all endpoints of the greenhouse and community study. In contrast, the current study derived a PEL of 2 to 6 and a DEL of 4 to 8. These ranges are based on average soil properties in the STSIU, and the covariate analysis showed that these ranges can change depending on the specific texture (clay content), chemistry (extractable iron), and surface condition (granular or rocky) of a soil. Also, these ranges may change if more information is obtained to estimate a community PEL and DEL for other soil categories than flat granular soils.

The most important outcome of this study is that these thresholds vary depending on soil category, soil properties, plant species, and endpoints. These factors should be considered in the STSIU FS when weighing the benefits of various remediation options relative to the harm caused to the habitat by those remedial options. Some remedial options are more destructive than beneficial to the plant community and may not be warranted in a semi-desert area with slow recovery times, even if the pCu of an area is below the pre-RAC value. Balancing those factors, and considering the results from this study, as well as the Amendment, and White Rain studies in the FS will help ensure sound remedial decisions beneficial to the environment are made (Arcadis 2017a, 2017b).

5.2 Comparison between Greenhouse and Community Studies

One way of evaluating the quality of the current PEL results is to compare the final PEL for emergence in the greenhouse study to richness and cover of the same soil category from the community study. Emergence is the best greenhouse endpoint to compare because often it was the endpoint most correlated to community richness and cover endpoints (R^2 = 0.30 to 0.58, **Figures 13 to 16**). Such a comparison shows that flat granular soil locations have PELs for the greenhouse and community study that are both low—specifically, a PEL of 2.3 to 3.7 (**Appendix G**, **Table G-5**, range for both methods, excluding tansyaster) for emergence and a PEL of 2.1 for richness and 3.4 for cover (**Table 11**). The DEL is more variable between the studies on flat granular soil (3.0 to 5.2 for emergence vs. 5.6 to 7.5 for cover and richness), and thus is more difficult to interpret[22]. This may be because the community DEL is based on the minimum endpoint of only two reference locations, a dataset missing some of the flat granular reference locations observed a long distance from the smelter (~40 miles) that appear (based on photos)

---

[22] Without tansyaster, the non-flat granular soil category ranges are 4.5 to 6.6 for the DEL and 3.7 to 5.2 for the PEL (Appendix G)

to have low richness and cover (mostly mesquite) but probably have high pCu. This is a problem of having too low of a sample size for reference for the community study, as mentioned previously. The PEL of the community study is more consistent between the greenhouse and community studies and is best for establishing effect levels of concern, as was done when NMED established the pre-FS RAC for pCu (which was set equal to the PEL of the 1999 studies when above background copper concentrations of 327 mg/kg).

Because emergence is most strongly correlated to community endpoints, such as richness or cover (**Figures 13 to 16**), it is probably the most ecologically relevant greenhouse endpoint. Community endpoints also are the most relevant because they measure actual condition of the plant community on the Site. Field studies often have many more confounding factors, however, such as soil type and category influenced by slope, aspect, and amount of bedrock. These factors can be difficult to tease apart from effects of cupric ion activity. This study tested and accounted for the most strongly confounding factors as covariates, making the community results more reliable. Some uncertainty still remains because of differences in weather between years 2011 and 2014 that may not have been fully considered when adjusting conditions to 2011, given that precipitation can be highly localized. Nonetheless, the two lines of evidence—the greenhouse and community studies—support similar ranges of PELs for one soil category type (flat granular) for the most relevant endpoints. This validates the quality of the results.

Emergence may be most important individual plant endpoint affecting communities because the top inch of the soil has the lowest pCu, except for of four windblown tailing locations (STS-PT-2013-1, STS-PT-2013-2, STS-PT-2013-17, and STS-PT-2013-19; Arcadis 2017b). The inability of a seedling to emerge in this top inch may alter the community richness or cover, more than changes in the seedling's growth. Adverse effects on growth and survival of the seedling may diminish once roots are past the top inch, making the growth parameters less predictive of community effects. The community study captured this stratification in the soil pCu, but the greenhouse phytotoxicity study did not because the soil in the greenhouse study was homogenized over the 6-inch depth. The homogenization diluted the greenhouse soils in the top inch, possibly biasing the PEL low for emergence (affected by top inch) and high for growth endpoints (affected by deeper soil). The community study PEL is probably more ecologically relevant and is based on calculated pCu, which will be used to identify areas for remediation rather than measured pCu. Measured pCu will not be used because it is available for fewer locations compared to the extensive dataset available for copper and pH across the STSIU. Therefore, the community PELs may be the most accurate estimate of the threshold to apply for probable effects based on calculated pCu estimated throughout the STSIU for the FS. However, PELs from the community study are unavailable for the bedrock, slope, and flat rocky soil categories because reference areas were not sampled in these categories. The community study did show that communities in bedrock locations have lower amounts of richness, cover, and OAT scores than in flat granular soils at the same pCu, but likely this is because of bedrock limiting the growth medium, not necessarily because such communities are more sensitive to pCu. The greenhouse study showed that plants growing in soils from non-flat granular locations have lower emergence at the same low pCu than flat, granular soils. The emergence endpoint (because it is most similar to the community endpoints) for the greenhouse results for non-flat granular areas could be used to substitute and fill in the data gap for non-granular flat areas or else future sampling of other categories could be planned to develop more category-specific community PELs.

5.3 Uncertainty

The reference locations have a strong effect on the minimum reference-based DEL and PEL. It is uncertain whether the reference locations completely represent background in the area. Sample size for the reference dataset is low (four for the greenhouse study, two for the community study), and background locations with lower pCu potentially could be present but not included in the dataset. If missed, the PEL and DEL may actually be lower than estimated. This may be particularly true of the community DEL for flat granular soil areas, which only had two reference areas.

Alternatively, the minimum reference-based PEL and DEL may be higher than estimated if the reference sites are more impacted by the smelter or windblown tailings than expected. However, the proposed locations for *de minimis* were screened to identify which ones met criteria as reference using the background pH and sulfate information on **Figure 3**. The four identified for the greenhouse study and two for the community study likely are not impacted by the smelter or tailings. The copper concentrations in the selected reference areas were well below the background threshold of 327 mg/kg at 88 mg/kg, with a range of 56 to 130 mg/kg for greenhouse study and an average of 161 mg/kg with a range of 109 to 213 mg/kg for the community study. Furthermore, pH is high for the reference locations (6.9 to 7.7 for the greenhouse study and 5.9 to 7.6 for the community study), which results in a high pCu (8.2 to 9.2) for all greenhouse study reference locations and for all community study reference locations (6.7 to 9.0, Appendix A and Appendix F).

Of note, the reference locations are all in the flat granular soil category, and the minimum of these was entered into the dose-response equation developed with all site locations when using the minimum reference method for identification of the adverse effects thresholds. This could overestimate the thresholds (DEL and PEL) because the flat granular category of the reference locations generally has higher values of the endpoints, resulting in a higher corresponding pCu than if another reference soil category was used.

Another uncertainty is exclusion of root length and tansyaster data from the final estimated PEL and DEL range. The root length data are equivocal because they gave very different results for the same alfalfa cultivar when the test was repeated. However, if included, the final greenhouse PEL would change to a range of 3.7 to 6.5 (**Figure 9**) instead of 3.7 to 5.7. The high end of the range is much higher than the highest community PEL of 3.4 for flat granular soils. Root length (unlike emergence, shoot weight, and height) is unaffected by whether or not a soil is a flat granular soil (not significant covariate, **Appendix G**) and is often weakly related to community data (**Figures 13** to **16**). The weak correlations further suggest that root length data are too uncertain to rely upon.

If tansyaster is included, the data would provide a greenhouse PEL of 3.7 to 7.0 (**Figure 9 or Tables 8 and 9**). The EC50 for tansyaster is not detectable for survival because the confidence interval of the negative control overlaps the EC50 (**Table 6**). Additionally, the confidence interval for the shoot weight EC50 of 7.0 shows that the data are not useful because the interval has an extremely broad range of 3.8 to 10.2, which covers almost the entire range of pCu found on the STSIU. The failure of the tansyaster data leaves a data gap in knowledge about the response of native forbs to pCu at the individual scale. However, the community data include forbs, which contribute to richness; therefore, the effect of pCu on forbs, at least for flat granular soils, is indirectly included in the final DEL and PEL range.

The tansyaster data were problematic because non-standard test species often grow poorly in a greenhouse setting. Non-standard species often cannot meet standards developed for agricultural species or for thoroughly tested species recommended for phytotoxicity tests by OECD and ASTM. Though the seeds were stratified and grown in cool temperatures in the greenhouse, tansyaster may require natural stratification via a cold winter to have good germination (**Appendix B**), and it may take a long time to germinate in a greenhouse. Like the tansyaster, scarlet globemallow failed to germinate adequately. Possibly more of the globemallow would have germinated given a longer study time or if they had been germinated on paper towels and then planted. Using native forbs, as NMED requested, posed a high risk of failure, and subsequently did not succeed. In contrast, native rangeland grasses have performed satisfactorily as seen by Canadian guidelines that include them. Though no native forb could be used, this report includes the sideoats grama results and used the non-native alfalfa species to represent the forb, which creates uncertainty in the results. Field evidence indicates that native forbs are established on the low pCu sites and influence the richness results. The richness results are included in the DEL and PEL range, indicating that the uncertainty of the greenhouse study in not including a native forb DEL and PEL is probably of minimal concern.

Finally, the community results carry uncertainty because confounding factors unrelated to the evaluated parameters can create artifacts in the results. All efforts were made to adjust the data to remove possible artifacts and biases (e.g., adjust for effects of different weather conditions between years on the percent cover), but some factors affecting the results may have been missed. The controlled greenhouse studies do not carry as many confounding factors, but also lack the realism represented by the field study that includes the natural stratified soil structure, larger-scale environmental conditions, and disturbance history affecting plant communities.

6 CONCLUSIONS AND RECOMMENDATIONS FOR FEASIBILITY STUDY

The results were generally consistent between field and greenhouse studies conducted in 2013 and 2014 when similar soil categories were compared. The results from these two lines of evidence support the conclusion that the pCu DEL (range was 4 to 8) and PEL (range was 2 to 6) are variable and depend on the soil category, soil properties, plant species, and endpoints. The DELs and PELs are more variable than in the 1999 studies because the current study included a greater number of different macro- and micro-environments for plant communities. The use of agricultural crops or seeds cultivated in nurseries for the greenhouse study was not as important as the four types of soil categories found to affect the community DEL and PEL: (1) flat granular soils, (2) steep slopes, (3) flat rocky soils, and (4) bedrock-dominated areas. The rangeland condition (OAT) was not affected by pCu for three of the four soil categories, but the rangeland condition and soil complex of each type (rocky flat areas are generally poor rangeland) affects the plant community condition as well as the parent material and buffering capacity of the soil and should also be considered when selecting remedial measures and a cleanup level for specific locations. Of the greenhouse endpoints, emergence is the most correlated to the community parameters. The DEL and PELs for that endpoint and the community endpoints possibly should be given more weight than the other greenhouse endpoints.

This study results produced some data gaps, such as unknown DELs and PELs for the community study in three of the four soil categories and unknown results for a native forb in the greenhouse study. Future collection of reference soil and vegetation data in the slope, rocky flat, and bedrock categories could allow development of DELs and PELs for the other soil categories to assist in FS decisions. The ECx-based DEL and PEL for emergence was developed using all four soil categories, and its DEL and PEL for non-flat granular categories could also substitute for the missing community effect thresholds for soil categories.

In summary, the variable DEL and PEL values that are the outcome of this study create uncertainty around the pre-FS RAC. Ignoring this uncertainty could create more harm than good to the plant community and wildlife habitat. The uncertainty can be reduced by developing site-specific cleanup levels and remediation strategies that incorporate information from this report, the amendment report (Arcadis 2017a), and the white rain report (Arcadis 2017b) to ensure sound decision-making in the FS. This study and its conclusions will assist in preparing the STSIU FS and be an appendage to that same submittal. Furthermore, this study and its conclusions provide a line of evidence to assist the NMED and stakeholders in making final decisions for the STSIU, which will ultimately be documented in the ROD.

7 REFERENCES

Arcadis. 2011. Feasibility Proposal for Smelter/Tailings Soils Investigation Unit. Prepared for Chino Mines Company, Hurley, New Mexico.

Arcadis. 2012. SOP for Vegetation Monitoring for Smelter/Tailings Soils Investigation Unit. Prepared for Chino Mines Company, Hurley, New Mexico.

Arcadis. 2014. Work Plan: Smelter Tailing Soils Investigation Unit (STSIU) – Phytotoxicity and Vegetation Community Study. Prepared for Freeport-McMoRan Chino Mines Company, Administrative Order on Consent, Smelter/Tailing Soils Investigation Unit, Vanadium, New Mexico.

Arcadis. 2017a. Year 5 Monitoring Report for Smelter/Tailing Soils Investigation Unit Amendment Study Plots. June 2015. Prepared for Freeport-McMoRan Chino Mines Company, Vanadium, New Mexico.

Arcadis. 2017b. Year 5 Report on pH Monitoring to Evaluate the Effect of White Rain on Smelter/Tailing Soils. Sept 2015. Prepared for Freeport-McMoRan Chino Mines Company, Vanadium, New Mexico.

Association of Official Seed Analysis (AOSA). 2009. Seed vigor testing handbook.

ASTM International (ASTM). 2009. Standard guide for conducting terrestrial plant toxicity tests. Prepared by the American Society of Testing and Materials. Designation: E1963-09. Philadelphia, Pennsylvania.

Bestelmeyer, B.T., J.E. Herrick, D.A. Trujillo, and K.M. Havstad. 2004. Land management in the American southwest: a state-and-transition approach to ecosystem complexity. Environmental Management 34:38-51.

Belsley, D.A., K. Kuh, and R.E. Welsch. 1980. Regression diagnostics: Identifying influential data and sources of collinearity. John Wiley & Sons, New York.

Bondada, B., and L. Qiyingma. 2003. In S. Chandra & M. Srivastava (eds.), Pteridology in The New Millennium, 397-420. Kluwer Academic Publishers. Printed in the Netherlands

Bradshaw, A., T. McNeilly, and P. Putwain. 1990. The essential qualities. In: Heavy Metal Tolerance in Plants: Evolutional Aspects, J. Shaw (ed.). CRC Press, Boca Raton, Florida.

Chino. 1995. Administrative Order on Consent, Investigation Area, Remedial Investigation Background Report, Chino Mines Company, Prepared by Chino Mines Company, Hurley, New Mexico, October 5.

Chino. 2004. Comments on Site-wide Ecological Risk Assessment. March.

Chino. 2007. Comments on Smelter Tailings Soils Investigation Unit Ecological Risk Assessment. September.

Environment Canada. 2007. Guidance document on statistical methods for environmental toxicity tests. Methods Development and Applications Section. Environment Canada, Ottawa, ON. Report EPS I/RM/46 (with June 2007 amendments).

Haque. MD N. 2008. Screening the phytoremediation potential of native plants growing on mine tailings in Arizona, USA. PhD Dissertation, University of Texas, El Paso, Texas.

Hosmer, D. W., and S. Lemeshow. 2000. Applied logistic regression. Second edition. Wiley-Interscience Publication, John Wiley and Sons, New York, New York, USA.

Kopittke, P.M., Blamey, F.P.C., Asher, C.J., and N.W. Menzies. 2010. Trace metal phytotoxicity in solution culture: a review. Journal of Experimental Botany 61(4): 945-954.

Larcher, W. 1995. Physiological plant ecology. 3rd edition. Springer. New York.

Loneragan, J.F., A.D. Robson, and R.D. Graham. 1981. Copper in soils and plants. American Press.

MacDonald, D.D., C.G. Ingersoll, J. A. Sinclair, J. A. Steevens, J. K. Stanley, J. D. Farrar, N. E. Kemble, J. L. Kunz, W. G. Brumbaugh, and M. R. Coady. 2014. Evaluation of Relations Between Sediment Toxicity and Sediment Chemistry at the Anniston PCB Site. Chapter 5 in Ingersoll, C.G., Steevens, J.A., and MacDonald, D.D., eds., 2014, Evaluation of toxicity to the amphipod, *Hyalella azteca*, and to the midge, *Chironomus dilutus*; and bioaccumulation by the oligochaete, *Lumbriculus variegatus*, with exposure to PCB-contaminated sediments from Anniston, Alabama: U.S. Geological Survey Scientific Investigations Report 2013–5125, 122 p., *http://dx.doi.org/10.3133/sir20135125*.

MacNair, M.R. 1990. The genetics of metal tolerance in natural populations. In: Heavy Metal Tolerance in Plants: Evolutional Aspects. J. Shaw (ed.). CRC Press, Boca Raton, Florida.

MacNair, M.R. 1997. The evolution of plants in metal-contaminated environments. Pp. 3-24. In: Bijlsma, R. and V. Loeschcke (eds.) Environmental Stress, Adaptation and Evolution. Birkhauser Ver1ag:Bostn. of contaminated soil and water. Lewis Publishers: London, UK.

MacNair, M. R., G. H. Relston, and S. E. Smith. 2000. The genetics of metal tolerance and accumulation in higher plants. Pp. 235-248. In: Terry, N. and G. Banueoles (eds.) Phytoremediation

MFG. 2004. Letter to Mr. Chris Eustice from Ed Redente on January 9, 2004.

Motulsky, H. and A. Christopoulos. 2003. GraphPad PRISM. Version 4.0 Fitting models to biological data using linear and non-linear regression: a practical guide to curve fitting. GraphPad software. http://www.graphpad.com/manuals/prism4/RegressionBook.pdf

Nagelkerke N. 1991. A note on a general definition of the coefficient of determination. Biometrika, 78: 691-692.

NewFields. 2005. Chino Mines Administrative Order on Consent Site-wide Ecological Risk Assessment. Prepared for Chino Mines Company in November 2005

NewFields. 2008. Chino Mines Administrative Order on Consent, STSIU Ecological Risk Assessment, April.

New Mexico Environment Department (NMED). 2011. Letter to Mr. Ned Hall from Mr. Bill Olsen Regarding Resolution of Information Dispute Resolution. March 3.

Organization for Economic Cooperation and Development (OECD). 2006. Guidelines 208: Terrestrial Plant Test: Seedling Emergence and Seedling Growth Test. Adopted 19 July 2006.

OECD. 2012. Fish toxicity testing framework. Series on testing and assessment No. 171. Environment Directorate. Joint Meeting of Chemicals Committee and Working Party of Chemicals, Pesticides, and Biotechnology.IOMC. ENV/JM/MONO 2012 (16).

Paschke, M.W., and E.F. Redente. 2002. Copper toxicity thresholds for important restoration grass species of the Western United States. Environmental Toxicology and Chemistry 21(12) : 2692-2697.

Patsikka, E., M. Kairavuo, F. Sersen, E-M Aro, and E. Ty7ystjarvi. 2002. Excess copper predisposes photosystem II to photoinhibition in vivo by outcompeting iron and causing decrease in leaf chlorophyll. Plant Physiology 129:1359-1367.

Plaster, C.J. 2009. Soil science and management. 5th edition. Cengage Learning, New York.

Schafer and Associates. 1999. Chino Administrative Order of Consent – Sitewide Ecological Risk Assessment Technical Memorandum No. 1: ERA Workplan. CMC Agreement No. C59938.

Shank, M. 2008. Using Remote Sensing to Map Vegetation Density on a Reclaimed Surface Mine. Paper presented at the 2008 conference on “Incorporating Geospatial Technologies into SMCRA Business Processes”, March 25 – 27, 2008, Atlanta, GA. http://tagis.dep.wv.gov/tagis/projects/percent_cover_paper.pdf

Spiess, A-N, and N. Neumeyer. 2010. An evaluation of R2 as an inadequate measure for nonlinear models in pharmacological and biochemical research: a Monte Carlo approach. BMC Pharmacology. 10: 6.

SRK. 1997. Administrative Order on Consent Quality Assurance Project Plan.

SRK. 2008. Administrative Order on Consent Remedial Investigation Report for Smelter/Tailings Soils Investigation Unit. June 25.

Thomas, G.W. 1996. Soil pH and Soil Acidity. pp. 475-490. In D.L. Sparks et al. (eds.) Methods of Soil Analysis – Part 3, Chemical Methods. American Society of Agronomy, Madison, WI.

U.S. Department of Agriculture (USDA). 1983. Soil Survey of Grant County, New Mexico Central and Southern Parts. Soil Conservation Service and Forest Service, in cooperation with New Mexico Agricultural Experiment Station. Available at: https://www.nrcs.usda.gov/Internet/FSE_MANUSCRIPTS/new_mexico/NM662/0/grant.pdf.

U.S. Environmental Protection Agency (USEPA). 2002. Guidance for comparing background and chemical concentrations in soil for CERCLA sites. Office of Emergency and Remedial Response U.S. Environmental Protection Agency Washington, DC. EPA 540-R-01-003 OSWER 9285.7-41

USEPA. 2013. ProUCL Version 5.0.00 Technical Guide. Statistical Software for Environmental Applications for Datasets with and without Nondetect Observations. Prepared for Felicia Barnett, ORD Site Characterization and Monitoring Technical Support Center, U.S. Environmental Protection Agency by Singh, A., and A. K. Singh. EPA/600/R-07/041

Zappala, M.N., JT. Ellzey, J. Bader, J. R. Peralta-Videa, J. Gardea-Torresday. 2013. *Prosopsis pubescens* (screw bean mesquite) seedlings are hyperaccumulators of copper. Arch. Environ. Contam. Toxicol. 65:212-223.

TABLES

Table 1

Soil Sample Size and Quantities for Greenhouse Experiment

Freeport-McMoran Chino Mines Company
Vanadium, New Mexico
Smelter/Tailings Soils IU Phytotoxicity and Vegetation Community Study

	Native Grass per Location		Native Forb per Location		Alfalfa per Location	Total per Location	Total of all Locations[a]	Total Soil Collected (gallons)[b]
	Wild	Nursery	Wild	Nursery	Nursery			
Site Soil								
Pot replicates (#)	10	10	10	10	10	50	1250	--
Seeds (#)[c]	120	120	120	120	120	600	15000	--
Soil per location (cups)	30	30	30	30	30	150	3750	234
***De Minimis* Soil**								
Pot replicates (#)	10	10	10	10	10	50	400	--
Seeds (#)[c]	120	120	120	120	120	600	4800	--
Soil (cups)	30	30	30	30	30	150	1200	75
Control Soil								
Pot replicates (#)	10	10	10	10	10	50	50	--
Seeds(#)[c]	120	120	120	120	120	600	600	--
Soil(cups)	30	30	30	30	30	150	150	9
Total								
Pots	30	30	30	30	30	150	**1700**	--
Seeds (Collected)	360	--	360	--	--	720	**8160**	--
Seeds (Purchased)	--	360	--	360	360	1080	**12240**	--
Soil Collected (no artificial soil)	90	90	90	90	90	450	**5100**	**319**

Notes:

a. Multiplied total replicates per location by number of locations: 25 site locations, four *de minimis* locations, four reference locations, and one sample for control s
b. 4.3-inch diameter pots required 3 cups of soil each
c. 12 seeds were planted per pot

Table 2
Soil Sample Analyses for Greenhouse Experiment
Freeport-McMoran Chino Mines Company
Vanadium, New Mexico
Smelter/Tailing Soils IU Phototoxicity and Vegetation Community Study

Parameter	Extraction Method	Analytical Method
Alkalinity (total)	ASA Mono #9, Part 2, 10-2.3.1	A 2320B
Chloride	ASA Mono #9, Part 2, 10-3.2	E300.0
Fluoride	ASA Mono #9, Part 2, 10-3.2	A 4500 F-C/Technicon 380-7WE
Exchangeable Calcium (NH_4OAc) [a]	ASA Mono #9, Part 2, 13-4	6010/6020
Exchangeable Copper (NH_4OAc) [a]	ASA Mono #9, Part 2, 13-4	6010/6020
Exchangeable Magnesium (NH_4OAc) [a]	ASA Mono #9, Part 2, 13-4	6010/6020
Exchangeable Potassium (NH_4OAc) [a]	ASA Mono #9, Part 2, 13-4	6010/6020
Exchangeable Sodium (NH4OAc) [a]	ASA Mono #9, Part 2, 13-4	6010/6020
Sulfate (soluble)	ASA Mono #9, Part 2, 10-3.2	6010/6020
Copper (total)	3050	6010B
Copper (soluble), $CaCl_2$	Arcadis SOP	Arcadis SOP
Aluminum (soluble)	ASA Mono. #9, Part 2, Method 19-3.3	6010/6020
Iron (soluble)	ASA Mono. #9, Part 2, Method 19-3.3	6010/6020
Manganese (soluble)	ASA Mono. #9, Part 2, Method 19-3.3	6010/6020
Nitrate/Nitrite, in $CaCl_2$	ASA Mono. #9, Part 2, Method 38-8.1	350.1, 353.2, 351.4
pH (saturated paste with saturated %)	ASA Mono #9, Part 2, 10-3.2	9045C
pH, $CaCl_2$	Arcadis SOP	Arcadis SOP
Plant Available Phosphorus (Bray/Olsen)	ASA Mono. #9, Part 2,Method 24-5.1	365.1
Phosphate	ASA Mono. #9, Part 2, Method 24-5.3	365.1
Electrical Conductivity, saturated paste	ASA Mono. #9, Part 2,Method 10-3.3	ASA Mono #9 Part 2
Electrical Conductivity, $CaCl_2$	Arcadis SOP	Arcadis SOP
Total Organic Matter	ASA Mono. #9, Part 2,Method 29-3.5.2	Handbook 60
DOC	ASA Mono. #9, Part 2, Method 10-3	ASA Mono #9 Part 2
Soil Texture	ASA Mono. #9, Part 1, Method 15-4	NAPT S-10.101
$CaCO_3$	USDA Handbook 60, Method 23C	Handbook 60
Measured pCu in $CaCl_2$	Arcadis SOP in Work Plan	Arcadis SOP
Moisture (dry basis)	USDA Handbook 60,Method 26	

Acronyms/Abbreviations:

ASA Mono #9 = American Society of Agronomy Monograph #9
$CaCl_2$ = calcium chloride
$CaCO_3$ = calcium carbonate
DOC = dissolved organic carbon
NAPT = North American Proficiency Testing
NH_4OAc = ammonium acetate
SOP = standard operating procedure
USDA = United States Department of Agriculture

Notes:

a. NH_4OAc-exchangeable plus water soluble (saturated paste) concentrations produces the NH_4OAc-extractable concentration that is most available to plants, and the extractable concentrations are used in the covariate analysis.

Table 3
Manufactured Control Soil Characterization
Freeport-McMoran Chino Mines Company
Vanadium, New Mexico
Smelter/Tailing Soils IU Phytotoxicity and Vegetation Community Study

Parameter	Result	
Sand, Percent	89	
Silt, Percent	3	
Clay, Percent	8	
USDA Textural Class	Loamy Sand	
Bulk Density, disturbed (g/cm^3)	1.23	
Cation Exchange Capacity (meq/100 g)	3.9	
Moisture at 1/3 Bar (%)	8.5	
Moisture at 15 Bar (%)	4.5	
Organic Carbon - Walkley Black (%)	0.56	
Organic Matter - Walkley Black (%)	0.96	
pH in 1:1 soil:water ratio	7.2	
pH in 0.01M $CaCl_2$ (1:2)	6.7	
Olsen Phosphorus (ppm)	21	
Total Nitrogen (Analyzer) (%)	<0.01	
Soluble Salts (mmhos/cm)	0.49	
Base Saturation Data by Cation:	**(%)**	**(ppm)**
Calcium	70.4	546
Magnesium	10.3	48
Sodium	1.6	14
Potassium	3.3	50
Hydrogen	14.5	6

Acronyms/Abbreviations:

g/cm^3 = grams per cubic centimeter
meq/100 g = millequivalents per 100 grams
mmhos/cm = millimhos per centimeter
ppm = parts per million
USDA = United States Department of Agriculture

Table 4
Quality of Greenhouse Phytotoxicity Results Based on Performance of Control
Freeport-McMoran Chino Mines Company
Vanadium, New Mexico
Smelter/Tailing Soils IU Phytotoxicity and Vegetation Community Study

Species	Germination (%)	Survival (%)
Minimum Criteria Threshold		
Alfalfa	80	90
Sideoats Grama	65	90
Tansyaster	55	80
Results		
Alfalfa	80	96
Field Sideoats Grama	*64*	*82*
Nursery Sideoats Grama	*55*	*88*
Field Tansyaster	**28**	**30**
Nursery Tansyaster	**45**	**38**

Notes:

Italicized results were below criteria threshold by ≤ 10% in absolute units.
Bolded results in red were below criteria threshold by > 10% in absolute units.
Criteria are based on agricultural or rangeland grass species known to perform well in the laboratory (see text).
Survival was calculated for each negative control pot and then averaged across the pots. Wildlife International summed the number of survived seedlings across all pots and divided that by the number of emerged seedlings across all pots, resulting in a slightly different estimate.

Table 5
Summary of Calculated EC10s, EC20s, and EC50s with 95% Confidence Intervals for Greenhouse Study
Freeport-McMoran Chino Mines Company
Vanadium, New Mexico
Smelter/Tailings Soils IU Phytotoxicity and Community Study

Species	Emergence	Survival	Root Length	Shoot Weight	Shoot Height[a]
EC10					
Alfalfa					
EC10 (lower 95%)	3.87	3.55	6.92	5.91	6.68
EC10	4.33	3.75	7.44	7.18	7.35
EC10 (upper 95%)	4.79	3.95	7.95	8.45	8.01
Field Sideoats Grama					
EC10 (lower 95%)	6.10	5.37	6.71	6.57	6.68
EC10	6.72	6.76	7.10	7.74	7.35
EC10 (upper 95%)	7.34	8.15	7.49	8.91	8.01
Nursery Sideoats Grama					
EC10 (lower 95%)	6.10	5.37	6.71	6.57	6.68
EC10	6.72	6.76	7.10	7.74	7.35
EC10 (upper 95%)	7.34	8.15	7.49	8.91	8.01
Field Tansyaster					
EC10 (lower 95%)	5.81	5.20	5.16	5.66	6.68
EC10	6.91	5.34	6.07	9.07	7.35
EC10 (upper 95%)	8.01	5.47	6.98	12.5	8.01
Nursery Tansyaster					
EC10 (lower 95%)	5.81	4.92	5.16	5.66	6.68
EC10	6.91	5.02	6.07	9.07	7.35
EC10 (upper 95%)	8.01	5.13	6.98	12.5	8.01
EC20					
Alfalfa					
EC20 (lower 95%)	3.81	3.60	6.63	5.37	6.22
EC20	4.13	3.72	7.07	6.42	6.73
EC20 (upper 95%)	4.45	3.85	7.52	7.46	7.24
Field Sideoats Grama					
EC20 (lower 95%)	5.65	5.11	6.44	6.07	6.22
EC20	6.13	6.15	6.74	6.97	6.73
EC20 (upper 95%)	6.60	7.20	7.03	7.88	7.24
Nursery Sideoats Grama					
EC20 (lower 95%)	5.65	5.11	6.44	6.07	6.22
EC20	6.13	6.15	6.74	6.97	6.73
EC20 (upper 95%)	6.60	7.20	7.03	7.88	7.24
Field Tansyaster					
EC20 (lower 95%)	5.30	5.18	4.82	4.98	6.22
EC20	6.32	5.30	5.71	8.31	6.73
EC20 (upper 95%)	7.34	5.42	6.59	11.6	7.24
Nursery Tansyaster					
EC20 (lower 95%)	5.30	4.90	4.82	4.98	6.22
EC20	6.32	4.98	5.71	8.31	6.73
EC20 (upper 95%)	7.34	5.07	6.59	11.6	7.24
EC50					
Alfalfa					
EC50 (lower 95%)	3.58	3.61	6.10	4.34	5.40
EC50	3.79	3.68	6.46	5.10	5.67
EC50 (upper 95%)	4.00	3.75	6.82	5.86	5.95
Field Sideoats Grama					
EC50 (lower 95%)	4.85	4.57	5.95	5.17	5.40
EC50	5.11	5.11	6.12	5.66	5.67
EC50 (upper 95%)	5.37	5.66	6.29	6.16	5.95
Nursery Sideoats Grama					
EC50 (lower 95%)	4.85	4.57	5.95	5.17	5.40
EC50	5.11	5.11	6.12	5.66	5.67
EC50 (upper 95%)	5.37	5.66	6.29	6.16	5.95
Field Tansyaster					
EC50 (lower 95%)	4.37	5.13	4.22	3.77	5.40
EC50	5.30	5.23	5.09	6.99	5.67
EC50 (upper 95%)	6.24	5.33	5.96	10.2	5.95
Nursery Tansyaster					
EC50 (lower 95%)	4.37	4.84	4.22	3.77	5.40
EC50	5.30	4.92	5.09	6.99	5.67
EC50 (upper 95%)	6.24	4.99	5.96	10.2	5.95

Acronyms/Abbreviations:

ECx = Effect concentration of x%, which is pCu when endpoint is reduced by x% from the modeled no effect threshold, R_{max}

pCu = cupric ion activity

R_{max} = Upper endpoint threshold of S-shaped dose-response curve (where curve plateaus)

Notes:

a. One nursery sideoats grama outlier excluded.

Table 6
Approximation of Minimum Effect Detectable Based on Negative Control Variability
Freeport-McMoran Chino Mines Company
Vanadium, New Mexico
Smelter/Tailing Soils IU Phytotoxicity and Vegetation Community Study

Parameter	Half the 95% Confidence Interval of Negative Control					
	Alfalfa 1999	Alfalfa 2014	Field Sideoats Grama	Nursery Sideoats Grama	Field Tansyaster	Nursery Tansyaster
Emergence (%)	12	13	20	24	16	17
Survival (%)	14	4	16	13	71	39
Root Length (cm)	13	10	20	21	37	20
Shoot Weight (g dw)	4	16	33	29	47	24
Shoot Height (cm)	12	10	12	12	31	8
Detectable ECx range	EC5 - EC15	EC5 - EC20	EC15 - EC35	EC15 - EC30	EC20 - EC75	EC10 - EC40

Acronyms/Abbreviations:

cm = centimeters
ECx = effect concentration of x%, which is pCu when endpoint is reduced by x% from the modeled no effect threshold (R_{max})
g dw = grams dry weight
pCu = cupric ion activity
R_{max} = upper endpoint threshold of S-shaped dose-response curve (where curve plateaus)

Notes:

Values in table are 2*standard error/mean of negative control's endpoint, converted to percent (x 100), where 2 approximates a t value (OECD 2012). This value approximates half the 95% confidence interval of the negative control.

Table 7

Summary of Greenhouse DELs and PELs based on Minimum of Reference Locations
Freeport-McMoran Chino Mines Company
Vanadium, New Mexico
Smelter/Tailings Soils IU Phytotoxicity and Vegetation Community Study

Species	Emergence	Survival	Root Length	Shoot Weight	Shoot Height
Alfalfa					
DEL	4.33	3.96	7.73	7.11	6.88
PEL	3.74	3.69	6.41	4.90	5.41
Field Sideoats Grama					
DEL	5.86	6.72	8.01	6.60	6.57
PEL	4.71	4.96	6.11	5.13	5.31
Nursery Sideoats Grama					
DEL	6.61	7.17	7.18	6.79	6.60
PEL	4.94	5.02	6.04	5.21	5.32
Field Tansyaster					
DEL	4.87	5.31	4.62	6.21	6.24
PEL	4.18	5.22	4.24	5.37	5.17
Nursery Tansyaster					
DEL	5.37	5.06	5.13	5.81	5.55
PEL	4.54	4.91	4.63	5.02	4.75

Acronyms/Abbreviations:

DEL = *de minimis* effect level = pCu at endpoint that is the minimum of reference locations
PEL = probable effect level = pCu at half the endpoint that is the minimum of reference locations
When minimum reference was >Rmax, Rmax was the endpoint value for the DEL (the case for alfalfa survival)
pCu = cupric ion activity

Table 8
Summary of Greenhouse Final DELs and PELs for Alfalfa and Sideoats Grama
Freeport-McMoran Chino Mines Company
Vanadium, New Mexico
Smelter/Tailings Soils IU Phytotoxicity and Vegetation Community Study

Species	Emergence	Survival	Shoot Weight	Shoot Height
Alfalfa				
DEL based on minimum of reference	4.33	3.96	7.11	6.88
PEL based on minimum of reference	3.74	3.69	4.90	5.41
EC10 (DEL)	4.33	3.75	7.18	7.35
EC50 (PEL)	3.79	3.68	5.10	5.67
Average Sideoats Grama				
DEL based on minimum of reference	6.24	6.94	6.69	6.58
PEL based on minimum of reference	4.83	4.99	5.17	5.31
EC10 (DEL)	6.72	6.76	7.74	7.35
EC50 (PEL)	5.11	5.11	5.66	5.67

Notes:

DEL = *de minimis* effect level in pCu units
PEL = probable effect level in pCu units
ECx = Effect concentration of x%, which is pCu when endpoint is reduced by x% from the modeled no effect threshold, R_{max}
pCu = cupric ion activity
R_{max} = Upper endpoint threshold of S-shaped dose-response curve (where curve plateaus)
When minimum reference was >Rmax, Rmax was the endpoint value for the DEL (the case for alfalfa survival)

Table 9
Summary of Greenhouse DELs and PELs for Tansyaster
Freeport-McMoran Chino Mines Company
Vanadium, New Mexico
Smelter/Tailings Soils IU Phytotoxicity and Vegetation Community Study

Species	Emergence	Survival	Root Length	Shoot Weight	Shoot Height
Field Tansyaster					
DEL based on minimum of reference	4.87	5.31	4.62	6.21	6.24
PEL based on minimum of reference	4.18	5.22	4.24	5.37	5.17
EC10 (DEL)	6.91	5.34	6.07	9.07	7.35
EC50 (PEL)	5.30	5.23	5.09	6.99	5.67
Nursery Tansyaster					
DEL based on minimum of reference	5.37	5.06	5.13	5.81	5.55
PEL based on minimum of reference	4.54	4.91	4.63	5.02	4.75
EC10 (DEL)	6.91	5.02	6.07	9.07	7.35
EC50 (PEL)	5.30	4.92	5.09	6.99	5.67

Notes:

DEL = *de minimis* effect level in pCu units

PEL = probable effect level in pCu units

ECx = Effect concentration of x%, which is pCu when endpoint is reduced by x% from the modeled no effect threshold, R_{max}

pCu = cupric ion activity

R_{max} = Upper endpoint threshold of S-shaped dose-response curve (where curve plateaus)

Notes:

Tansyaster results separated from other results in Table 9 because results are considered unreliable.

Table 10
Comparison of Greenhouse DEL and PEL of Alfalfa Test in 1999 to Alfalfa Test in 2014
Freeport-McMoran Chino Mines Company
Vanadium, New Mexico
Smelter/Tailing Soils IU Phytotoxicity and Vegetation Community Study

Species	Emergence	Survival[a]	Root Length	Shoot Weight	Shoot Height
1999 Alfalfa					
EC10 (DEL)	5.19	5.26	4.97	7.52	6.52
EC50 (PEL)	4.23	4.30	4.89	5.23	5.08
DEL based on minimum of reference	8.26	5.34	5.24	8.58	10.82
PEL based on minimum of reference	4.32	4.23	4.89	5.15	5.10
2014 Alfalfa					
EC10 (DEL)	4.33	3.75	7.44	7.18	7.35
EC50 (PEL)	3.79	3.68	6.46	5.10	5.67
DEL based on minimum of reference	4.33	3.96	7.73	7.11	6.88
PEL based on minimum of reference	3.74	3.69	6.41	4.90	5.41

Acronyms/Abbreviations:

DEL = *de minimis* effect level in pCu units
PEL = probable effect level in pCu units
pCu = cupric ion activity
ECx = Effect concentration of x%, which is pCu when endpoint is reduced by x% from the modeled no effect threshold, R_{max}
R_{max} = Upper endpoint threshold of S-shaped dose-response curve (where curve plateaus)

Notes:

a. Survival was originally calculated as number surviving divided by total seeds planted in 1999, whereas in 2014, it was calculated as number surviving divided by total that emerged. All 1999 data were re-calculated using same 2014 methods in this report and table for comparison.

Table 11
General Linear Model Results for Richness, Cover, OAT Scores, and Community DEL and P
Freeport-McMoran Chino Mines Company
Vanadium, New Mexico
Smelter/Tailing Soils IU Phytotoxocity and Vegetation Community Study

Effect	Coefficient	Standard Error	Standardized Coefficient	t-value	p-value	DEL	PEL
Richness (n = 30^a, R^2=0.83)$^{a:}$ All categories							
Constant	0.97	1.36	0	0.7151	0.4812		
Calculated pCu	1.23	0.18	0.52	6.7616	**<0.0001**		
Bedrock	-4.43	1.11	-0.46	-3.9827	**0.0005**	NA	NA
Flat Granular	3.05	1.09	0.32	2.7967	**0.0098**	7.47	2.10
Flat Rocky	-2.90	1.16	-0.28	-2.4986	**0.0194**	NA	NA
Cover (n = 19, R^2 = 0.84) for flat granular and bedrock locations only^b							
Constant	-3.70	1.25	0	-2.9508	0.0094		
Calculated pCu	1.28	0.21	0.54	6.0412	**<0.0001**		
Flat Granular	7.46	0.95	0.71	7.8829	**<0.0001**	5.64	3.42
OAT score (n = 9, R^2 = 0.57) for only bedrock locations							
Constant	-2.65	4.748	0	-0.558	0.5944		
Calculated pCu	2.86	0.935	0.76	3.055	**0.0185**		

Notes:

a. Excludes two outliers

b. Excludes one outlier

OAT = Observed apparent trend

Slope is the reference group for the "indicator" variable of soil category (includes bedrock, flat granular, flat rocky, slope) in the multiple regression. R^2 is adjusted for number of variables in model.

Bolded P values have $p < 0.05$.

NA = not available because no reference locations were available for that soil category; only flat granular had reference locations.

pCu = cupric ion activity

Table 12
Hypotheses Tested for Greenhouse and Community Studies
Freeport-McMoran Chino Mines Company
Vanadium, New Mexico
Smelter/Tailing Soils IU Phytotoxicity Vegetation Community Study

Hypothesis	Outcome
H1a. Native species will have a lower EC50 of each greenhouse study endpoint than agricultural species	H1a. Rejected for all endpoints except root length (Figure 9)[a].
H1b. Native species will have lower minimum reference PEL for each greenhouse study endpoint than agricultural species	H1b. Rejected for all endpoints except root length[a] and shoot height (Figure 9).
H2a. Field-collected site seeds of native species will have a lower EC50 than nursery seeds of the same species in greenhouse study	H2a. Rejected for all endpoints (Figure 9).
H2b. Field-collected site seeds of native species will have a lower minimum reference PEL than nursery seeds of same species in greenhouse study	H2b. Supported except for root length of sideoats grama. Not supported for tansyaster except for emergence and root length[a] (Figure 9). Unlikely the slight differences for either species are significant.
H3. The DEL and PEL of the alfalfa study will differ from the 1999 alfalfa study DEL and PEL with the inclusion of more representative reference and site locations[b].	H3. Supported. Lower than 1999 for three endpoints (average difference across all PELs and DELs of 0.6 to 0.8 pCu units), and higher for shoot height and root length (average difference of 0.6 to 1.9[a], respectively, Table 8) .
H4. The DEL and PEL from the community study will differ by physical habitat type and differ from the 1999 study with the inclusion of more representative reference locations.	H4. Supported. The four soil categories affected richness, and to a less extent cover and OAT score. The PEL (but not the DEL) for the only category with a PEL, flat granular soil, was lower than the final PEL of the soils in relatively flat areas in the 1999 study (Table 9).

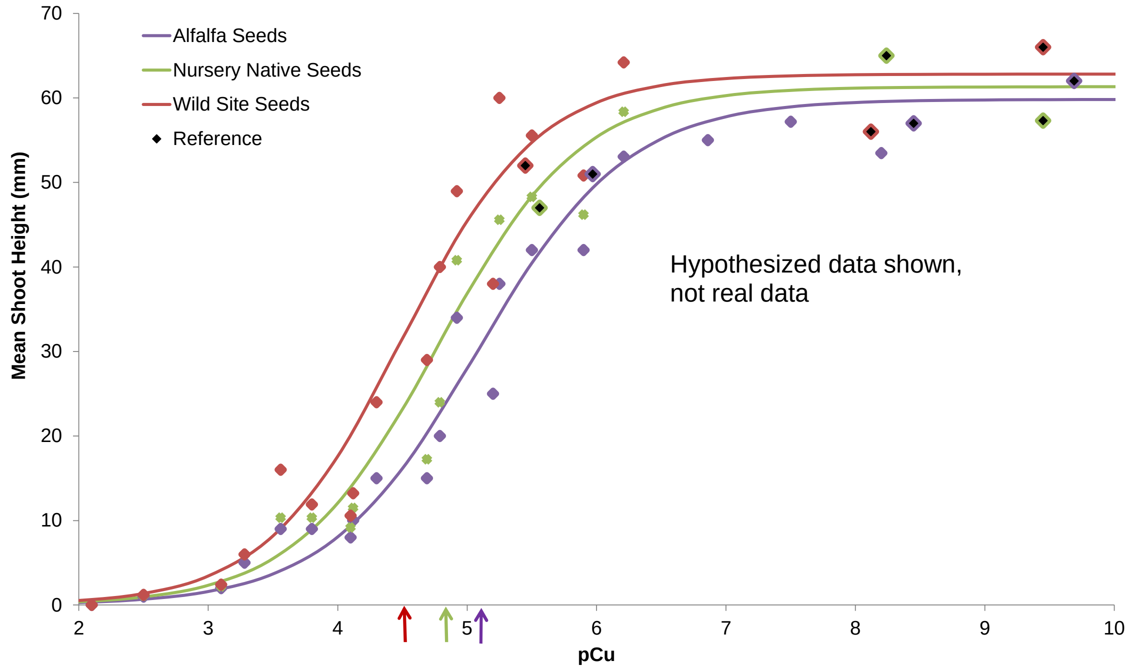
Notes:

[a] Root length data are not reliable in 2014 study, nor are the tansyaster results.

[b] Though including east-side locations for reference is more representative than the one west-side reference in 1999, the 2014 reference locations only represented the flat, granular soil category.

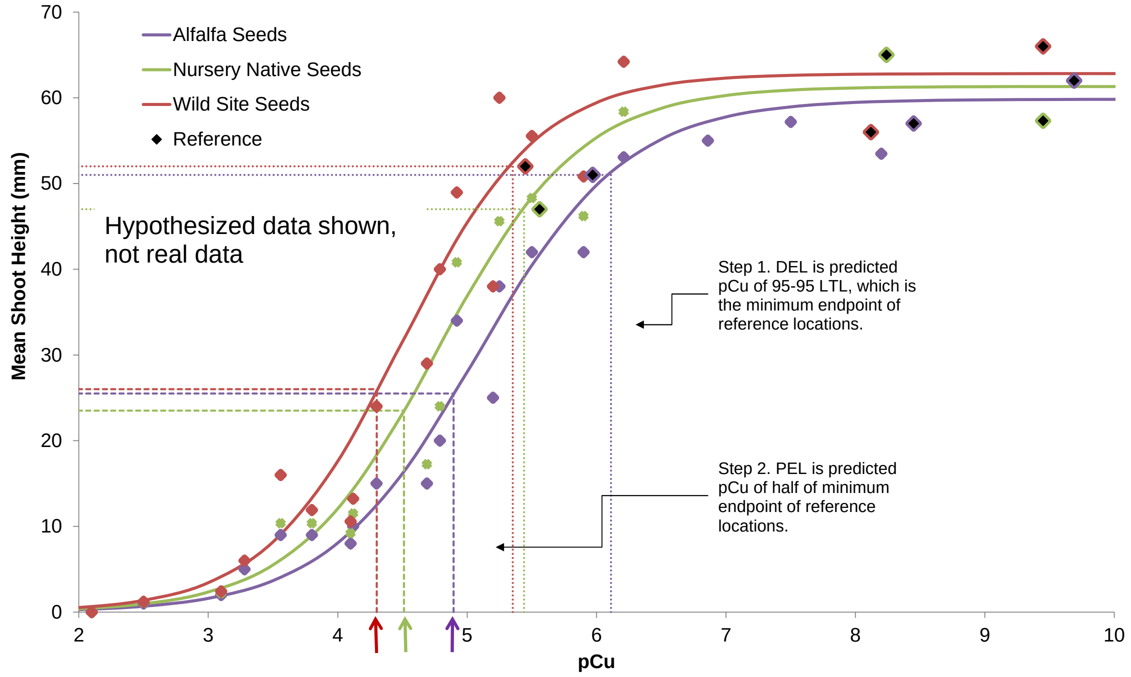
DEL = *de minimis* effect level
PEL = probable effect level
pCu = cupric ion activity
OAT = observed apparent trend
ECx = Effect concentration of x%, which is pCu when endpoint is reduced by x% from the modeled no effect threshold, R_{max}
R_{max} = Upper endpoint threshold of S-shaped dose-response curve (where curve plateaus)

FIGURES



Hypothesized data shown, not real data

a. ECx method, where the PEL is the pCu associated with a 50% reduction (modeled EC50) of endpoint values.



Hypothesized data shown, not real data

Step 1. DEL is predicted pCu of 95-95 LTL, which is the minimum endpoint of reference locations.

Step 2. PEL is predicted pCu of half of minimum endpoint of reference locations.

b. Minimum of reference locations method, where the PEL is estimated as the predicted pCu at half the minimum of reference endpoints.

Notes:

DEL = *de minimis* effects level
PEL = probable effects level

Shown is the hypothesized leftward shift in pCu relationship with shoot height if native, wild site seeds are used instead of nursery or agricultural (alfalfa) seeds. Symbols with black centers are reference (color represents seed type). Arrows represent the PEL for each curve.

FREEPORT-MCMORAN CHINO MINES COMPANY
VANADIUM, NEW MEXICO

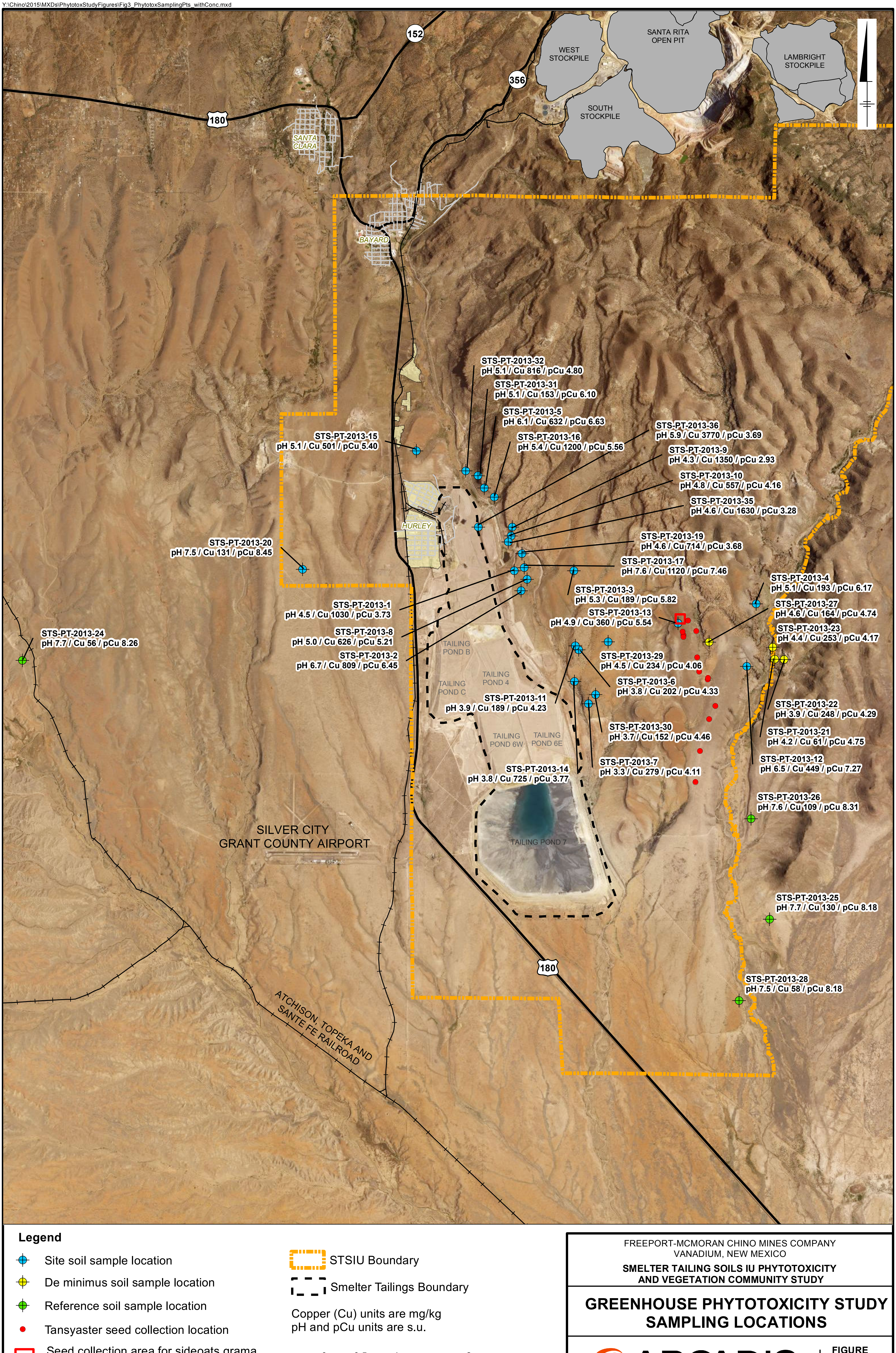
PHYTOTOXICITY AND VEGETATION COMMUNITY STUDY

Hypothesized Relationship between pCu and Shoot Height by Seed Type with Made-up Data

ARCADIS

FIGURE
1

OFFICE: LAKEWOOD DB: MEB TM: MB PM: AT
PROJECT# B0063543.0000 6/28/2017 12:37:58 PM
Y:\Chino\2015\MXDs\PhytotoxStudyFigures\Fig3_PhytotoxSamplingPts_withConc.mxd



Legend

- ⊕ Site soil sample location
- ⊕ De minimus soil sample location
- ⊕ Reference soil sample location
- ● Tansyaster seed collection location
- ☐ Seed collection area for sideoats grama protected from grazing
- ▭ STSIU Boundary
- ▭ Smelter Tailings Boundary

Copper (Cu) units are mg/kg
pH and pCu units are s.u.

0 0.5 1 2 Miles
GRAPHIC SCALE

Service Layer Credits: USDA, N AIP 2016

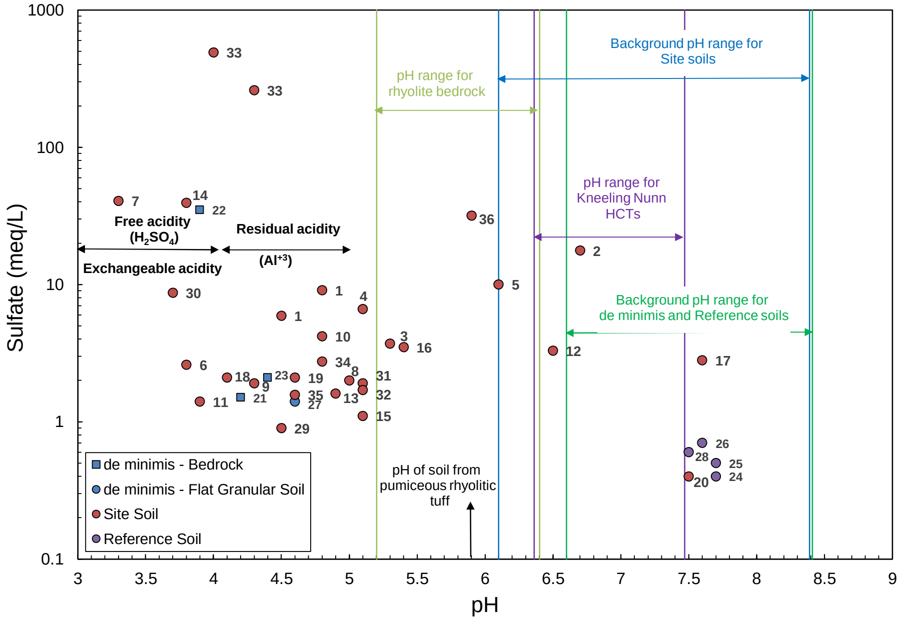
FREEPORT-MCMORAN CHINO MINES COMPANY
VANADIUM, NEW MEXICO

SMELTER TAILING SOILS IU PHYTOTOXICITY AND VEGETATION COMMUNITY STUDY

GREENHOUSE PHYTOTOXICITY STUDY SAMPLING LOCATIONS

ARCADIS

FIGURE
2



Notes:
Numbers represent the last number of the location IDs on Figure 2.
HCTs = Humidity Cell Tests for kinetic testing of rock

FREEPORT-MCMORAN CHINO MINES COMPANY
VANADIUM, NEW MEXICO

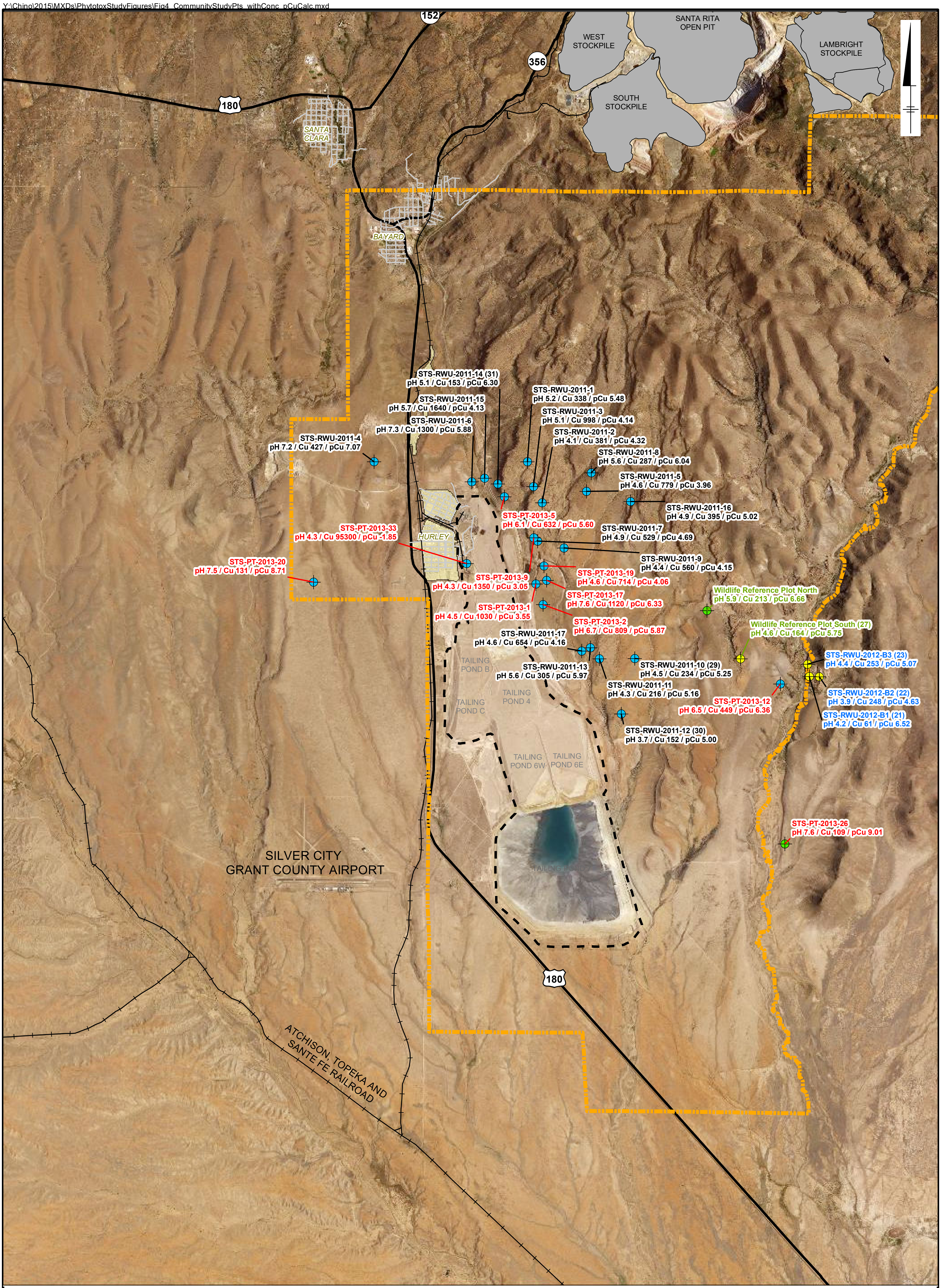
PHYTOTOXICITY AND VEGETATION COMMUNITY STUDY

Relationship between Soluble Sulfate and pH used to Identify Impacted Locations

ARCADIS

FIGURE
3

OFFICE: LAKEWOOD DB:MEB TM: MB PM: AT
PROJECT# B0063543.0000 8/3/2017 1:43:11 PM
Y:\Chino\2015\MXDs\PhytotoxStudyFigures\Fig4_CommunityStudyPts_withConc_pCuCalc.mxd



Legend

- ⊕ Site vegetation survey and soil sampling location
- ⊕ De minimus vegetation survey and soil sampling location
- ⊕ Reference vegetation survey and soil sampling location
- ▭ STSIU Boundary
- ▭ Smelter Tailings Boundary

0 0.5 1 2 Miles

GRAPHIC SCALE

Notes:
Black labels denote sites sampled for vegetation only in 2011
Blue labels denote sites sampled for vegetation only in 2012
Red labels denote sites sampled for vegetation only in 2014
Green labels denote sites sampled for vegetation in 2011 and 2014

Soil samples taken at all locations in 2013.

Location labels with a number in parenthesis are for locations also sampled in the laboratory phytotoxicity study (Figure 3) and indicate the X in that study's STS-PT-2013-X label.

Copper (Cu) units are mg/kg
pH and pCu units are s.u.

Service Layer Credits: USDA, NAIP 2016

FREEPORT-MCMORAN CHINO MINES COMPANY
VANADIUM, NEW MEXICO

SMELTER TAILING SOILS IU PHYTOTOXICITY AND VEGETATION COMMUNITY STUDY

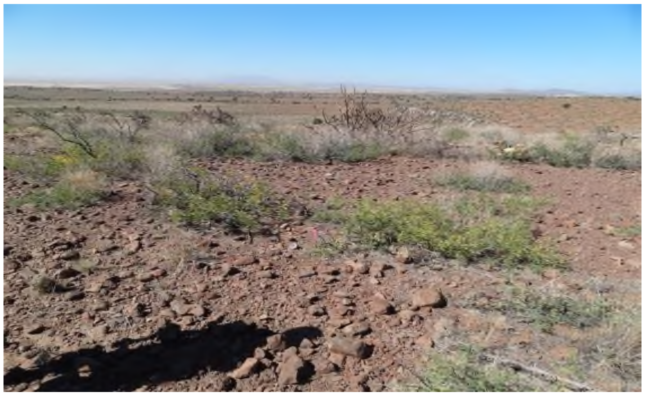
VEGETATION COMMUNITY STUDY SAMPLING LOCATIONS

ARCADIS

FIGURE
4

Bedrock (≥ 60%)

Flat Rocky (with eroded topsoil as shown by rocks sitting on top)



Slope (>14%)

Flat Granular Soil (rocks embedded)

Notes:
Photographs show areas that are an example of the four soil categories used in the Community Study.

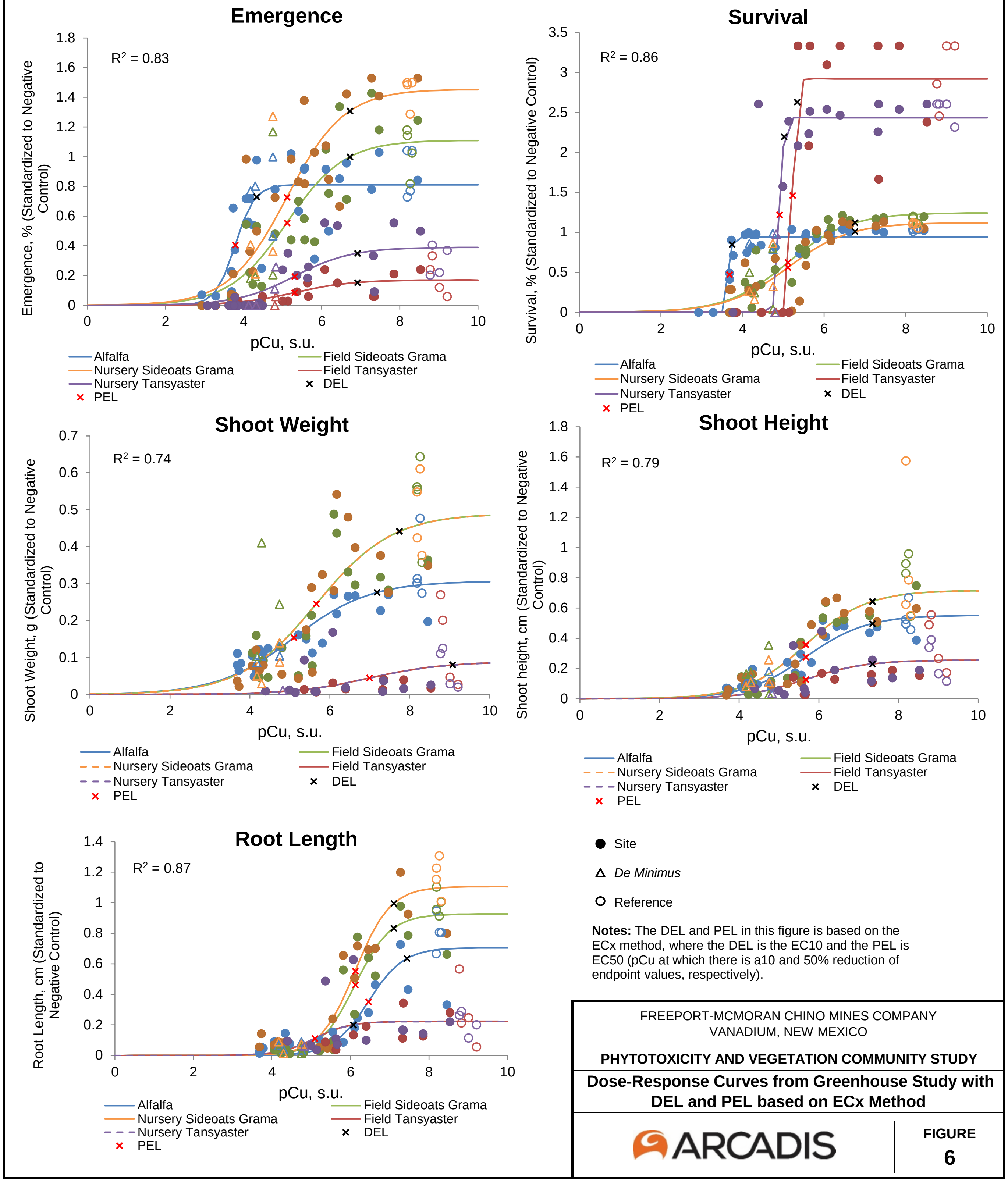
FREEPORT-MCMORAN CHINO MINES COMPANY
VANADIUM, NEW MEXICO

PHYTOTOXICITY AND VEGETATION COMMUNITY STUDY

Four Soil Categories

ARCADIS

FIGURE
5



Notes: The DEL and PEL in this figure is based on the ECx method, where the DEL is the EC10 and the PEL is EC50 (pCu at which there is a10 and 50% reduction of endpoint values, respectively).

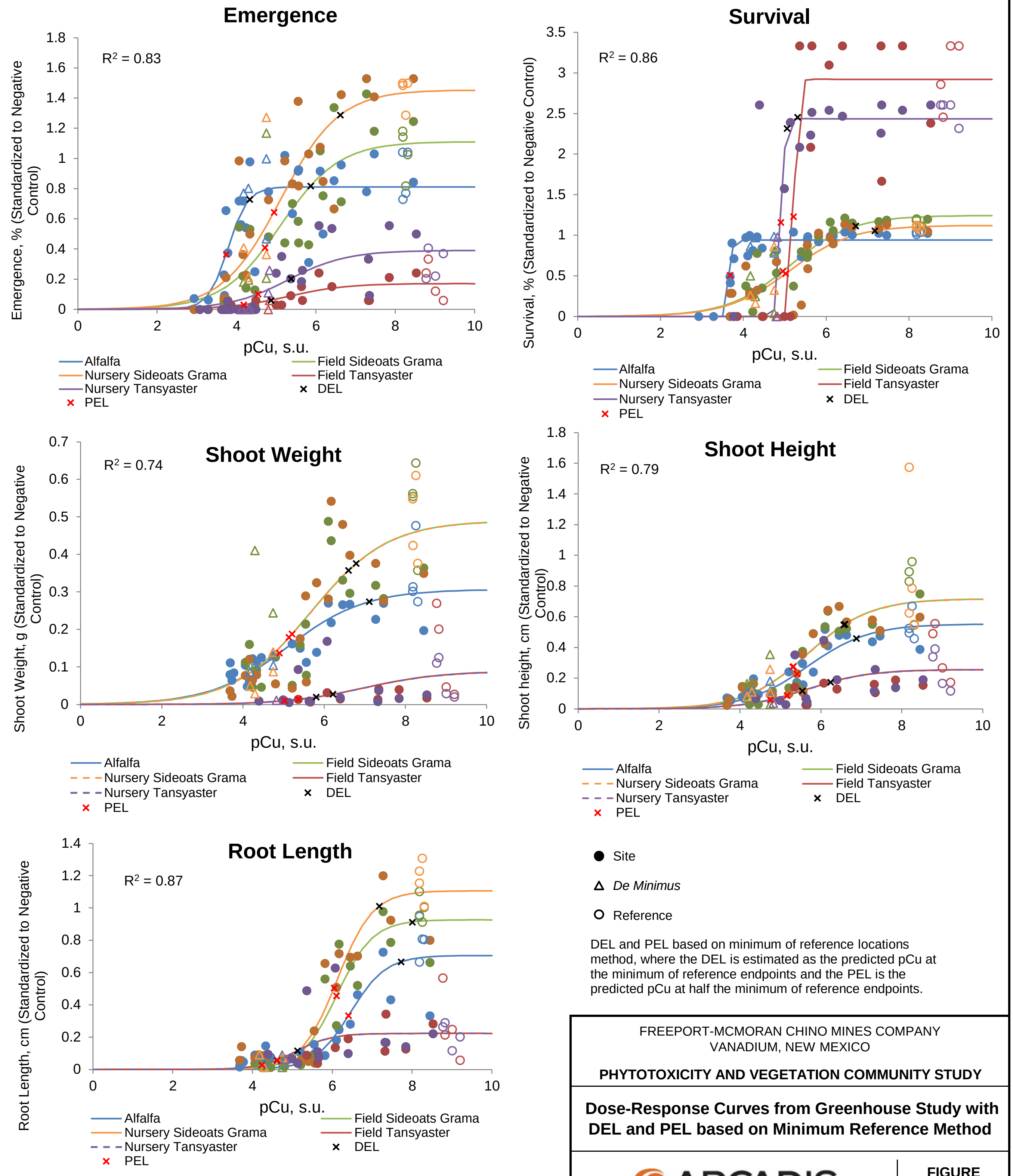
FREEPORT-MCMORAN CHINO MINES COMPANY
VANADIUM, NEW MEXICO

PHYTOTOXICITY AND VEGETATION COMMUNITY STUDY

Dose-Response Curves from Greenhouse Study with DEL and PEL based on ECx Method

ARCADIS

FIGURE
6



DEL and PEL based on minimum of reference locations method, where the DEL is estimated as the predicted pCu at the minimum of reference endpoints and the PEL is the predicted pCu at half the minimum of reference endpoints.

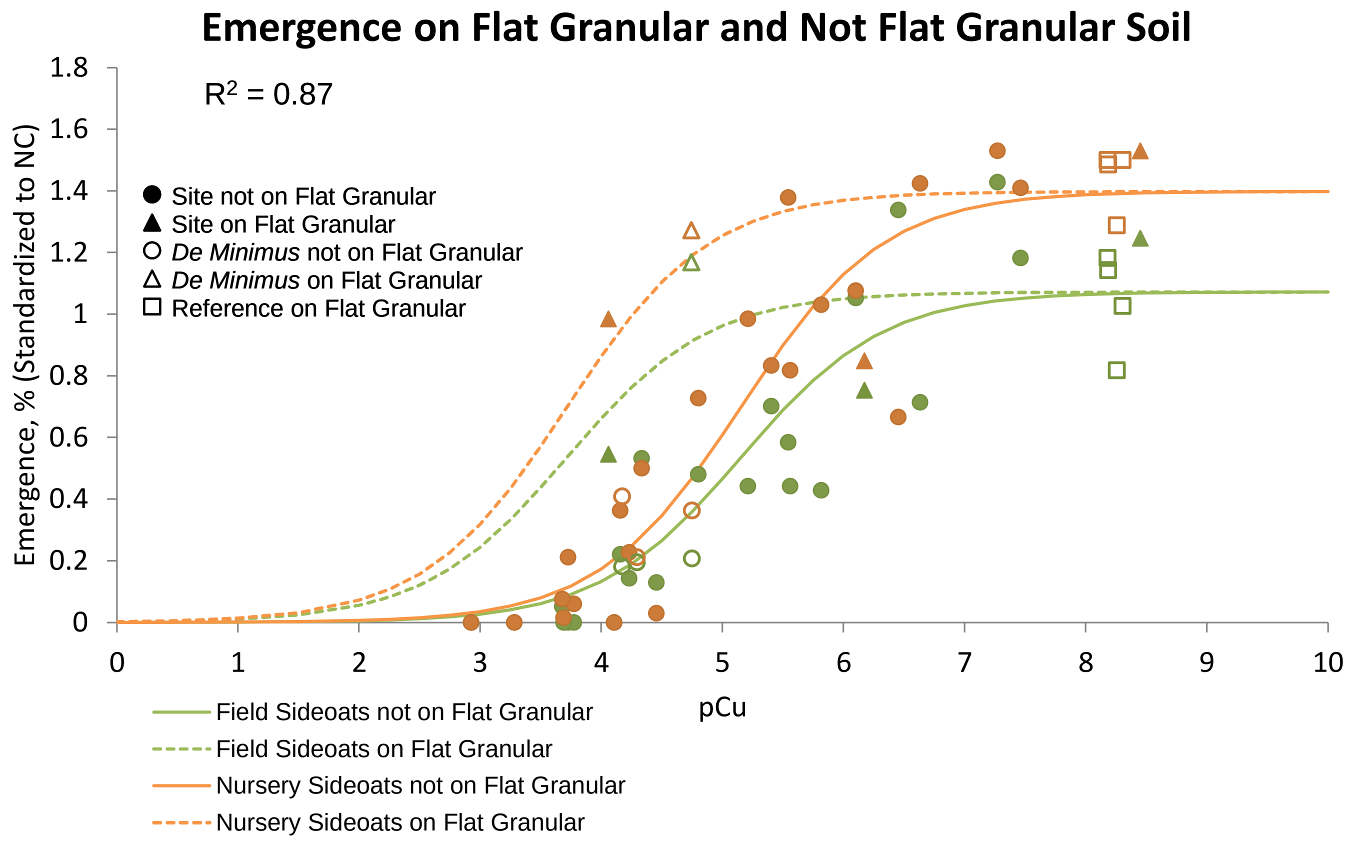
FREEPORT-MCMORAN CHINO MINES COMPANY
VANADIUM, NEW MEXICO

PHYTOTOXICITY AND VEGETATION COMMUNITY STUDY

Dose-Response Curves from Greenhouse Study with DEL and PEL based on Minimum Reference Method

ARCADIS

FIGURE
7



Notes:

All reference areas were on flat granular and therefore no points represent reference areas on non-flat granular soils.

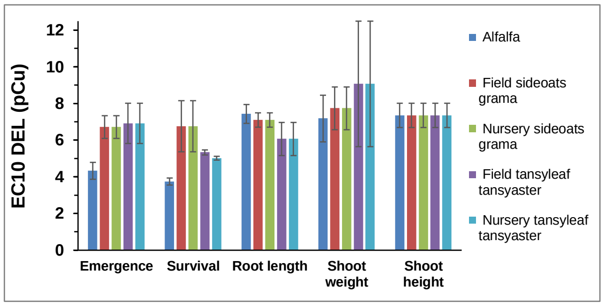
FREEPORT-MCMORAN CHINO MINES COMPANY
VANADIUM, NEW MEXICO

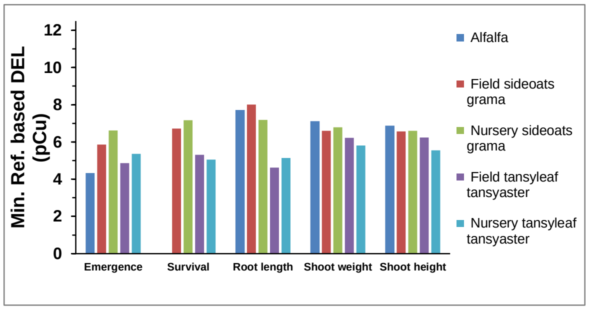
PHYTOTOXICITY AND VEGETATION COMMUNITY STUDY

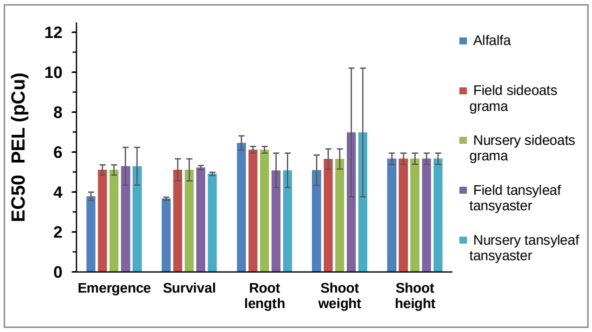
One Example of a Greenhouse Dose-Response Curve for Sideoats Grama with Flat Granular Covariate

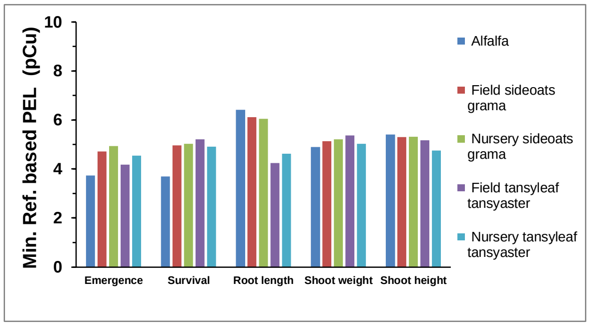
ARCADIS

FIGURE
8









Notes:
Graphs to left are ECx-based DEL (EC10) and PEL (EC50)
Graphs to right are minimum-reference (Min. Ref.) based DEL and PEL
Confidence intervals are from Table 5, available only for ECx-based DEL and PEL.

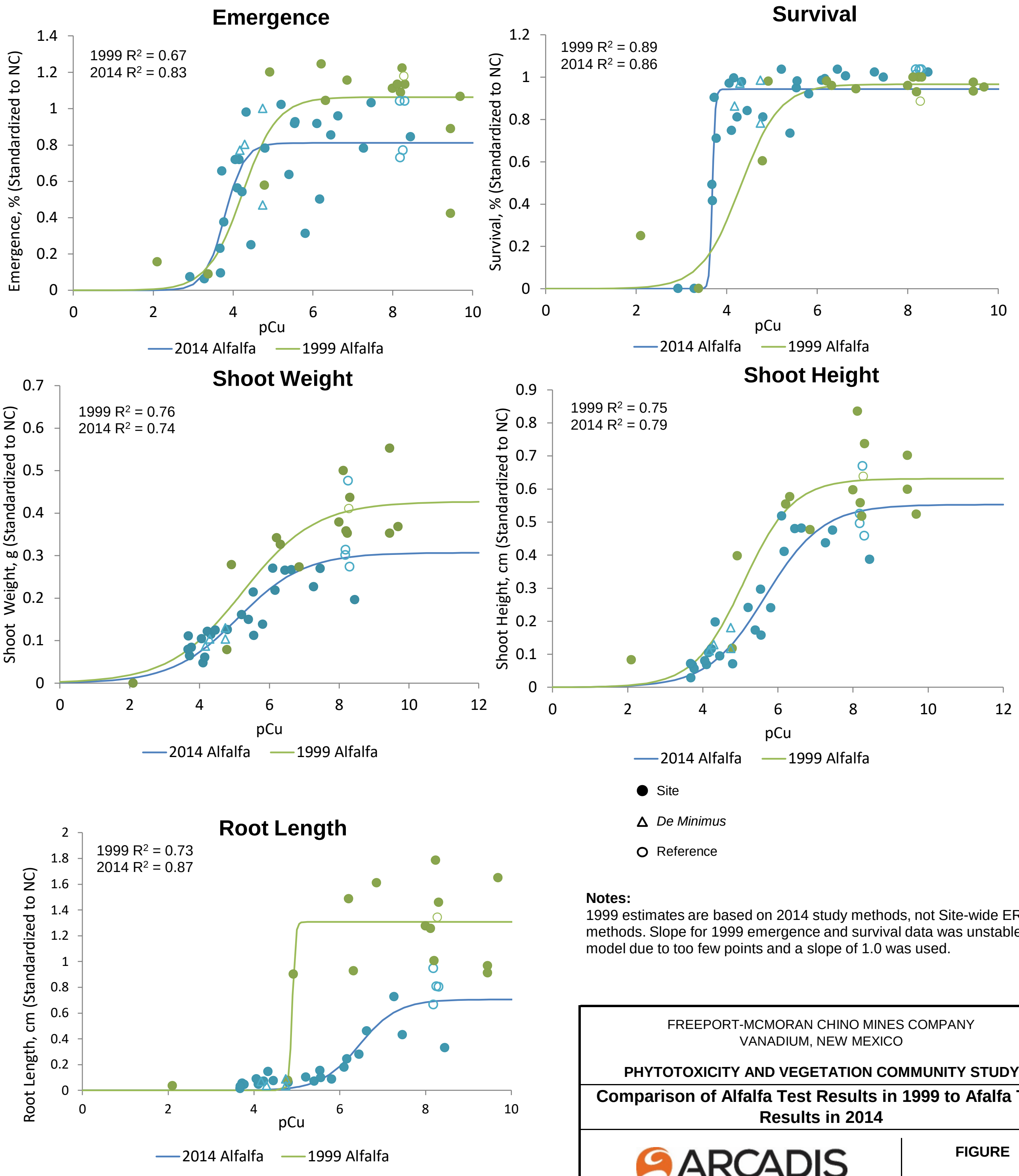
FREEPORT-MCMORAN CHINO MINES COMPANY
VANADIUM, NEW MEXICO

PHYTOTOXICITY AND VEGETATION COMMUNITY STUDY

DELs and PELs by Endpoint, Seed type, and Method for Greenhouse Study

ARCADIS

FIGURE
9



Notes:
1999 estimates are based on 2014 study methods, not Site-wide ERA methods. Slope for 1999 emergence and survival data was unstable in model due to too few points and a slope of 1.0 was used.

FREEPORT-MCMORAN CHINO MINES COMPANY
VANADIUM, NEW MEXICO

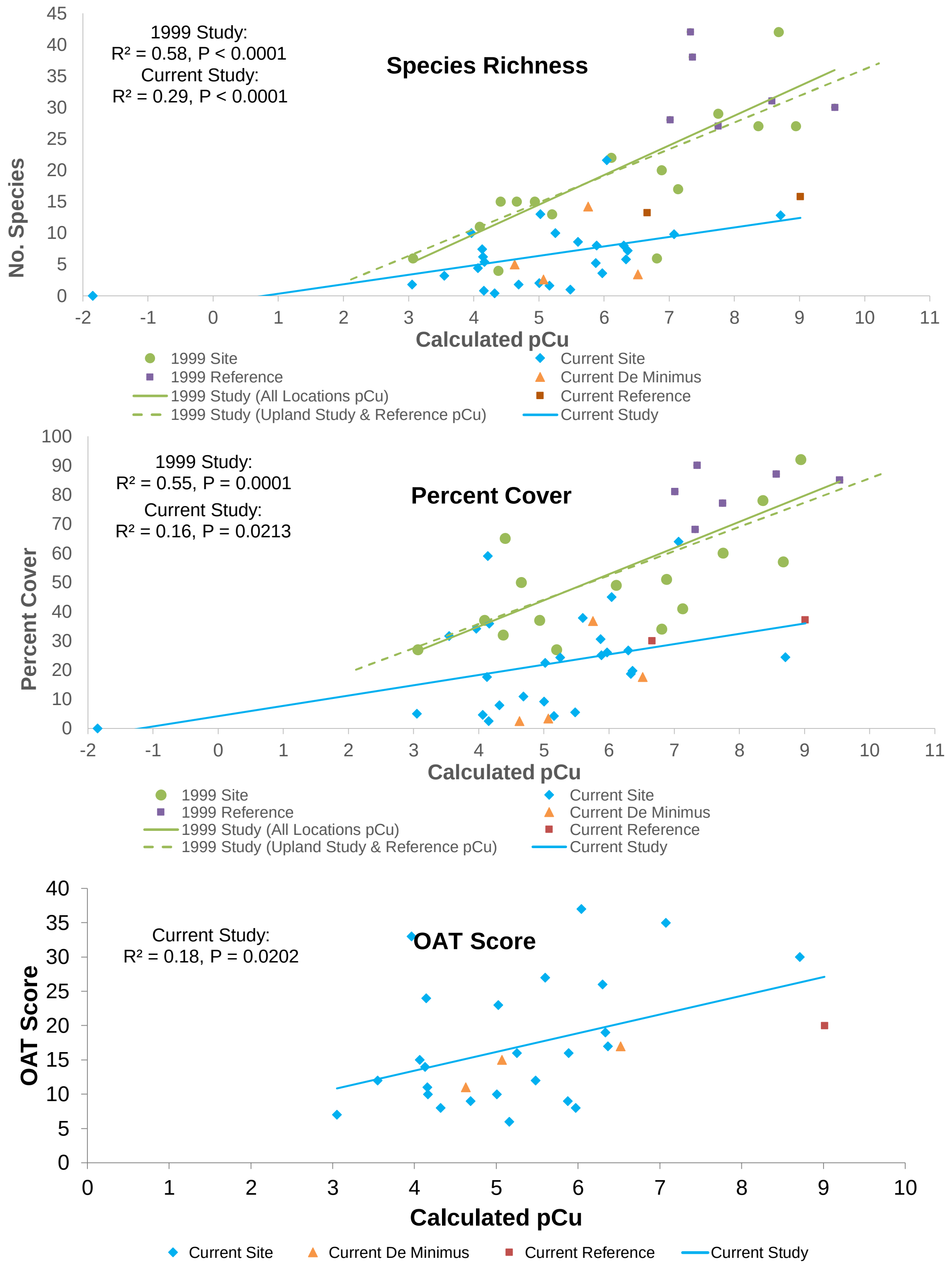
PHYTOTOXICITY AND VEGETATION COMMUNITY STUDY

Comparison of Alfalfa Test Results in 1999 to Afalfa Test Results in 2014

ARCADIS

FIGURE

10



Notes:

1999 study used "All Locations" ERA equation to calculate pCu while current study used "Upland Study & Reference" ERA equation to calculate pCu. 1999 study points plotted here use "All Locations" equation, though alternate trendline (dashed line) is shown for 1999 study points using "Upland Study & Reference" equation.

OAT score was not assessed at ERA locations in 1999 and unavailable in two locations of current study. Percent cover and richness are not directly comparable between the two studies because of different sampling methods and higher precipitation in 1999. The two 50-m point transects in 1999 at each location are more likely to traverse heterogenous habitats, creating higher richness than the more compact 20'x20' blocks averaged within the 100' x 100' plots placed in homogeneous areas. Other reasons for differences are the current study used Daubenmire method for cover (rather than point intercept), and the current study includes a greater variety of habitats (bedrock, slopes).

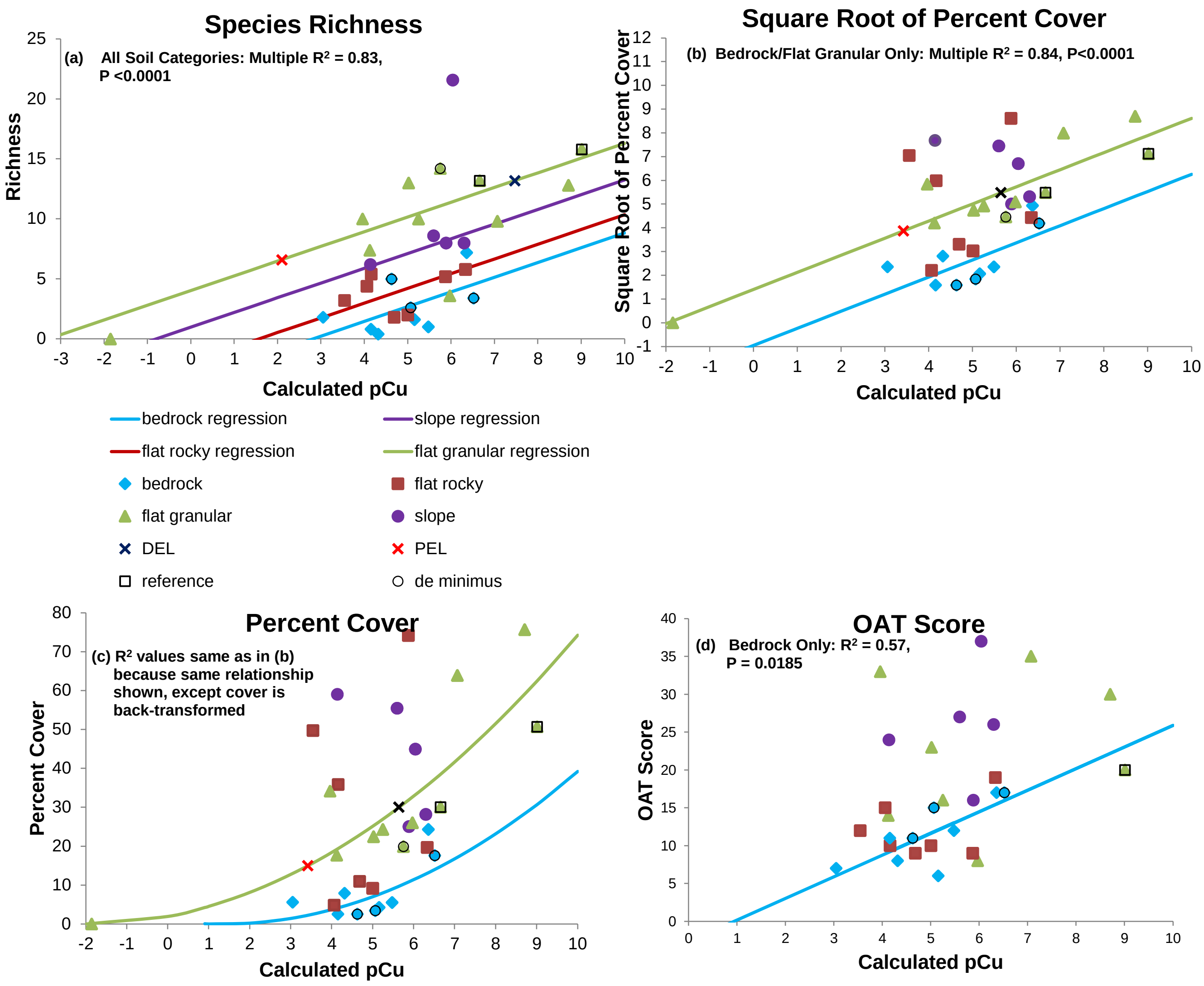
FREEPORT-MCMORAN CHINO MINES COMPANY
VANADIUM, NEW MEXICO

PHYTOTOXICITY AND VEGETATION COMMUNITY STUDY

Comparison of Community Results in 1999 to Community Results in Current Study

ARCADIS

FIGURE
11



Notes:

(a) Regression lines for richness exclude the high "slope" (purple) outlier and low "flat granular" (green) outlier. (b) The square root of percent cover was modeled to meet assumption of homogeneous variance for regression (backcalculated curve also shown in (c) and had the "flat granular" outlier removed). (d) Relationship between calculated pCu and OAT score is significant only for bedrock locations, and no reference locations were available for bedrock (only for flat granular, which had no significant relationship with pCu). OAT score was not obtained on Wildlife Reference North (reference plot) or Wildlife Reference South (de minimus plot). Note, the lowest calculated pCu of -1.85 had no plant cover and generally fell near the linear line projected through the other locations for richness and cover in flat granular locations (and thus was included in the model), further supporting the linear model. R^2 represents R^2 adjusted for number of variables in model.

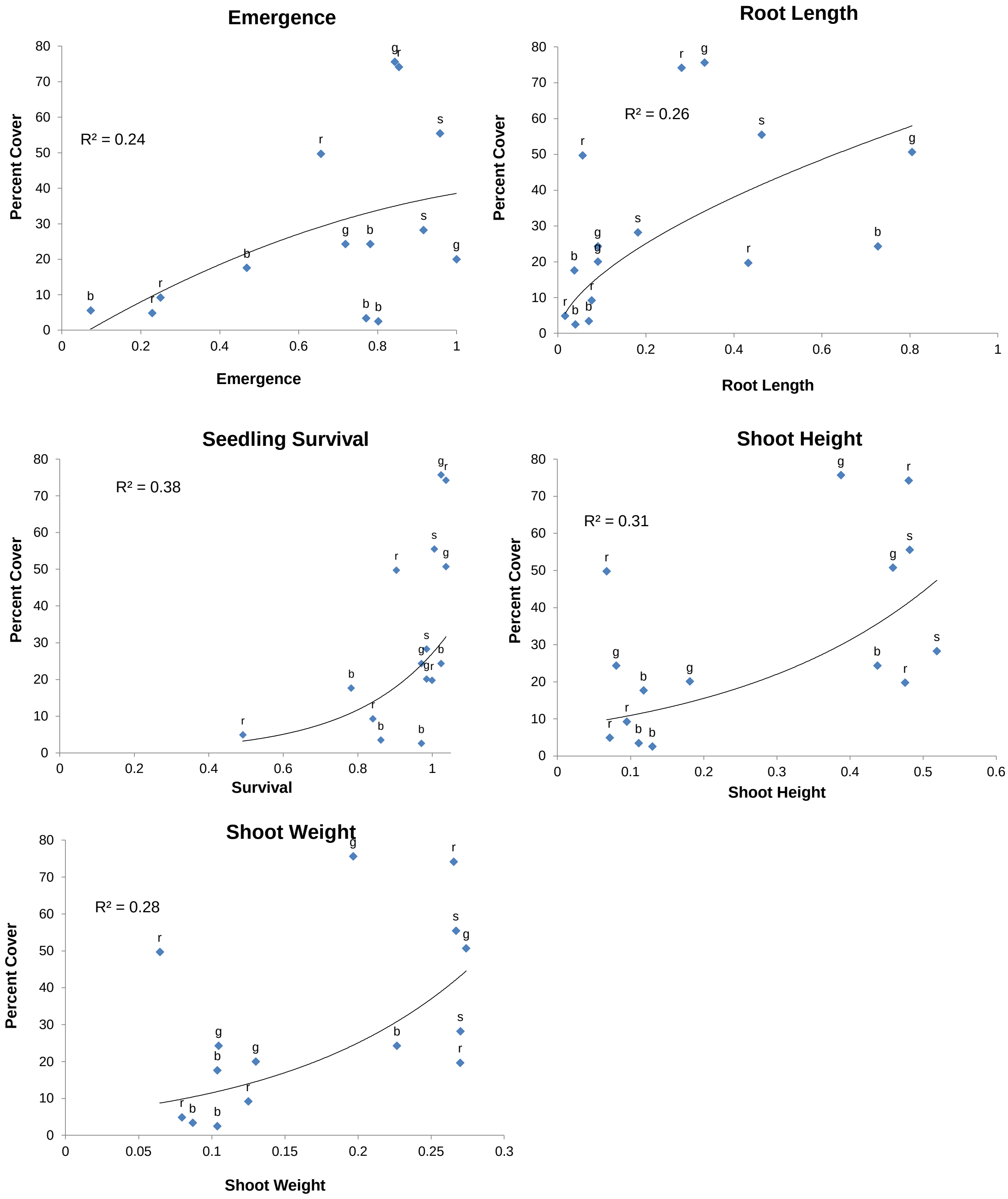
FREEPORT-MCMORAN CHINO MINES COMPANY
VANADIUM, NEW MEXICO

PHYTOTOXICITY AND VEGETATION COMMUNITY STUDY

Relationship between pCu and Community Endpoints with Soil Category Covariate

ARCADIS

FIGURE
12



Notes:
All relationships were statistically significant at $P < 0.05$. Letters above points represent soil category, where b = bedrock, r = flat rocky, g = flat granular, and s = slope.

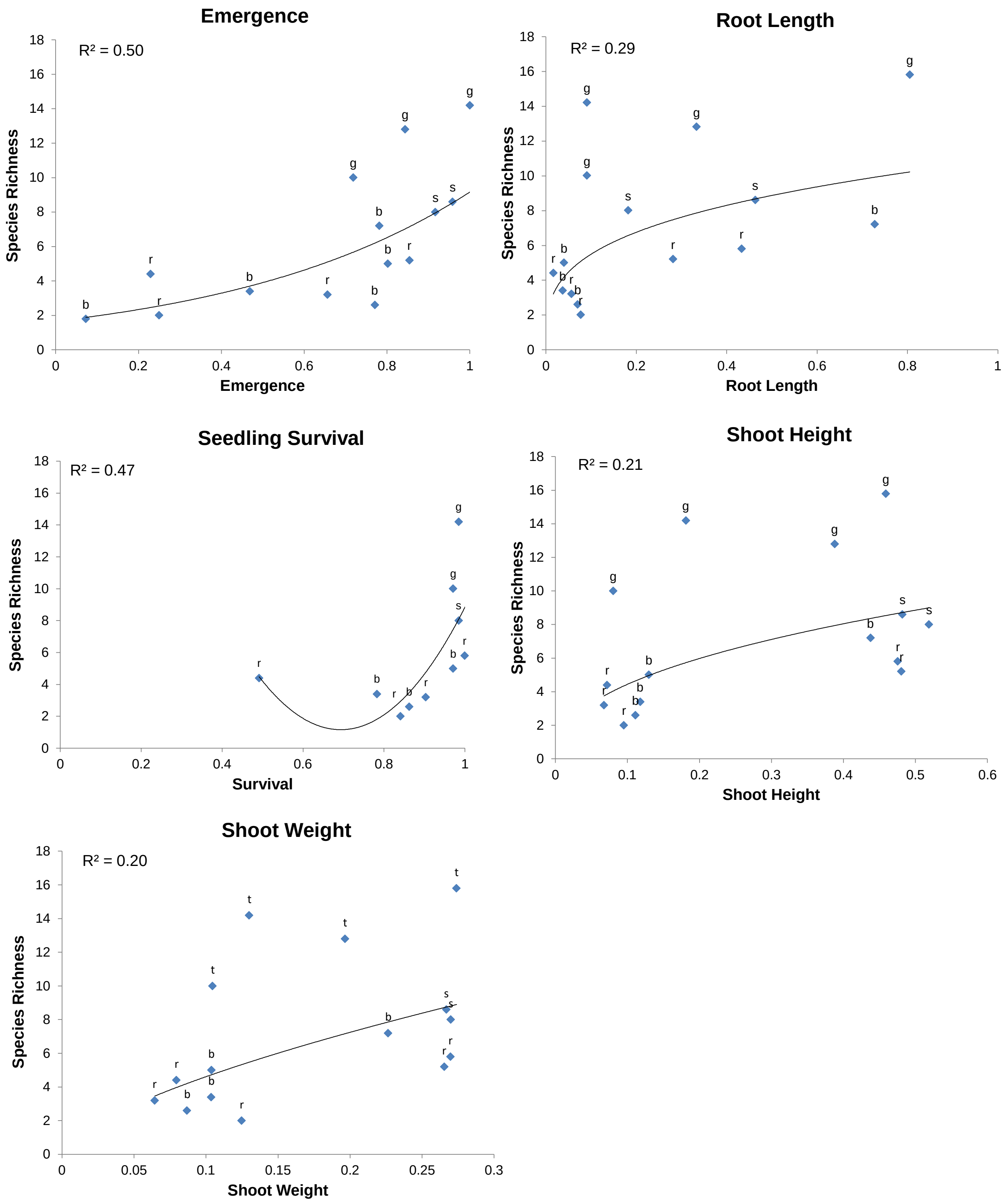
FREEPORT-MCMORAN CHINO MINES COMPANY
VANADIUM, NEW MEXICO

PHYTOTOXICITY AND VEGETATION COMMUNITY STUDY

Relationship between Greenhouse Study and Community Endpoints for Alfalfa: Canopy Cover

ARCADIS

FIGURE
13



Notes:
All relationships were statistically significant at $P < 0.05$. Letters above points represent soil category, where b = bedrock, r = flat rocky, g = flat granular, and s = slope.

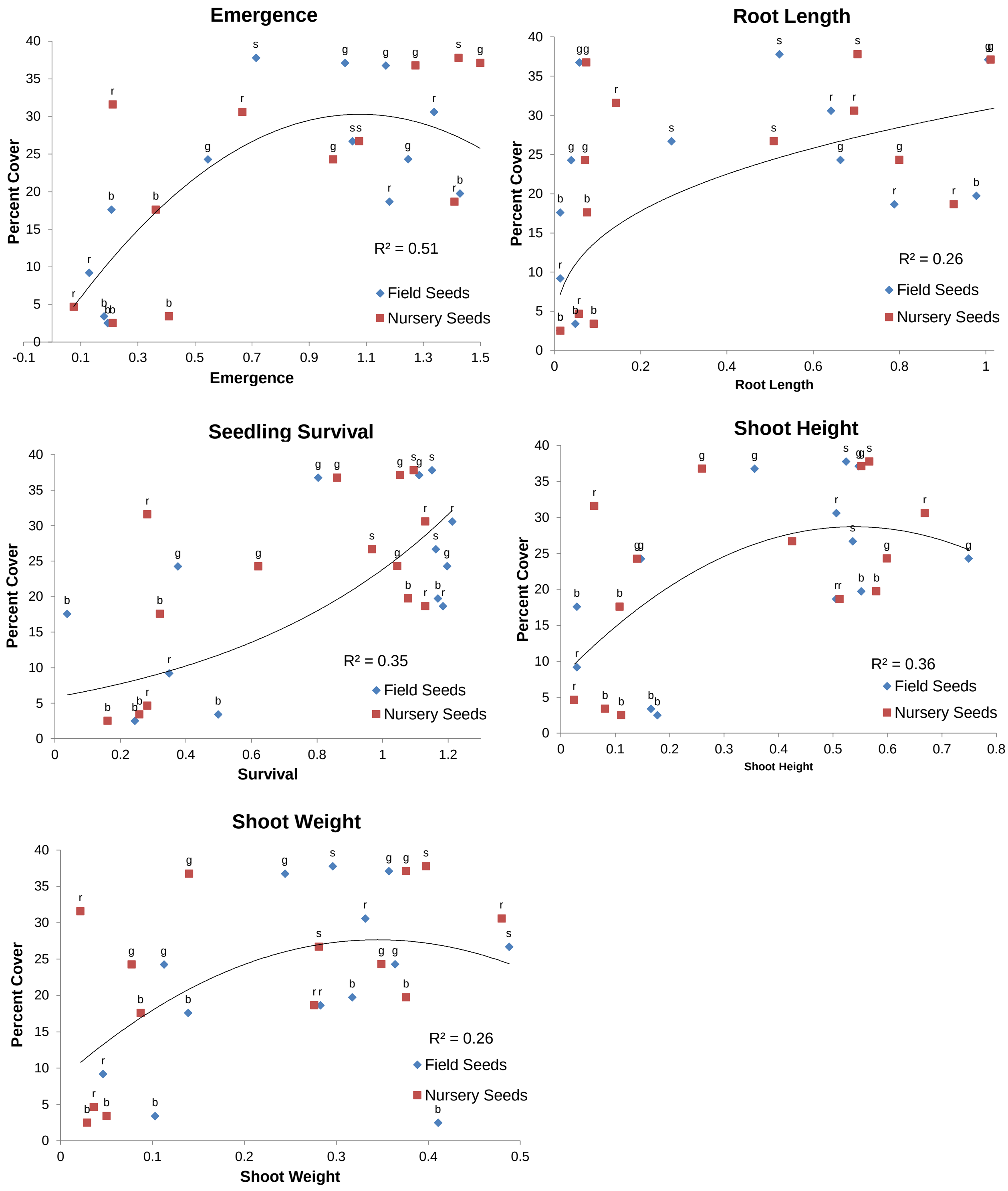
FREEPORT-MCMORAN CHINO MINES COMPANY
VANADIUM, NEW MEXICO

PHYTOTOXICITY AND VEGETATION COMMUNITY STUDY

Relationship between Greenhouse Study and Community Endpoints for Alfalfa: Species Richness

ARCADIS

FIGURE
14



Notes:
All relationships were statistically significant at $P < 0.05$. Letters above points represent soil category, where b = bedrock, r = flat rocky, g = flat granular, and s = slope.

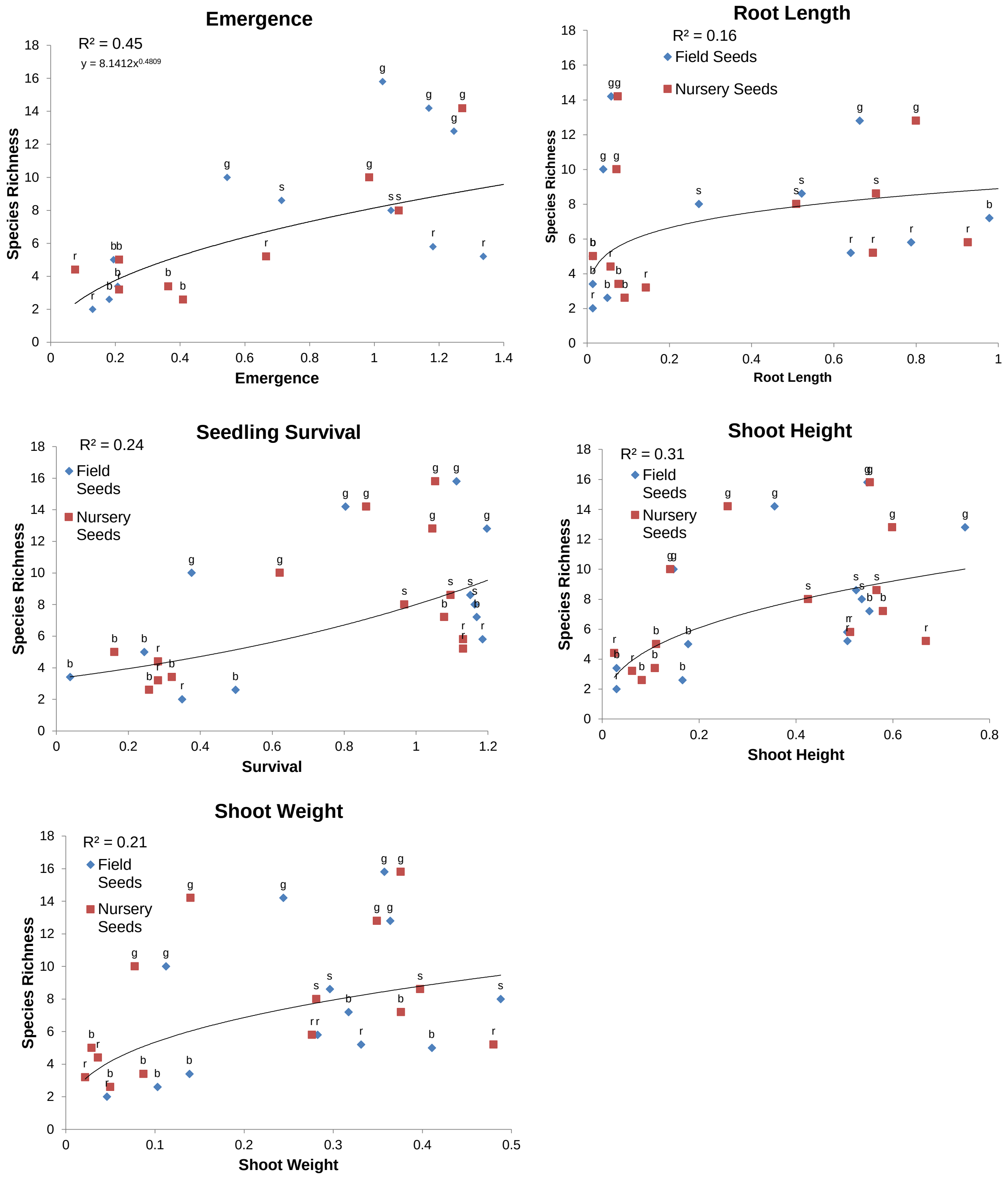
FREEPORT-MCMORAN CHINO MINES COMPANY
VANADIUM, NEW MEXICO

PHYTOTOXICITY AND VEGETATION COMMUNITY STUDY

Relationship between Greenhouse Study and Community Endpoints for Sideoats: Canopy Cover

ARCADIS

FIGURE
15



Notes:
All relationships were statistically significant at $P < 0.05$. Letters above points represent soil category, where b = bedrock, r = flat rocky, g = flat granular, and s = slope.

FREEPORT-MCMORAN CHINO MINES COMPANY
VANADIUM, NEW MEXICO

PHYTOTOXICITY AND VEGETATION COMMUNITY STUDY

Relationship between Greenhouse Study and Community Endpoints for Sideoats: Species Richness

FIGURE
16

APPENDIX A

Soil Chemistry

Arcadis U.S., Inc.

1687 Cole Blvd.

Suite 200

Lakewood

Colorado 80401

Tel +1 303 231 9115

Fax +1 303 231 9571

APPENDIX A

Soil Chemistry

Table A-1. Measured pCu

Freeport-McMoran Chino Mines Company
Vanadium, New Mexico
Smelter/Tailing Soils IU Phytotoxicity and Vegetation Community Study

Location ID	Type of Site	pCu, measured (s.u.) 2013 Data	pCu, measured (s.u.) 2015 Data
STS-PT-2013-1	Site	3.73	3.67
STS-PT-2013-2	Site	6.45	7.34
STS-PT-2013-3	Site	5.82	5.63
STS-PT-2013-4	Site	6.17	6.07
STS-PT-2013-5	Site	6.63	6.40
STS-PT-2013-6	Site	4.33	4.39
STS-PT-2013-7	Site	4.11	4.01
STS-PT-2013-8	Site	5.21	5.13
STS-PT-2013-9	Site	2.93	3.07
STS-PT-2013-10	Site	4.16	3.77
STS-PT-2013-11	Site	4.23	4.20
STS-PT-2013-12	Site	7.27	7.32
STS-PT-2013-13	Site	5.54	5.36
STS-PT-2013-14	Site	3.77	3.85
STS-PT-2013-15	Site	5.40	4.99
STS-PT-2013-16	Site	5.56	4.48
STS-PT-2013-17	Site	7.46	7.85
STS-PT-2013-18	Site (dup. not used)	3.75	NA
STS-PT-2013-19	Site	3.68	3.62
STS-PT-2013-20	Site	8.45	8.53
STS-PT-2013-21	De Minimus	4.75	4.79
STS-PT-2013-22	De Minimus	4.29	4.13
STS-PT-2013-23	De Minimus	4.17	4.32
STS-PT-2013-24	Reference	8.26	8.82
STS-PT-2013-25	Reference	8.18	8.77
STS-PT-2013-26	Reference	8.31	9.20
STS-PT-2013-27	De Minimus	4.74	4.83
STS-PT-2013-28	Reference	8.18	9.00
STS-PT-2013-29	Site	4.06	4.44
STS-PT-2013-30	Site	4.46	4.38
STS-PT-2013-31	Site	6.10	5.66
STS-PT-2013-32	Site	4.80	4.12
STS-PT-2013-33	Site (comm. study)	1.98	NA
STS-PT-2013-34	Site (dup, not used)	3.79	NA
STS-PT-2013-35	Site	3.28	3.27
STS-PT-2013-36	Site	3.69	3.75

Notes:
See Appendix E for derivation of measured pCu.
2015 data used for tansyaster 2015 experiments, 2013 for other plant species in earlier tests.

Table A-2. 2013 Soil Results (0-6 inch depth) for Greenhouse Phytotoxicity Study

Freeport-McMoran Chino Mines Company
Vanadium, New Mexico
Smelter/Tailing Soils IU Phytotoxicity and Vegetation Community Study

Location ID	Moisture (wt%)	Sand (%)	Silt (%)	Clay (%)	Texture	Saturation (%)	pH Saturated Paste (s.u.)	Copper Total (mg/kg)	Alkalinity Saturated Paste (mg/L)	Bicarbonate Saturated Paste (mg/L)	Conductivity Saturated Paste (mmhos/cm)	Calcium Saturated Paste (meq/L)	Magnesium Saturated Paste (meq/L)	Potassium Saturated Paste (meq/L)	Sodium Saturated Paste (meq/L)	Alkalinity Saturated Paste (meq/L)	Bicarbonate Saturated Paste (meq/L)	Fluoride (mg/L)	Sulfate Saturated Paste (meq/L)	Chloride Saturated Paste (meq/L)	Calcium NH_4OAc (mg/kg)	Copper NH_4OAc (mg/kg)	Magnesium NH_4OAc (mg/kg)	Sodium NH_4OAc (mg/kg)	Calcium Extractable, NH_4OAc (meq/100g)
STS-PT-2013-1	4.3	51	31	18	L	30.2	4.5	1030	--	--	0.7	4.14	1.19	0.24	0.69	0.44	0.44	<2	5.9	0.2	1180	227	168	20	5.87
Dup1 for STS-PT-2013-1	3.9	50	31	19	L	29	4.8	879	--	--	0.8	4.51	1.25	0.25	0.82	0.44	0.44	<2	9.1	0.3	1070	291	145	21	5.34
STS-PT-2013-2	5.5	48	28	24	L	41.7	6.7	809	--	--	1.8	16.8	2.74	0.24	0.66	3.53	3.53	<2	17.7	0.3	5790	38	343	20	28.9
STS-PT-2013-3	2.2	54	24	22	SCL	30.5	5.3	189	--	--	0.7	3.46	1.46	0.42	0.61	0.56	0.56	<2	3.7	0.2	1610	16	312	18	8.01
STS-PT-2013-4	4.2	60	18	22	SCL	32.3	5.1	193	--	--	1.5	7.77	3.59	0.69	1.04	0.62	0.62	<2	6.6	0.8	1840	8	422	23	9.21
STS-PT-2013-5	7.4	34	20	46	C	67.8	6.1	632	--	--	1.3	8.21	2.62	0.21	1.47	1.75	1.75	<2	10	0.3	6140	41	999	84	30.6
STS-PT-2013-6	2.5	52	40	8	L	38	3.8	202	--	--	0.4	1.72	0.34	0.26	0.33	0.11	0.11	<2	2.6	0.2	212	5	26	10	1.06
STS-PT-2013-7	1.9	48	42	10	L	45.4	3.3	279	--	--	3	25.1	4.08	0.1	0.81	<0.02	<0.02	6	40.6	0.2	745	8	55	17	3.72
STS-PT-2013-8	8.3	28	30	42	C	46.2	5	626	--	--	0.4	1.16	0.5	0.15	1.1	0.64	0.64	<2	2	0.4	3380	53	752	46	16.9
STS-PT-2013-9	3.5	52	26	22	SCL	26.1	4.3	1350	--	--	0.4	1.45	0.4	0.17	0.59	0.43	0.43	<2	1.9	0.2	688	452	110	12	3.44
STS-PT-2013-10	3.5	73	17	10	SL	25	4.8	557	--	--	0.6	2.86	0.7	0.18	0.81	0.44	0.44	<2	4.2	0.3	672	109	78	19	3.35
STS-PT-2013-11	3.1	64	24	12	SL	29.6	3.9	189	--	--	0.3	0.94	0.18	0.14	0.5	0.41	0.41	<2	1.4	0.2	176	11	21	12	0.876
STS-PT-2013-12	2.3	60	26	14	SL	27.9	6.5	449	--	--	0.7	4.51	0.76	0.14	0.8	2.92	2.91	<2	3.3	0.2	2100	15	161	22	10.5
STS-PT-2013-13	3.9	42	34	24	L	32.2	4.9	360	--	--	0.4	1.07	0.58	0.33	0.95	0.58	0.58	<2	1.6	0.3	1600	19	403	20	7.99
STS-PT-2013-14	10.9	34	26	40	C	53.4	3.8	725	--	--	3	24.6	10.5	0.33	1.32	<0.02	<0.02	5	39.3	0.2	3930	100	728	46	19.6
STS-PT-2013-15	5.9	40	28	32	CL	36.1	5.1	501	--	--	0.3	0.35	0.18	0.08	0.63	0.55	0.55	<2	1.1	0.4	2410	44	463	69	12
STS-PT-2013-16	6	33	23	44	C	62.4	5.4	1200	--	--	0.6	2.46	1.01	0.19	1.21	0.85	0.85	<2	3.5	0.5	4590	95	945	51	22.9
STS-PT-2013-17	5.9	32	28	40	C	48.8	7.6	1120	--	--	0.6	4.6	0.65	0.23	0.71	3.03	3.02	<2	2.8	0.4	6830	43	354	21	34.1
STS-PT-2013-18	4.7	54	24	22	SCL	30.4	4.1	311	--	--	0.3	1.14	0.29	0.1	0.75	0.41	0.41	<2	2.1	0.2	281	34	39	20	1.4
STS-PT-2013-19	3.2	62	22	16	SL	26.9	4.6	714	--	--	0.4	1.79	0.44	0.13	0.79	0.43	0.43	<2	2.1	0.2	888	163	106	18	4.43
STS-PT-2013-20	5.3	46	34	20	L	41.4	7.5	131	--	--	0.5	3.67	0.37	0.09	0.94	4.24	4.24	<2	<0.4	0.8	5940	2	135	34	29.6
Dup3 for STS-PT-2013-20	3.8	48	31	21	L	38.4	7.6	174	--	--	0.5	3.68	0.37	0.13	0.37	3.66	3.66	<2	4.4	0.5	5680	10	129	15	28.3
STS-PT-2013-21	5.7	48	20	32	SCL	38.1	4.2	61	--	--	0.2	0.71	0.24	0.11	0.71	0.43	0.43	<2	1.5	0.2	390	2	61	18	1.95
STS-PT-2013-22	4	58	26	16	SL	35.1	3.9	248	--	--	2.7	22.4	5.78	0.33	1.89	<0.02	<0.02	7	35	0.4	1230	19	114	36	6.14
STS-PT-2013-23	2.6	68	20	12	SL	24.1	4.4	253	--	--	0.4	1.52	0.35	0.17	0.61	0.41	0.41	<2	2.1	0.2	330	17	46	14	1.65
STS-PT-2013-24	3.6	64	18	18	SL	33.6	7.7	56	--	--	0.5	3.73	0.31	0.23	0.52	4.5	4.49	<2	<0.4	0.3	5060	<1	155	11	25.3
STS-PT-2013-25	1.3	74	18	8	SL	22.8	7.7	130	--	--	0.6	3.57	0.46	0.8	0.55	4.85	4.85	<2	0.5	0.4	7500	2	216	14	37.4
STS-PT-2013-26	5.5	42	30	28	CL	40	7.6	109	--	--	0.4	2.74	0.23	0.26	0.61	3.08	3.08	<2	0.7	0.3	1190	8	226	20	5.94
STS-PT-2013-27	4.9	58	20	22	SCL	30	4.6	164	--	--	0.3	0.78	0.33	0.16	0.87	0.48	0.48	<2	1.4	0.3	4360	<1	403	17	21.8
STS-PT-2013-28	5.7	44	23	33	CL	40	7.5	58	--	--	0.4	2.02	0.42	0.15	0.84	2.74	2.74	<2	0.6	0.4	489	48	73	17	2.44
STS-PT-2013-29	2.1	66	19	15	SL	21.4	4.5	234	--	--	0.2	0.56	0.16	0.25	0.61	0.46	0.46	<2	0.9	0.3	391	4	44	12	1.95
STS-PT-2013-30	2.2	67	20	13	SL	23.6	3.7	152	--	--	1	5.8	0.94	0.27	0.61	<0.02	<0.02	<2	8.7	0.3	376	4	41	12	1.88
STS-PT-2013-31	11.8	32	23	45	C	56.4	5.1	153	--	--	0.4	1.53	0.6	0.09	1.2	0.46	0.46	<2	1.9	0.5	4300	7	797	123	21.5
STS-PT-2013-32	7	42	33	25	L	35.3	5.1	816	--	--	0.4	1.89	0.58	0.32	0.44	0.63	0.63	<2	1.7	0.3	1300	119	166	32	6.5
STS-PT-2013-33	3.2	46	45	9	L	29	4.3	95300	--	--	12.8	18.8	35.4	<0.03	1.33	0.64	0.64	44	260	4.9	20500	16100	190	26	102
Dup2 for STS-PT-2013-33	3	46	45	9	L	27.2	4	92500	--	--	21.8	18.1	42.6	0.03	1.23	0.59	0.59	64	491	5.5	20600	16800	211	18	103
STS-PT-2013-34	7.5	60	21	19	SL	24.1	4.8	1200	22	27	0.4	2.74	0.86	0.31	0.31	0.44	0.44	<0.1	2.74	0.16	552	266	61	17	2.76
STS-PT-2013-35	11.1	34	41	25	L	33.8	4.6	1630	21	26	0.4	1.7	0.61	0.16	0.24	0.42	0.42	<0.1	1.57	0.13	1290	648	145	23	6.46
STS-PT-2013-36	7.6	56	23	21	SCL	33	5.9	3770	211	258	2.6	31.2	5.02	0.18	0.56	4.23	4.22	<1	31.7	0.22	2700	1040	170	28	13.5
Negative Control	--	89	3	8	LS	--	7.2	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

Notes:

a. Olsen method used if pH > 6.5, otherwise Bray method

Soil Texture Codes:

C = clay
CL = clay loam
L = loam
LS = loamy sand
SCL = sandy clay loam
SL = sandy loam
LOI = loss on ignition
DTPA = diethylene triamine pentaacetic acid extraction
For locations with duplicates, original used in the analysis
Locations STS-PT-2013-18, 33, and 34 were not used in phytotoxicity study

Table A-2. 2013 Soil Results (0-6 inch depth) for Greenhouse Phytotoxicity Study

Freeport-McMoran Chino Mines Company
Vanadium, New Mexico
Smelter/Tailing Soils IU Phytotoxicity and Vegetation Community Study

Location ID	Magnesium Extractable, NH$_4$OAc (meq/100g)	Potassium Extractable, NH$_4$OAc (meq/100g)	Potassium NH$_4$OAc (mg/kg)	Sodium Extractable, NH$_4$OAc (meq/100g)	Calcium Exchangeable (meq/100g)	Magnesium Exchangeable (meq/100g)	Potassium Exchangeable (meq/100g)	Sodium Exchangeable (meq/100g)	Copper Exchangeable (meq/100g)	Organic Matter LOI (%)	Lime (%)	Phosphorus Olsen-Bray (mg/kg)[a]	Phosphate (mg/kg)	Nitrate + Nitrite (mg/kg)	Copper CaCl$_2$ (mg/kg)	Aluminum DTPA (mg/kg)	Iron DTPA (mg/kg)	Manganese DTPA (mg/kg)	Dissolved Organic Carbon (DOC) (mg/kg)	Conductivity CaCl$_2$ (mmhos/cm)	Millivolts (mV)	pH CaCl$_2$ (s.u.)	Soil Category
STS-PT-2013-1	1.39	0.496	194	0.087	5.8	1.4	0.5	<0.1	0.6	1.1	0.53	68.4	0.2	4	27.9	5.2	37	24.3	6	1.5	101	4	Flat Rocky
Dup1 for STS-PT-2013-1	1.21	0.465	182	0.09	5.2	1.2	0.5	<0.1	0.8	0.8	0.57	72	<1	4	31.8	6.2	39	23	5	1.7	110	4.6	Flat Rocky
STS-PT-2013-2	2.85	0.65	254	0.086	28.2	2.7	0.6	<0.1	0.1	1.4	2.07	16	<0.1	2	0.3	1.7	26	2.9	12	1.8	17	7.1	Flat Rocky
STS-PT-2013-3	2.59	0.786	307	0.08	7.9	2.6	0.8	<0.1	<0.1	0.9	0.58	17.7	<0.2	8	0.4	1.4	18	31	10	1.4	37	5.6	Flat Rocky
STS-PT-2013-4	3.5	0.806	315	0.101	8.6	3.1	0.8	<0.1	<0.1	1.6	0.66	30.2	<0.2	23	0.3	1.4	38	18.9	24	1.6	26	5.1	Flat Granular
STS-PT-2013-5	8.29	1.21	473	0.368	30.1	8.1	1.2	0.3	0.1	2.6	1.99	16	<0.1	9	0.4	1.3	13	7.9	18	1.7	12	6.1	Slope
STS-PT-2013-6	0.215	0.165	65	0.042	1	0.2	0.2	<0.1	<0.1	2	<0.01	6.3	<0.1	<1	3.5	27.6	252	3.4	14	1.5	82	3.4	Bedrock
STS-PT-2013-7	0.453	0.062	24	0.073	2.5	0.2	<0.1	<0.1	<0.1	3.9	<0.01	16.2	<1	2	10.9	27.3	314	16.8	14	2.4	89	3.2	Bedrock
STS-PT-2013-8	6.24	0.942	368	0.201	16.8	6.2	0.9	0.2	0.2	1.6	1.41	52.3	0.9	3	0.5	1.9	32	34	15	1.7	55	5.5	Flat Rocky
STS-PT-2013-9	0.912	0.356	139	0.051	3.4	0.9	0.4	<0.1	1.1	1	0.24	15.1	<0.1	3	114	5	9	8.7	4	1.6	125	4	Bedrock
STS-PT-2013-10	0.651	<1	91	0.083	3.3	0.6	<0.1	<0.1	0.3	0.8	0.24	5.2	<0.2	1	9.9	12.8	29	8	8	1.7	95	4.5	Bedrock
STS-PT-2013-11	0.173	0.174	68	0.054	0.8	0.2	0.2	<0.1	<0.1	1.3	0.06	20.3	<1	1	8.4	79.2	58	2.4	5	1.5	92	3.7	Bedrock
STS-PT-2013-12	1.33	0.335	131	0.097	10.4	1.3	0.3	<0.1	<0.1	1.3	0.75	6	<0.2	<1	0.2	1	24	7.3	15	1.5	4	6.2	Bedrock
STS-PT-2013-13	3.35	1.11	435	0.088	8	3.3	1.1	<0.1	<0.1	1.6	0.84	56.9	2	3	0.4	2.6	53	23.2	11	1.5	54	5	Flat Rocky
STS-PT-2013-14	6.04	0.691	270	0.202	18.3	5.5	0.7	0.1	0.2	1.2	0.86	57.7	<0.1	17	36.3	57.4	24	43.4	10	2.8	106	3.7	Flat Rocky
STS-PT-2013-15	3.85	0.885	346	0.298	12	3.8	0.9	0.3	0.1	1.6	0.97	41.7	3	<5	0.6	2.2	31	19.2	17	1.5	58	5.5	Flat Rocky
STS-PT-2013-16	7.84	1.34	523	0.222	22.7	7.8	1.3	0.1	0.3	3	1.66	22.3	0.9	4	1	1.3	27	19.4	23	1.6	54	5.4	Slope
STS-PT-2013-17	2.94	1.22	477	0.09	33.8	2.9	1.2	<0.1	0.1	1.5	3.69	9	0.2	6	0.4	1.5	9	2.8	14	1.5	-2	6.8	Flat Rocky
STS-PT-2013-18	0.326	0.184	72	0.088	1.4	0.3	0.2	<0.1	<0.1	1	0.09	2.9	<0.1	<1	25.3	34.5	37	4.3	6	1.5	106	3.8	Bedrock
STS-PT-2013-19	0.883	0.393	154	0.078	4.4	0.9	0.4	<0.1	0.4	0.7	0.3	8.9	<0.1	3	28	5.2	30	16.6	4	1.5	109	4.3	Flat Rocky
STS-PT-2013-20	1.12	0.5	195	0.149	29	1.1	0.5	<0.1	<0.1	2.3	22.3	5	0.1	2	0.2	0.7	3	4.5	22	1.5	-30	6.5	Flat Granular
Dup3 for STS-PT-2013-20	1.07	0.6	234	0.064	27.8	1	0.6	<0.1	<0.1	2	21.7	7	<0.1	1	1.6	1.1	4	5.4	19	2.1	4	7.5	Flat Granular
STS-PT-2013-21	0.51	0.275	108	0.078	1.8	0.4	0.3	<0.1	<0.1	1.2	0.1	6.3	<1	<1	2.3	93.9	18	3.3	7	1.6	78	3.5	Bedrock
STS-PT-2013-22	0.946	0.255	100	0.158	5.4	0.8	0.2	<0.1	<0.1	3.3	0.24	11.8	<0.1	<1	10.7	46.9	95	18.8	27	2.6	91	3.6	Bedrock
STS-PT-2013-23	0.381	0.235	92	0.06	1.6	0.3	0.2	<0.1	<0.1	0.8	0.16	30.9	<0.1	2	9.1	53.8	55	6.1	4	1.6	94	3.8	Bedrock
STS-PT-2013-24	1.29	0.713	278	0.049	25.2	1.3	0.7	<0.1	<0.1	1.4	2.41	7	0.7	2	<0.1	1.3	6	4.2	11	1.7	-25	6.7	Flat Granular
STS-PT-2013-25	1.79	1.89	737	0.061	37.5	1.8	1.9	<0.1	<0.1	1.1	0.91	9	1.4	2	0.2	1.4	4	3.9	12	1.6	-22	6.6	Flat Granular
STS-PT-2013-26	1.88	0.562	220	0.086	5.9	1.9	0.6	<0.1	<0.1	2.3	18.1	7	<0.2	2	0.1	0.9	4	3.9	15	1.6	-26	6.7	Flat Granular
STS-PT-2013-27	3.34	1.15	449	0.074	21.5	3.4	1.1	<0.1	<0.1	1.3	0.45	9.5	1	1	2.4	3.5	34	23.6	12	1.6	78	4.9	Flat Granular
STS-PT-2013-28	0.609	0.472	184	0.073	2.3	0.5	0.5	<0.1	0.1	1	1.68	6	<0.2	3	0.2	0.9	6	4	12	1.6	-22	6.6	Flat Granular
STS-PT-2013-29	0.361	0.149	58	0.054	1.9	0.3	0.2	<0.1	<0.1	0.3	0.2	27.9	1	1	11.2	6.5	26	48.3	6	1.6	98	4.1	Flat Granular
STS-PT-2013-30	0.341	0.156	61	0.053	1.8	0.3	0.2	<0.1	<0.1	0.5	<0.01	11.2	<0.1	3	4	18.2	137	4.5	7	1.8	86	3.4	Flat Rocky
STS-PT-2013-31	6.62	0.759	297	0.537	21.7	7	0.7	0.4	<0.1	1.2	1.39	11	5	10	0.2	1.2	20	6.8	23	1.7	38	5.4	Slope
STS-PT-2013-32	1.38	1.77	692	0.139	6.4	1.4	1.8	0.1	0.4	1.9	0.6	20.9	1	7	2.4	11.3	38	16.4	15	1.6	76	5.4	Flat Rocky
STS-PT-2013-33	1.57	0.018	7	0.113	114	0.5	<0.1	<0.1	75.4	2.4	<0.01	5.5	1.7	2	3410	0.9	<1	67.8	13	5	152	4.3	Flat Granular
Dup2 for STS-PT-2013-33	1.75	0.02	8	0.078	114	0.4	<0.1	<0.1	68.2	2.2	<0.01	5.7	1	2	5620	1.5	<1	66.6	13	5.8	154	4.2	Flat Granular
STS-PT-2013-34	0.506	0.429	168	0.075	2.7	0.5	0.4	<0.1	0.8	1.8	0.33	55.4	3	2	22.4	10.5	91	28.3	10	1.6	105	4.7	Flat Rocky
STS-PT-2013-35	1.21	0.732	286	0.098	6.4	1.2	0.7	<0.1	1.8	1.9	0.51	21.8	2	2	73.6	0.7	7	11.4	10	1.6	120	4.3	Flat Rocky
STS-PT-2013-36	1.41	0.329	129	0.12	12.4	1.2	0.3	0.1	3.2	1.4	1.38	12.9	<1	3	30.7	0.8	3	2.7	6	1.8	108	6.1	Flat Rocky
Negative Control	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	6.7	--

Notes:

a. Olsen method used if pH > 6.5, otherwise Bray method

Soil Texture Codes:

C = clay
CL = clay loam
L = loam
LS = loamy sand
SCL = sandy clay loam
SL = sandy loam
LOI = loss on ignition
DTPA = diethylene triamine pentaacetic acid extraction
For locations with duplicates, original used in the analysis
Locations STS-PT-2013-18, 33, and 34 were not used in phytotoxicity study

Table A-3. 2015 Soil Results for Soils that had been Used for Scarlet Globemallow Experiment, Re-Used for Tansyaster Experiment

Freeport-McMoran Chino Mines Company
Vanadium, New Mexico
Smelter/Tailing Soils IU Phytotoxicity and Vegetation Community Study

Location ID	Copper $CaCl_2$ (mg/kg)	Conductivity $CaCl_2$ (mmhos/cm)	Millivolts (mV)	pH $CaCl_2$ (s.u.)
STS-PT-2013-1	33.5	2.3	44	4.5
STS-PT-2013-2	0.2	2.2	-58	6.8
STS-PT-2013-3	0.4	2.4	-10	5.1
STS-PT-2013-4	0.4	2.4	-22	5.0
STS-PT-2013-5	0.2	2.6	-31	5.7
STS-PT-2013-6	8.8	3.1	24	3.5
STS-PT-2013-7	36.1	3.9	35	3.0
STS-PT-2013-8	1.4	2.5	4	4.7
STS-PT-2013-9	145	2.3	61	4.1
STS-PT-2013-10	31.9	2.5	42	4.5
STS-PT-2013-11	12.1	2.6	30	3.7
STS-PT-2013-12	0.1	3.1	-57	6.2
STS-PT-2013-13	0.9	2.4	-2	4.6
STS-PT-2013-14	37.4	3.6	40	3.6
STS-PT-2013-15	2.0	2.5	8	4.8
STS-PT-2013-16	6.9	2.7	22	4.8
STS-PT-2013-17	0.2	2.7	-72	6.9
STS-PT-2013-19	45.3	2.4	46	4.3
STS-PT-2013-20	0.2	2.5	-91	7.2
STS-PT-2013-21	3.3	2.4	13	3.8
STS-PT-2013-22	16.1	2.3	32	4.0
STS-PT-2013-23	9.9	2.4	27	3.9
STS-PT-2013-24	<0.1	2.6	-99	6.9
STS-PT-2013-25	<0.1	2.4	-98	6.9
STS-PT-2013-26	<0.1	2.5	-110	7.3
STS-PT-2013-27	3.1	2.4	12	4.4
STS-PT-2013-28	<0.1	2.5	-104	7.1
STS-PT-2013-29	7.5	2.3	23	4.4
STS-PT-2013-30	10.7	2.7	25	3.4
STS-PT-2013-31	0.7	2.5	-11	4.7
STS-PT-2013-32	16.2	2.4	32	4.6
STS-PT-2013-35	133	2.5	56	4.0
STS-PT-2013-36	52.3	2.9	42	4.8

Table A-4. Chemical analysis of rock samples from rhyolite bedrock at Lampbright Draw.
Freeport-McMoran Chino Mines Company
Vanadium, New Mexico
Smelter/Tailing Soils IU Phytotoxicity and Vegetation Community Study

Sample ID	pH (s.u.) 2016 Data	Copper (mg/kg) 2016 data
Lambright Draw #1	6.4	167
Lambright Draw #2	5.2	53
Lambright Draw #3	5.2	72
Lambright Draw #4	5.3	93
Lambright Draw #5	5.7	105
Notes:		
See laboratory report.		

Also, soil from rhyolitic pumiceous tuff had pH of 5.9 from Golder (1998).
Golder. 1998. An Assessment of Soil in the Chino Mine Proposed Action Area.
Prepared for Chino Mines Company. May 28, 1998

Table A-5. Chemical analysis of rock samples from bedrock at Rustler Canyon from Kinetic Test.

Freeport-McMoran Chino Mines Company
Vanadium, New Mexico
Smelter/Tailing Soils IU Phytotoxicity and Vegetation Community Study

Week	Composite A	Composite A	Composite B	Composite B
	pH units (s.u.)	Copper (mg/kg)	pH units (s.u.)	Copper (mg/kg)
0	6.96	0.08	6.71	0.021
1	7.02	0.014	7.19	<0.005
2	7.17		7.19	
3	7.06		7.04	
4	7.25		7.18	
5	7.14	<0.005	7.17	<0.005
6	7.34		7.19	
7	7.33		7.28	
8	6.80		7.12	
9	6.93		6.96	
10	7.47	<0.005	7.24	<0.005
11	6.77		7.07	
12	6.7		6.8	
13	6.69		6.36	
14	6.59		6.58	
15	6.61		6.77	
16	6.92		6.59	
17	6.93		6.92	
18	6.95		6.74	
19	6.58		6.77	
20	6.86	<0.005	6.59	<0.005

Notes:

Sulfate was 10 mg/kg for Composite A for week 0 and was <10 mg/kg for the rest of the weeks and in Composite B.

Data from Golder. 2000. Rustler Canyon Waste Rock Characterization. Memorandum to Ned Hall, Chino Mines Company.

APPENDIX B

Field Seed Collection SOP

ARCADIS
Infrastructure · Water · Environment · Buildings

Imagine the result

Freeport McMoRan Copper and Gold
Chino Mines Company
Grant County, New Mexico

Standard Operating Procedures for Seed Collection and Storage

November 2015

ARCADIS

Standard Operating Procedures for Seed Collection and Storage

Mary Carroll

Mary Carroll
Senior Ecologist

Carolyn Meyer

Carolyn Meyer
Technical Expert/Ecologist

Prepared for:
Chino Mines Company
Grant County, New Mexico

Prepared by:
ARCADIS U.S., Inc.
Suite 200
Lakewood
Colorado 80401
Tel 303 231 9115

Date:
November 2015

Figure

Standard Operating Procedures for Seed Collection and Storage

Chino Mines Company
Grant County, New Mexico

1. Introduction

This document outlines Standard Operating Procedures (SOPs) used for seed collection and storage in support of phytotoxicity studies used to evaluate the effects of copper on native vegetation at the Chino Mines Site (Site) located in Grant County, New Mexico (the Site, Figure 2 in main text). The Site is located east of the town of Hurley and approximately 12 miles southeast of Silver City; it includes historical smelting facilities, mineral processing facilities, tailing impoundments, and surrounding areas.

This SOP document outlines the timing and quality and quantity of seed material collected, documentation procedures, collection procedures, and storage procedures for seed material used in the phytotoxicity study.

Sideoats grama (*Bouteloua curtipendula*)) and scarlet globemallow (*Sphaeraclea coccinea*) seeds were collected in 2013 and planted in the greenhouse pots in spring and summer 2014, respectively (see Appendix C). The scarlet globemallow failed to adequately germinate at the greenhouse (0 of 12 nursery seeds and 2 of site-collected seeds emerged of 120 seeds planted each in the control soil). Tansyleaf tansyaster (*Machaeranthera tanacetifolia*) seed was collected in the fall of 2014 to replace the scarlet globemallow seed.

2. Seed Collection Procedures

Native seeds at the Chino Mines Site were collected per requirements outlined in the Smelter Tailing Soils Investigation Unit (STSIU) – Phytotoxicity and Vegetation Community Study Work Plan (ARCADIS 2014). The phytotoxicity tests evaluated sideoats grama (*Bouteloua curtipendula*) and tansyaster (*Machaeranthera tanacetifolia*), which are herbaceous species common and native to the Site.

2.1 Seed Collection Localities

Sideoats grama (and scarlet globemallow seeds) were collected from one ten-acre location (Seed Collection Area, Figure 2 in main text). That location was protected from grazing in September 2013 to increase the potential for seed availability. Due to limited availability of tansyaster in the Seed Collection Area, tansyaster seeds were collected from twelve sites around and south of the Seed Collection Area in the late August (8/27) of 2014 (Figure 2 in main text).

2.2 Seed Viability and Quantity

In order to reduce the variables in the phytotoxicity study, healthy seeds were collected and seed viability was tested to ensure standard results. Seeds were sent to Growing Solutions Restoration Education Institute in Santa Barbara, California to cull potentially non-viable seeds (based on appearance), clean, dry, and store the seeds until the seeds were provided for the phytotoxicity tests that were performed in spring and summer 2014 (sideoats grama) and January 2015 (tansyaster, note: globemallow tests that failed were in June 2013 for nursery seeds and July 2013 for field seeds, completed by July 31, 2013). Seed germination viability was obtained during the phytotoxicity tests on the control pots with manufactured potting soil. Methods that were used to ensure mostly pure, healthy seed were collected in the field are described in more detail below in Section 2.4.

The phytotoxicity tests conducted at Wildlife International Laboratory required a minimum of 4,080 seeds per species collected on site (34 soils x 10 pots x 12 seeds/pot, ARCADIS 2014, Table 1 of main text). To protect against loss and account for culling, > 8,000 seeds of sideoats grama and > 8,000 seeds of tansyaster were collected. These species were confirmed to be available from nursery or commercial seed suppliers with germination requirements compatible with Wildlife International Laboratory capabilities, had reported high germination rates (≥80 percent for the grass and ~ 70% for the forb) in greenhouses and were abundant in or around the Seed Collection Area. Other species were considered but were problematic. Vine mesquite (*Panicum obtusum*) and purple threeawn (*Aristida purpurea*) were common on the Site but are reported as difficult to germinate in a greenhouse at high rates. Plains bristlegrass (*Setaria macrostachya*) is also common but nursery strains are purportedly often a mix of several species (*S*. *macrostachya*, S. *leucopila*, S. *texana*) and the species hybridize.

2.3 Seed Collection Timing

Seed collection occurred after the monsoon season, when seeds of target species had ripened. Sideoats grama seeds were collected the first week in October 2013 and tansyaster seeds were collected in late August 2014. During collection the seeds were examined in the field for viability, as described below.

2.4 Field Collection Guidelines

Maximum seed viability is achieved when fully ripened, pest-free seeds are collected. Seed viability can be affected by lack of pollinators, parasitism, and a range of environmental conditions and there can be a fairly high percentage of unviable seeds. Healthy seeds are generally filled internally from edge to edge with white moist endosperm or embryo tissue (Wall 2012). The following recommendations were used to enhance the likelihood of collecting viable seed from diverse maternal lines:

- Hand lenses were used in the field to check the condition of the seeds. Fully developed, mature, viable seeds generally turn dark in color with maturity (vs. green), separate from the ovary wall, and/or are easily detached from the plant. A cut test was used in the field on representative seeds by using a single edge razor, a small wood block, and a hand lens or microscope. Plump seeds were indicators of mature seeds for each species (Section 4).

- Seeds were collected from multiple parent plants. This diversification allowed for a better representation of Site seeds and it allowed the species to reseed.
- Seeds were not collected from parent plants with observed pests, fungus, or other illness.
- Seeds were hand collected or knocked from the parent plant and placed in large paper bags for drying. Paper bags were taped on bottom to prevent seeds from falling through.
- Seeds were not collected from the ground as this increases the likelihood of mixed species and soil and seed pathogens.
- Seeds or fruits were loosely placed in sturdy paper bags. Air circulation was essential to maintain seed health.
- Cursory cleaning was performed in the field to maximize the number of seeds in the bags.

Each collection bag was labeled with the initials of the collector, the date, and the species, location, and estimated number of seeds in the bag.

Field data were recorded to detail the areas from which seeds were collected that had the target population in bloom and/or fruiting. Additionally, species growing with these species which look similar to the target species were noted and checked against herbarium specimens to ensure accurate species identification. Site, soil type, slope exposure, elevation, and global positioning system (GPS) waypoint of the Seed Collection Area was recorded from the NRCS database and GIS slope/aspect maps prior to collection activities commenced. Given the lack of tansyaster seeds in the Seed Collection Area, tansyaster seeds were collected from multiple areas outside of the Seed Collection Area and were marked with a GPS waypoint to allow similar information to be obtained. Field observations were recorded to confirm the information recorded from the GIS and soil database. Soil and site characteristics observed in the field fenced collection area were described (presence of A horizon, if armored with rock, percent bedrock in area) and photographs taken (e.g., Figure B-1). A voucher specimen of each species was collected, dried, and labeled to demonstrate the correct species was sampled. The voucher specimen consisted of a typical plant or portions of a plant with stems, leaves, and reproductive structures. Each dried specimen was carefully stored in a dry location and sent to the local herbarium at Western New Mexico University.

3. Seed Drying and Storage Guidelines

For all seeds provided for drying and storage, the collection identification information was provided with each seed lot.

Seeds were dried to reduce seed moisture and facilitate seed ripening. Seeds were sent to Growing Solutions Restoration Education Institute in Santa Barbara, California for drying, cleaning, culling, and processing. The sideoats grama seeds were stored for a few days prior to shipping to this laboratory in labeled paper bags or envelopes containing a small amount of desiccant (silica gel). Desiccant packs were commercially purchased through Amazon.com. The paper seed containers containing sideoats grama were placed in refrigerator prior to shipping to Santa Barbara. Tansyaster seeds were also placed in paper seed containers with desiccant, but they were shipped to Growing Solutions the same day they were collected.

The protocol for the Santa Barbara laboratory is described below.

The seed heads were processed to remove as much non-seed material (i.e., “chaff” and/or other plant material) as possible prior to drying. Seed processing was performed manually by sifting collected materials over ½ inch hardware cloth to separate seed from stems and flower heads. Seeds were dried on an open screen at room temperature (~ 65-70ºF) with low humidity until there is no clear sign of moisture. The seeds were stirred every day during the drying process.

After seed drying and processing, seeds were examined for uniformity, health, and plumpness. Malformed or diseased seeds were culled. The largest seeds were retained and the smallest seeds culled (accomplished with a sieve). The tansyaster seeds have a pappus that was have actively removed before planting but seeds that lost the pappus were fine to plant.

Because humidity changes are easily transferred through paper, seeds were placed in a tightly closing sealed container with a dessicant pack in each container prior to shipping to Wildlife International. At the laboratory, these stored seeds were inspected every few weeks for any signs of decay or degradation, and decaying seeds were removed. Desiccant packs were changed if necessary.

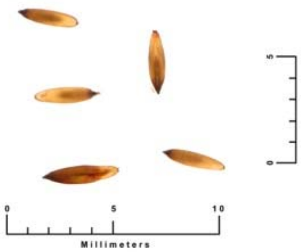
4. Species Descriptions

Seeds of sideoats grama (*Bouteloua curtipendula*) and tansyaster (*Machaeranthera tanacetifolia*) were selected for this study as both species are common and native to the Chino site. A brief description of each species and its seed characteristics and germination requirements is provided below, and was provided to the greenhouse laboratory. In addition, alfalfa (*Medicago sativa*), an agricultural species used in previous phytotoxicity studies, and scarlet globemallow, which did not germinate successfully in the greenhouse, are discussed below.

Sideoats Grama (*Bouteloua curtipendula*)—grass species

Sideoats grama is a widely distributed warm season perennial grass in the Grass Family. Most plants either arise singly, in clumps, or form large patches, depending on the variety. The variety *caespitosa* occurs from the southwestern United States to South America in prairies and arid grasslands, desert scrub, pine-oak and pinyon-juniper woodlands, and Ponderosa pine forests, whereas the variety *curtipendula* extends from the southwestern United States north to Canada in prairies, hardwood savannas, and other habitats; a third variety is confined to Mexico. Sideoats grama occurs at a range of elevations, from near sea level to over 8,000 feet. Due to the importance of this grass in rangelands and habitat restoration, considerable information is available on its biology and several horticultural forms have been developed.

The elongate flower spikes produce pendulous spikelets from mid-summer to fall, with seed ripening following several weeks later. The elliptical seeds (caryopsis) are 4.5 mm long by 1.5 mm wide. There are 160,000 seeds/ per pound (USDA 2013). Seeds are generally collected while still retain surrounding flowering structures, which are removed during cleaning. Germination rates vary with place of seed origin, temperature, timing of rainfall, and other environmental conditions and have ranged from 18 to 96 percent in various studies, with common values of 30 to 70 percent. Germination is favored when floral parts are removed from the caryopses; when seeds are planted one-inch deep vs. shallower or deeper; when seeds are relatively plump and heavy; and under various experimental temperatures that tended to be warm, between 50 and 86ºF (USDA 2013). Germination may occur within 2 to 7 days in moist soil (Wasser 1982, Jordan and Haferkamp 1989).



Tansyaster (*Machaeranthera tanacetifolia*)—first choice forb species

Tansyaster, also known as prairie aster, is an annual or biennial forb in the Sunflower Family with highly dissected gray-green leaves that occurs in arid grasslands, desert scrub, and pine-oak and pinyon-juniper woodlands from sea level to 5,600 feet in many western states, from California, Nevada, Arizona and New Mexico north to Montana, South Dakota, and Alberta, Canada and south to Texas into Mexico.

Tansyaster produces showy flowers comprised of narrow purple ray flowers surrounding a central yellow disk of many disk flowers. It blooms in late spring from May to October, depending on location, with seeds ripening a few weeks later. The flattened seed-containing structures (achenes) are 2-4 mm in length, narrowly obovate in shape, and covered in silky hairs; the pappus on top of the seed is 2-8 mm in length and comprised of 30-80 tawny barbed bristles. There are 400,000 to 490,000 seeds/pound (USDA 2013). Seeds can easily be collected once the seed heads spread wide, revealing the tawny pappus atop each achene. Average seed weight is 1 gram and seed viability is high if seed is stored in a precise way (orthodox seed method, drying seed to low moisture content [<15 percent relative humidity] and then freezing for 16 days at -20ºC, based on data from the Royal Botanic Garden at Kew Seed Information Database (2013)]. However, seed viability of many members of the Sunflower Family quickly drops under normal temperatures and humidity conditions. All *Machaeranthera* species are easily grown in any rich, well drained soil in a sunny spot (needs full sun outdoors). About 30 seeds (within achene called a cypsela) are in a seed head.

Germination Requirements: The diaspore (dispersal unit) of *Machaeranthera tanacetifolia* is not the “seed” but the fruit called a cypsela, which is indehiscent (does not open upon drying) and is derived from the ripened ovary surrounding the matured ovule or “seed”. Hence, germination of the seed inside the fruit (cypsela) may require conditions different than seeds dispersed outside of the protective covering of the fruit. This can be important regarding issues of dormancy (structural or physiological). The pappus falls off naturally if stored overwinter (e.g., or more ideally outdoors in its environment where it undergoes vernalization over the winter). If not, it can be removed before planting to increase speed of planting and reduce chance of seed drying out *but it does not need to be removed. It is critical that the seeds remain moist during planting or else they will return to being dormant and not germinate.*

The vendor seed purchased is Prairie aster (aka Tansyaster) (Machaeranthera tanacetifolia) and is commercially grown – not wildland harvested. The Tansyaster seed lot is 85.52% pure X 68% viable.

- Pre-treatment requirements
  - “Seed” germination is improved indoors after 2 weeks of cold treatment (stratification) in a moist medium before germination. If seeds are to be sown indoors, they should be stored in a moistened medium in the refrigerator for 2 weeks prior to sowing or sow outdoors in early spring. http://www.wildflowermix.com/info/180+common/aster-prairie.html
  - BLM studies found 50-60% germination with no stratification (cold treatment) and 50 - 70% with stratification, with the best results obtained from treatment at 57 - 68 degrees F (14 – 20 degrees C).

    www.blm.gov/pgdata/etc/medialib/blm/ut/natural_resources/Colorado_Plateau/2012meeting.Par.13246.File.dat?Kramer.pdf
  - KEW found 98% germination at 59 and 68 degrees F (15 - 20 degrees C) pre-treatment and 95% with 77 degrees F (25 degrees C) pre-treatment.
  - Deno (1993, p. 197) found 20 - 30% germination in 3 – 10 days with 70 degrees F (21 degrees C) pretreatment, (unknown if higher percent germination over more days), using fresh or dry-stored seed (stored 6 months at 70 or 40 degrees F., better germination at 40 degrees)
  - If grown outside, “seeds” should be sown in early spring for best results. Seeds require a prolonged cooling period prior to germination in late spring. However, “seeds” will germinate in winter, spring, or summer with varying results. Germination time is 15 - 45 days, depending on weather conditions. www.seedman.com/GoodCentsFlowers.htm
  - Others say pre-treatment should include
  - Scarification: Soak in water, let stand in water for 24 hours. https://sheffields.com/seeds/Machaeranthera/tanacetifolia
  - Stratification: cold stratify for 14 days.
- Germination: surface sow flat and keep moist. https://sheffields.com/seeds/Machaeranthera/tanacetifolia/9401
- The vendor of the tansyaster seeds purchased for the greenhouse experiment (Granite Seed) said:
  The germination protocol is: top of blotters in a plastic box (BB), germinated at 15 degrees C for 10 days. The seeds are sensitive to temperatures above 18 degrees C, and Wildlife International Laboratories kept the temperature below this level during the germination period.

Soil temperature: optimum soil temperature after planted is 55 – 65 degrees F (12.8 – 18.3 degrees C). https://aggie-horticulture.tamu.edu/wildseed/38/38.5.html The species is sensitive to temperatures above 18*C.

Depth: 1/16 – 1/8th inches is recommended. https://aggie-horticulture.tamu.edu/wildseed/38/38.5.html
www.seedman.com/GoodCentsFlowers.htm

Soils: preferred soils are well-drained sands and gravels with neutral pH; plants are not adapted to fine and acidic soils and are marginal in basic soils.
www.graniteseed.com/products/seeds/machaeranthera-tanacetifoliawww.easywildflowers.com/quality/mac.tan.htm

Mycorrhizae: plant survival is dependent upon mycorrhizae in the soil, as noted by at least two sources. https://wild.its.utexas/expert/show.php?id=9472, www.graniteseed.com/products/seeds/machaeranthera-tanacetifolia

Recommendation: Based on the information at hand, it seems the best indoor (lab) germination results are provided when seeds are stratified in a moist medium for at least two weeks under temperatures between 59 and 68 degrees F (15 and 20 degrees C). Outdoor sowing in late winter or early spring also overcomes dormancy. The seeds should be stored outside over winter and then germinated to achieve best results.

Alfalfa (*Medicago sativa*)—agricultural species

Alfalfa is a deep-rooted herbaceous perennial forb in the Pea Family that is cultivated for forage in many regions of the world. Multiple stems arise from a narrow woody crown and reach up to 1 m (3 feet) in height at maturity, bearing alternate leaves divided into three lance-shaped to ovoid leaflets. Flowers appear in spring, summer, and early fall and range in color from violet to yellow-green; the small legume fruits are spiraled in two to three turns and each contains 10 to 20 seeds. Alfalfa is considered a species complex, with nine facies classified as subspecies and hundreds of cultivars; there are both diploid and tetraploid forms. It originated in Southeast Asia and was first cultivated in Iran.

There are approximately 200,000 seeds per pound; viable seeds are bright olive-green. On average, about 45 to 73 percent of seeds have a hard seed coat that requires scarification for germination (USDA 1982); hard seed coats are produced more frequently on plants in cold climates (northern latitudes or higher elevations) compared with warm climates such as southern California or lower latitudes. Long-lived seeds have exhibited 81 percent germination after 19 years of seed storage (Watts et. al 1992). Seeds can be pretreated by mechanical scarification or by heating in hot water (219ºF) for 4 minutes. Recommended planting depth for alfalfa seeds is ¼ to ½ inch (5-10 mm). Optimal germination rates are obtained with ambient temperatures between 65 and 77ºF and seedlings appear within three to four days (Horton 1989).

The alfalfa variety Nitro Plus was obtained from Territorial Seed Company in Cottage Grove OR for this study (Lot # 18041). This variety exhibits germination rates of 87 percent during laboratory testing.

Scarlet globemallow (*Sphaeralcea coccinea*)—collected but not analyzed due to poor germination

Scarlet globemallow is a low-spreading, warm season, long-lived perennial forb to half-shrub in the Mallow Family. Stems emerge from a woody caudex located just under the soil surface and reach a height of 10-40 cm (4-16 inches). Plants are densely covered with stellate hairs. Leaves are alternate, palmately lobed, 1-3.7 cm long and 1-5 cm wide. The deep orange to pinkish colored flowers are clustered in dense, short racemes. There are 5 distinct petals, 5 united sepals, and 5 to numerous styles. Stamens are joined by their stalks into a tube and several pistils united in a ring. The fruit is an indehiscent schizocarp with 1-seeded carpels. Plants are rhizomatous. Growth begins in March and April, flowering in May to July and seed matures unevenly between July and August throughout much of its range. There are approximately 500,000 seeds per pound. The seed has a hard seed coat that must be scarified in order for germination to occur.

Eight species of Sphaeralcea occur at Chino (Newfields 2005) and care should be taken to ensure that the seeds of the correct species are collected. About 15 percent of the seeds of a plant are ripe at any one time (indeterminate seed ripener; St. Johns and Ogle 2009); one must ensure ripe seeds are harvested. In addition, seed may be subject to insect predation while still on the parent plant. Globemallow should be harvested when lower capsules begin to dry (St. Johns and Ogle 2009). Seed capsules can be cut from the parent plant and placed in seed collection bags to save time, and cleaning can be done later. Care should be used to wear gloves and safety glasses when handling seed because the stellate hairs on the seed and surrounding capsules can be a severe eye irritant. Fruit is a wedge-shaped capsule held in a ring of ten or more seeds. Avoid collecting seeds exhibiting seed predation.

Scarlet globemallow germinates best after 30-day stratification (cold period) and mechanical (or acid) scarification of the seed coat to germinate (Dunn 2011, St Johns and Ogle 2009). Recommended planting depth is 6.4 mm (Rawlins et. al 2009), though Prairie Moon Nursery said the seed should be on top of the soil, not buried. Seeds germinate rapidly with scarification, sometimes within 1 day (Deno 1993). The greenhouse study results showing 50% of sites germinated on paper towels (though none of the nursery seeds germinated) suggests seeds should probably not be buried in any future experiments.

5. References

ARCADIS. 2014. *Work Plan: Smelter Tailing Soils Investigation Unit (STSIU) – Phytotoxicity and Vegetation Community Study*. Prepared for Chino Mines Company, Hurley, New Mexico.

Deno, N. C. 1993. *Seed germination theory and practice.* International Board for Plant Genetic Resources. State College, PA.

Dunn, B. 2011. *Improved germination of two Sphaeralcea A. St.-Hil (Malvaceae) species with scarification plus stratification treatments*. Native Plants 12(1):13-17. [Web Page]. Located at http://npj.uwpress.org/content/12/1/13.refs

Horton, H., ed. and compiler. 1989. *Interagency forage and conservation planting guide for Utah.* Extension Circular 433. Logan, UT: Utah State University, Cooperative Extension Service. 67 p.

Jordan, G. L.; Haferkamp, M. R. 1989. *Temperature responses and calculated heat units for germination of several range grasses and shrubs*. Journal of Range Management. 42(1): 41-45.

Newfields. 2005. Chino Mines Administrative Order on Consent Site-wide Ecological Risk Assessment. Prepared for Chino Mines Company in November 2005.

Rawlins, J. K.; Anderson V.J.; Johnson R.; T. Krebs. 2009. *Optimal seeding depth of five forb species from the Great Basin*. Native Plants Journal 10:32-42

St. Johns, L., and D.G. Ogle. 2009. *Plant guide: scarlet globemallow (Sphaeralcea coccinea Nutt. Ryd)*. USDA-Natural Resources Conservation Service, ID Plant Materials Center, Aberdeen, ID 83210.

United States Department of Agriculture (USDA), Soil Conservation Service. 1982. *National list of scientific plant names. Vol. 1. List of plant names*. SCS-TP-159. Washington, DC. 416 p.

United States Department of Agriculture (USDA). 2013. *Fire Effects Information System*. [Web Page]. Located at http://www.fs.fed.us/database/feis/plants/. Accessed: August 27, 2013.

Wall, M. 2012. *Seed Collection and Storage Guidelines*. Rancho Santa Ana Botanic Garden. 25 pp.

Wasser, C. H. 1982. *Ecology and culture of selected species useful in revegetating disturbed lands in the West*. FWS/OBS-82/56. Washington, DC: U.S. Department of the Interior, Fish and Wildlife Service, Office of Biological Services, Western Energy and Land Use Team. 347 p.

Watts, W.A.; B.C.S. Hansen, and E.C. Grimm. 1992. *Camel Lake: A 40,000-yr record of vegetational and forest history from northwest Florida.* Ecology. 73(3): 1056-1066. [18727]

Figure B-1. Photographs of fenced 10-acre seed collection area in 2013, situated at about 5700' on east-facing slope with slopes < 15 degrees (flat granular category). Area has topsoil with some rocky armoring, and pCu is expected to be about 5.5 based on nearby sampled areas (minimally impacted but probably above background copper concentrations).

APPENDIX C

Wildlife International Greenhouse Report on Test Methods and Results

A TEST TO DETERMINE THE SEEDLING EMERGENCE AND GROWTH OF TERRESTRIAL PLANTS IN VARIOUS FIELD-COLLECTED SOILS

WILDLIFE INTERNATIONAL PROJECT NUMBER: 757P-101

AUTHOR:

John R. Porch, M.S.

STUDY INITIATION DATE: February 28, 2014

STUDY COMPLETION DATE:

SUBMITTED TO:

ARCADIS U.S., Inc.

Wildlife International
EVANS ANALYTICAL GROUP
8598 Commerce Drive
Easton, Maryland 21601 USA
1-(410) 822-8600

REPORT APPROVAL

SPONSOR: Arcadis U.S., Inc.

TITLE: A Test to Determine the Seedling Emergence and Growth of Terrestrial Plants in Various Field-Collected Soils

WILDLIFE INTERNATIONAL PROJECT NUMBER: 757P-101

STUDY DIRECTOR:

John R. Porch, M.S.
Manager of Plant and Invertebrate Toxicology

Date

TABLE OF CONTENTS

TABLE

APPENDICES

TABLE OF CONTENTS
(continued)

APPENDICES
(continued)

INTRODUCTION

This seedling emergence study was conducted for Arcadis U.S., Inc. at the Wildlife International plant testing facility in Easton, Maryland. The test species were sideoats grama, scarlet globemallow, tansy aster and alfalfa. The study was based on procedures in OECD Guideline for Testing of Chemicals, Guideline 208: *Terrestrial Plant Test: Seedling Emergence and Seedling Growth Test* (1) and ASTM Standard Guide for Conducting Terrestrial Plant Toxicity Tests (2), with some modifications to allow use of natural Chino soils and replicate aspects of a 1999 phytotoxicity study in the Ecological Risk Assessment (e.g., measure root length). The test with alfalfa was conducted between March 6 and 24, 2014. Testing with sideoats grama was conducted between March 20 and April 21, 2014. Testing with scarlet globemallow was conducted between June 17 and July 31, 2014. Testing with tansy aster was conducted from January 30 to March 23, 2015. Raw data generated by Wildlife International, the study protocol, and the final report are filed in archives located on the Wildlife International site. Key personnel involved in the study are listed in Appendix 1.

OBJECTIVE

The objective of this study was to determine the emergence and growth of four species of terrestrial non-target higher plants in various field-collected soils.

EXPERIMENTAL DESIGN

For each of the species tested, seeds were planted in each of thirty-four test soils. Thirty-three soils were provided to the laboratory by the sponsor, and one greenhouse-prepared soil mixture was used as a reference. No test substance was incorporated into the soil used for planting. There were ten replicate pots for each soil type, with twelve seeds planted per replicate. The replicates were placed on a benchtop in a greenhouse according to a randomized design. The test duration was 14 days after 50% control emergence for alfalfa, 21 days after 50% control emergence for sideoats grama, and 21 days after the control emergence reached a plateau for tansy aster. Possible effects of the various soils on seedling emergence and growth of emerged seedlings were evaluated when appropriate. Data collected from all replicates within a soil type were pooled for calculating group means.

MATERIALS AND METHODS

Species Tested

The four species of plants planned for use in this study are listed below:

Family	Scientific Name	Common Name	Planting Depth
	Monocot		
Poaceae	*Bouteloua curtipendula*	Sideoats grama	20 mm
	Dicots		
Malvaceae	*Sphaeralcea coccinea*	Scarlet globemallow	10 mm
Asteraceae	*Machaeranthera tanacetifolia*	Tansy Aster	10 mm
Fabaceae	*Medicago sativa*	Alfalfa	10 mm

Sideoats grama, tansy aster and scarlet globemallow were tested as two distinct populations: one consisting of field-collected seeds and the other consisting of seeds provided by a plant nursery or seed supplier. One seed source of alfalfa was tested. Seeds were planted at the species specific depths shown in the above table. Seeds used in this study were not treated with fungicides, insecticides or repellents prior to test initiation. Seeds were provided by the Sponsor. Documentation provided by the supplier concerning the identification and history of the seeds used is filed with the study data.

Test Soils

Test soils were received in plastic buckets from the sponsor. A standard, artificial greenhouse soil was prepared and used as a reference substrate. The field-collected soils were sieved to 2 mm prior to receipt at the laboratory. Soils were used as received for tests with alfalfa, scarlet globemallow and sideoats grama. Due to the limited supply, soils reclaimed from these initial tests were used for the test with tansy aster. Prior to planting and at the conclusion of each test, the pH of each soil type was measured with a Kelway soil probe and/or a laboratory pH meter.

Environmental Conditions

The test was conducted within a greenhouse. Relative humidity, light intensity and temperature within the greenhouse were measured continuously with a Campbell CR10 datalogger. The lights were controlled by a combination of a timer and light meter. Each day, the lights come on at 5 AM and remained on until the ambient light level outdoors reached the set-point, at which time they were turned off. During the day, when the sunlight fell below the set-point, the lights were turned on to supplement the natural sunlight. Each evening, as the light fell below the set-point, the lights were again turned on, and stayed on until 9 PM. A photoperiod of at least 16 hours of light was maintained in the greenhouse. Artificial lighting was used to supplement natural sunlight on short days or on overcast days. The temperature within the greenhouse was controlled by a Wadsworth Micro/Step 50 Control System at a set-point temperature of ~20 degrees Celsius. Greenhouse side vents were left open during testing with tansy aster in order to maintain the ambient temperature as low as possible.

Test Procedure

Test plants were grown in plastic pots approximately 11 cm in diameter and 10 cm in depth. Fifty growth pots were filled with each test soil, and twelve seeds of one species (either wild or nursery population as warranted) were planted per replicate, following Table 3 in the study plan. Scarification and stratification were not required for alfalfa or sideoats grama. For scarlet globemallow, the seeds were scarified and then cold stratified using the following procedure:

1. Seeds were scarified by rubbing sand paper by nicking each seed with a tiny cut through seed coat. Seeds were washed after scarification.
2. Then, seeds were cold stratified for approximately 30 days. Seeds were placed in a sealed container and stored in a refrigerator at a temperature of 35 – 41°F. Seeds were kept moist during the entire length of the treatment. Stratification was ended on the day of planting to begin the test.

Tansy aster seeds were prepared for use in the test in the following manner:

1. An inoculum provided by the sponsor was added to seeds according to instructions provided.
2. Sand was placed in clean petri dishes, inoculated seeds were placed on the sand and covered with moist filter paper. Petri dishes were covered with lids.
3. Petri dishes were placed on trays, which were enclosed in plastic bags and moved to a walk-in refrigerator for cold stratification (14 days at a temperature of 35 – 41°F). Stratification was ended on the day of planting to begin the test.

Seeds were planted at the species appropriate depth and were approximately equally spaced. Pots were uniquely identified with the species name, project number, designation of soil type, and replicate. For the species other than alfalfa, the pots were also labeled as wild or nursery seed. After planting, the growth pots were placed on benches in the greenhouse in a randomized configuration to minimize bias from microclimates that may exist within the greenhouse. Water was supplied to the growth pots by watering from the top to keep the soil evenly moist, simulate natural conditions and reduce leaching of metals and salts in the soil column. The pH of irrigation water was adjusted to approximately 6 using HCl before it is used to water plants. Records of the days that watering occurs and the source of water used were kept in the study data.

The control growth pots were observed for germination daily in order to determine the day on which 50% emergence is reached. The in-life portion of the test terminated not less than after 50% of the control plants grown from nursery seed in the greenhouse mixture have germinated for the grass and alfalfa species. The tests were terminated for each species at least 14 days after 50% of the seeds had emerged. On the day of test termination, the pH of each soil type was measured prior to planting using a soil probe. At the termination of the in-life portion of the test, percent germination, height of plant shoots, length and weight measurements of the shoot and length of the root, and the condition and survival of the emerged seedlings was recorded. On the day of test termination, seedlings in each replicate were observed for symptoms of toxicity and assigned a rating score to describe the severity of any observed effects (Table 1). After shoot heights and observations were complete, well water (not pH adjusted) was added to the pots to loosen the soil and facilitate the removal of seedlings. When seedlings were removed from the pot, root masses were rinsed to clean away attached soil and placed on a paper towel. The length of the longest root for each replicate pot was measured with a ruler. The plants were placed in bags by replicate, dried, and weighed. The total replicate weight was divided by the number of plants weighed in order to determine the mean (per plant) dry weight for each replicate.

Data Analyses

The mean number of emerged seedlings, surviving seedlings as the percentage of those that emerged, shoot height, total plant dry weight and root length for each treatment group (soil type) were calculated.

RESULTS

Observations and Measurements

Time to 50% emergence in the controls, the final control emergence and survival, and duration of the test with each species are presented in the table below.

Species	Days Until 50% Control Emergence	Final Control Emergence (%)	Control Survival (% of emerged)	Duration of Test (days after 50% control emergence)
Alfalfa	4	80	97	14
Sideoats grama (Nursery-Provided)	10	55	92	21
Sideoats grama (Field-Collected)	7	64	83	21
Scarlet Globemallow (Nursery-Provided)	>21	0	-	-
Scarlet Globemallow (Field-Collected)	>21	0	-	-
Tansy Aster (Nursery-Provided)	reached 45% on day 19, remained 45% until day 38 and afterwards	45	41	14
Tansy Aster (Field-Collected)	reached 28% on day 19, remained 28% until day 43 and afterwards	28	24	14

Environmental conditions during the test period are provided in Appendix 2. Daily counts of control emergence are provided by species in Appendices 3.1 through 3.7. Complete results of the tests with alfalfa, sideoats grama and tansy aster are provided by species in Appendices 4 through 8.

Validity Criteria

Compliance with the OECD criteria for control survival was evaluated based on the following criteria:

- Alfalfa: 80% germination was obtained, and 90% of emerged seeds survived until test termination. The test with alfalfa was considered valid.
- Sideoats Grama: Control emergence (55% for nursery-provided seeds and 64% for field-collected seeds) and survival (92% for nursery-provided seeds and 83% for field-collected seeds) were less than desired, but were considered adequate for the test.
- Scarlet globemallow: Control emergence was substantially less than 55%, and the test was not valid.
- Tansy aster: Control emergence for the field-collected and nursery-provided seeds were 28% and 45%, respectively, and survival of the emerged seedlings was 24% and 41%, respectively. The test was considered marginally acceptable.

Integrity of the Data

The data and observations that were made are accurately reported. However, the following circumstances may have affected the quality of the data:

- The probes used to measure soil pH in test pots were not validated. However, they were used according to directions.
- It is not known whether the use of reclaimed soils for tansy aster affected results.
- It is not known whether copper in the irrigation lines had an adverse effect on the test.
- It is not known if the species that were used in the test (with the exception of alfalfa) are suitable to be raised in a greenhouse under the conditions of the study.

REFERENCES

1 **OECD Guideline for the Testing of Chemicals.** 2006. Guideline 208: Terrestrial Plant Test: Seedling Emergence and Seedling Growth Test.

2 **ASTM. 2009.** Standard guide for conducting terrestrial plant toxicity tests. Prepared by the American Society of Testing and Materials. Designation: E1963-09. Philadelphia, Pennsylvania.

Table 1

Seedling Condition Rating System

Rating	Category	Description
0	No Effect	No noticeable effect
10	Slight Effect	Effect barely noticeable
20		Some effect, not apparently detrimental
30		Effect more pronounced, not obviously detrimental
40	Moderate Effect	Effect moderate, plants appear able to recover
50		More lasting effect, recovery doubtful
60		Lasting effect, recovery doubtful
70	Severe Effect	Heavy injury, loss of individual leaves
80		Plant nearly destroyed, a few surviving leaves
90		Occasional surviving leaves
100	Complete Effect	Death of entire plant

Rating scale adapted from:
Frans, Robert E. and Ronald E. Talbert. 1977. Design of Field Experiments and the Measurement and Analysis of Plant Responses. Pages 15-23 in B. Truelove, ed. Research Methods in Weed Science. Southern Weed Science Society, Auburn University, Alabama.

Appendix 1

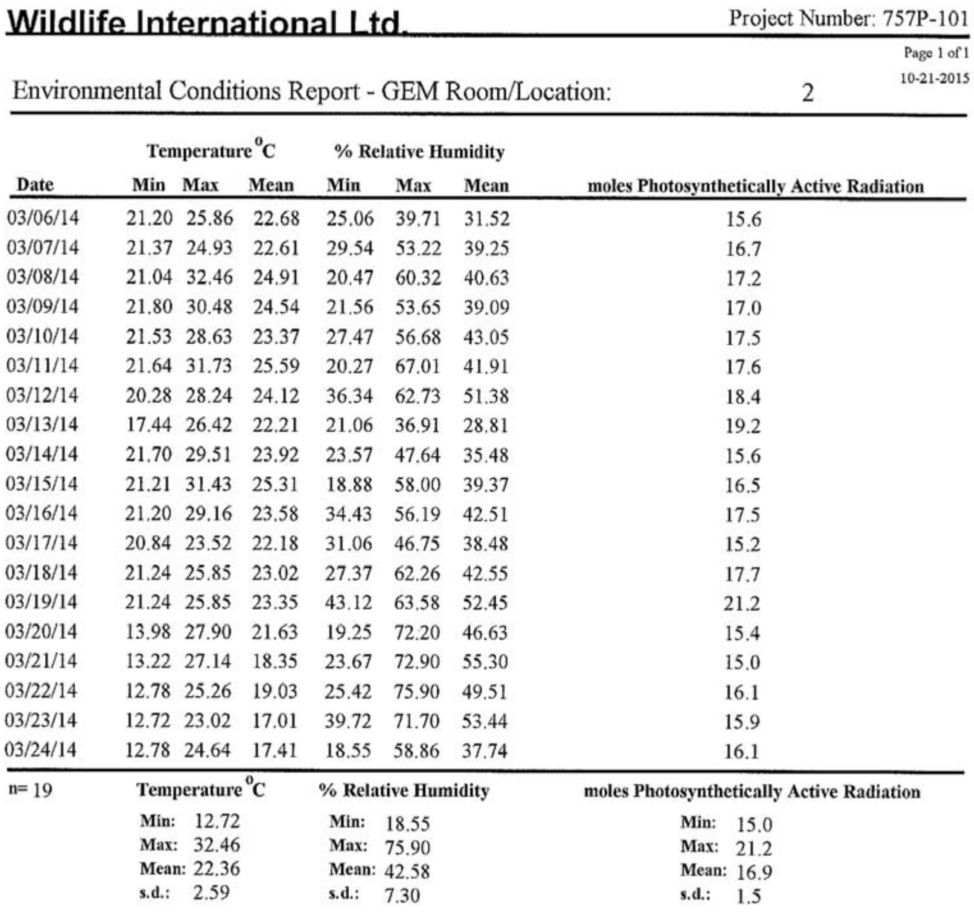
Personnel Involved in the Study

The following key personnel were involved in the conduct or management of this study:

(2) John R. Porch, Manager of Plant and Invertebrate Toxicology
(3) Joshua T. Oakes, Greenhouse Supervisor
(4) Eric W. Peterson, Biologist
(5) Kathryn P. Jenson, Biologist

Appendix 2

Environmental Conditions
Alfalfa



Wildlife International Ltd. Project Number: 757P-101

Page 1 of 1
10-21-2015

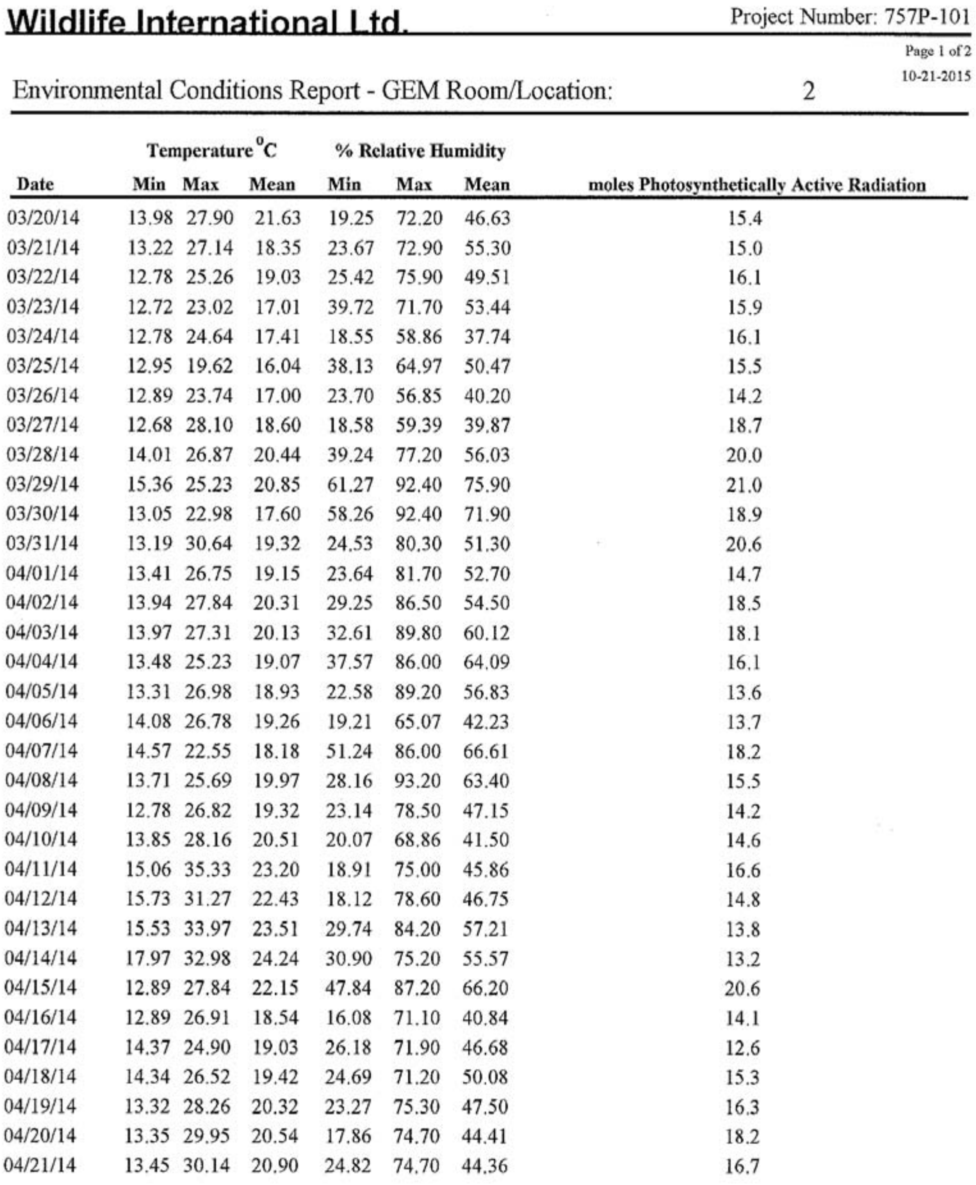
Environmental Conditions Report - GEM Room/Location: 2

	Temperature ^{o}C			% Relative Humidity			
Date	**Min**	**Max**	**Mean**	**Min**	**Max**	**Mean**	**moles Photosynthetically Active Radiation**
03/06/14	21.20	25.86	22.68	25.06	39.71	31.52	15.6
03/07/14	21.37	24.93	22.61	29.54	53.22	39.25	16.7
03/08/14	21.04	32.46	24.91	20.47	60.32	40.63	17.2
03/09/14	21.80	30.48	24.54	21.56	53.65	39.09	17.0
03/10/14	21.53	28.63	23.37	27.47	56.68	43.05	17.5
03/11/14	21.64	31.73	25.59	20.27	67.01	41.91	17.6
03/12/14	20.28	28.24	24.12	36.34	62.73	51.38	18.4
03/13/14	17.44	26.42	22.21	21.06	36.91	28.81	19.2
03/14/14	21.70	29.51	23.92	23.57	47.64	35.48	15.6
03/15/14	21.21	31.43	25.31	18.88	58.00	39.37	16.5
03/16/14	21.20	29.16	23.58	34.43	56.19	42.51	17.5
03/17/14	20.84	23.52	22.18	31.06	46.75	38.48	15.2
03/18/14	21.24	25.85	23.02	27.37	62.26	42.55	17.7
03/19/14	21.24	25.85	23.35	43.12	63.58	52.45	21.2
03/20/14	13.98	27.90	21.63	19.25	72.20	46.63	15.4
03/21/14	13.22	27.14	18.35	23.67	72.90	55.30	15.0
03/22/14	12.78	25.26	19.03	25.42	75.90	49.51	16.1
03/23/14	12.72	23.02	17.01	39.72	71.70	53.44	15.9
03/24/14	12.78	24.64	17.41	18.55	58.86	37.74	16.1

n= 19	**Temperature ^{o}C**	**% Relative Humidity**	**moles Photosynthetically Active Radiation**
Min:	12.72	18.55	15.0
Max:	32.46	75.90	21.2
Mean:	22.36	42.58	16.9
s.d.:	2.59	7.30	1.5

Pots were top-watered using pH-adjusted water on the following days :
07 Mar 14
10 Mar 14
13 Mar 14
16 Mar 14
19 Mar 14
21 Mar 14

Appendix 2
(continued)
Environmental Conditions
Sideoats Grama



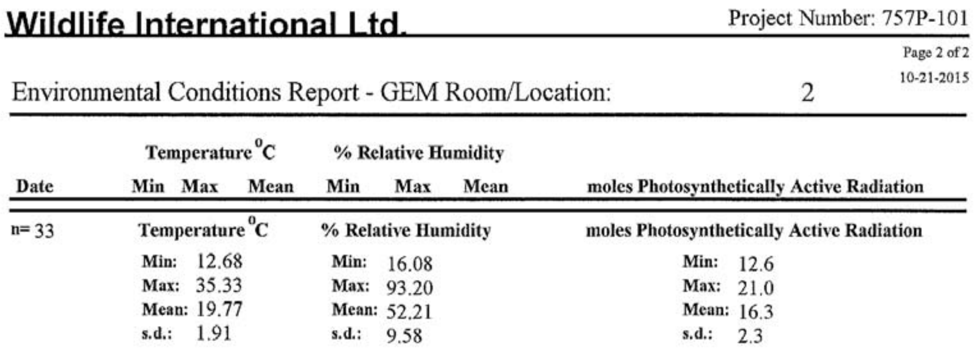
Wildlife International Ltd.

Project Number: 757P-101
Page 1 of 2
10-21-2015

Environmental Conditions Report - GEM Room/Location: 2

Date	Temperature °C Min	Max	Mean	% Relative Humidity Min	Max	Mean	moles Photosynthetically Active Radiation
03/20/14	13.98	27.90	21.63	19.25	72.20	46.63	15.4
03/21/14	13.22	27.14	18.35	23.67	72.90	55.30	15.0
03/22/14	12.78	25.26	19.03	25.42	75.90	49.51	16.1
03/23/14	12.72	23.02	17.01	39.72	71.70	53.44	15.9
03/24/14	12.78	24.64	17.41	18.55	58.86	37.74	16.1
03/25/14	12.95	19.62	16.04	38.13	64.97	50.47	15.5
03/26/14	12.89	23.74	17.00	23.70	56.85	40.20	14.2
03/27/14	12.68	28.10	18.60	18.58	59.39	39.87	18.7
03/28/14	14.01	26.87	20.44	39.24	77.20	56.03	20.0
03/29/14	15.36	25.23	20.85	61.27	92.40	75.90	21.0
03/30/14	13.05	22.98	17.60	58.26	92.40	71.90	18.9
03/31/14	13.19	30.64	19.32	24.53	80.30	51.30	20.6
04/01/14	13.41	26.75	19.15	23.64	81.70	52.70	14.7
04/02/14	13.94	27.84	20.31	29.25	86.50	54.50	18.5
04/03/14	13.97	27.31	20.13	32.61	89.80	60.12	18.1
04/04/14	13.48	25.23	19.07	37.57	86.00	64.09	16.1
04/05/14	13.31	26.98	18.93	22.58	89.20	56.83	13.6
04/06/14	14.08	26.78	19.26	19.21	65.07	42.23	13.7
04/07/14	14.57	22.55	18.18	51.24	86.00	66.61	18.2
04/08/14	13.71	25.69	19.97	28.16	93.20	63.40	15.5
04/09/14	12.78	26.82	19.32	23.14	78.50	47.15	14.2
04/10/14	13.85	28.16	20.51	20.07	68.86	41.50	14.6
04/11/14	15.06	35.33	23.20	18.91	75.00	45.86	16.6
04/12/14	15.73	31.27	22.43	18.12	78.60	46.75	14.8
04/13/14	15.53	33.97	23.51	29.74	84.20	57.21	13.8
04/14/14	17.97	32.98	24.24	30.90	75.20	55.57	13.2
04/15/14	12.89	27.84	22.15	47.84	87.20	66.20	20.6
04/16/14	12.89	26.91	18.54	16.08	71.10	40.84	14.1
04/17/14	14.37	24.90	19.03	26.18	71.90	46.68	12.6
04/18/14	14.34	26.52	19.42	24.69	71.20	50.08	15.3
04/19/14	13.32	28.26	20.32	23.27	75.30	47.50	16.3
04/20/14	13.35	29.95	20.54	17.86	74.70	44.41	18.2
04/21/14	13.45	30.14	20.90	24.82	74.70	44.36	16.7

Appendix 2
(continued)
Environmental Conditions
Sideoats Grama



Wildlife International Ltd. Project Number: 757P-101

Page 2 of 2
10-21-2015

Environmental Conditions Report - GEM Room/Location: 2

	Temperature °C			% Relative Humidity			
Date	**Min**	**Max**	**Mean**	**Min**	**Max**	**Mean**	**moles Photosynthetically Active Radiation**

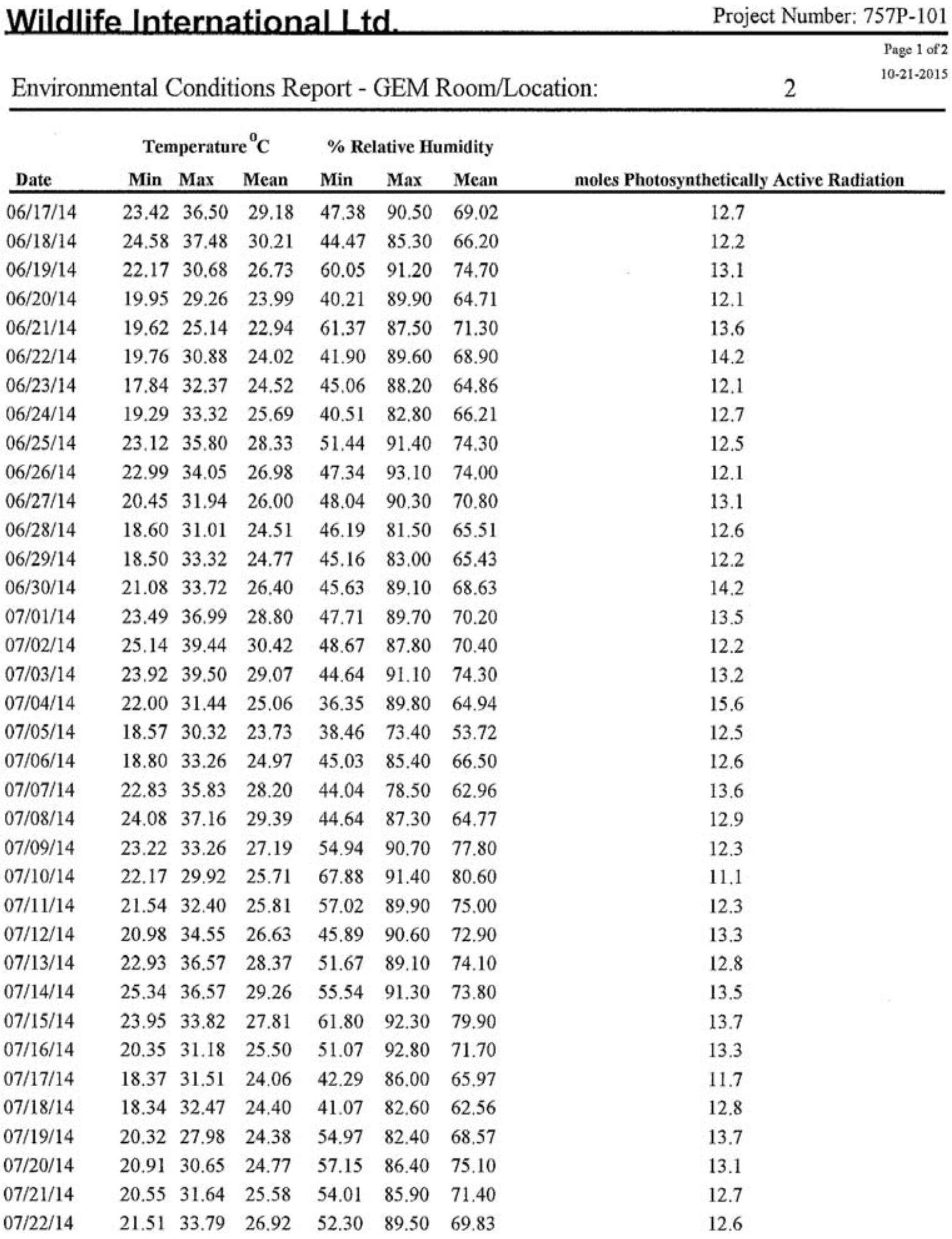
n= 33

Temperature °C		% Relative Humidity		moles Photosynthetically Active Radiation	
Min:	12.68	**Min:**	16.08	**Min:**	12.6
Max:	35.33	**Max:**	93.20	**Max:**	21.0
Mean:	19.77	**Mean:**	52.21	**Mean:**	16.3
s.d.:	1.91	**s.d.:**	9.58	**s.d.:**	2.3

Pots were top-watered using pH-adjusted water on the following days :

Field-Collected	Nursery-Provided
20 Mar 14	21 Mar 14
24 Mar 14	25 Mar 14
28 Mar 14	31 Mar 14
31 Mar 14	03 Apr 14
03 Apr 14	05 Apr 14
05 Apr 14	07 Apr 14
07 Apr 14	10 Apr 14
10 Apr 14	12 Apr 14
12 Apr 14	14 Apr 14
14 Apr 14	17 Apr 14
16 Apr 14	20 Apr 14

Appendix 2
(continued)
Environmental Conditions
Scarlet Globemallow



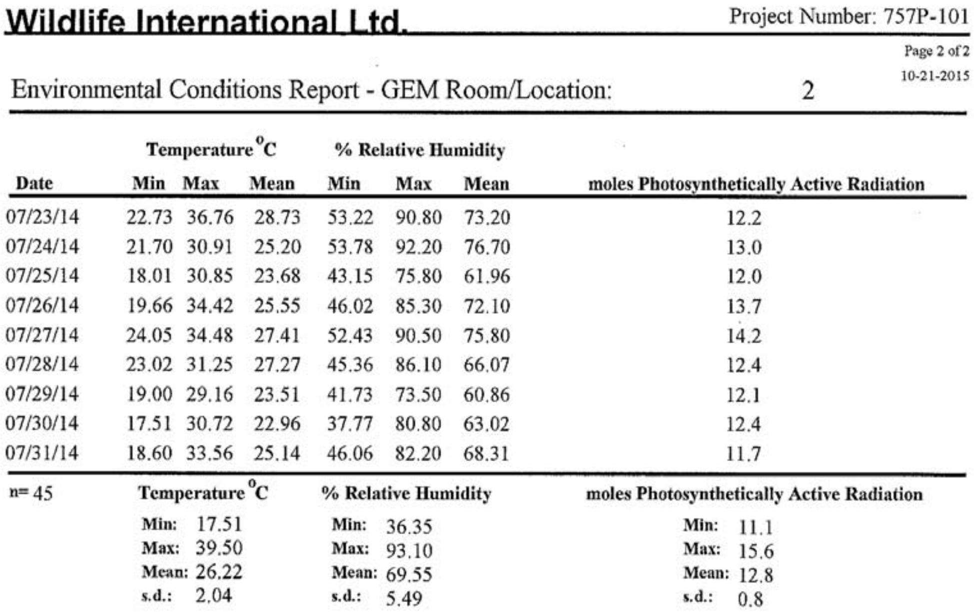
Wildlife International Ltd. Project Number: 757P-101

Page 1 of 2
10-21-2015

Environmental Conditions Report - GEM Room/Location: 2

Date	Temperature ^{0}C Min	Max	Mean	% Relative Humidity Min	Max	Mean	moles Photosynthetically Active Radiation
06/17/14	23.42	36.50	29.18	47.38	90.50	69.02	12.7
06/18/14	24.58	37.48	30.21	44.47	85.30	66.20	12.2
06/19/14	22.17	30.68	26.73	60.05	91.20	74.70	13.1
06/20/14	19.95	29.26	23.99	40.21	89.90	64.71	12.1
06/21/14	19.62	25.14	22.94	61.37	87.50	71.30	13.6
06/22/14	19.76	30.88	24.02	41.90	89.60	68.90	14.2
06/23/14	17.84	32.37	24.52	45.06	88.20	64.86	12.1
06/24/14	19.29	33.32	25.69	40.51	82.80	66.21	12.7
06/25/14	23.12	35.80	28.33	51.44	91.40	74.30	12.5
06/26/14	22.99	34.05	26.98	47.34	93.10	74.00	12.1
06/27/14	20.45	31.94	26.00	48.04	90.30	70.80	13.1
06/28/14	18.60	31.01	24.51	46.19	81.50	65.51	12.6
06/29/14	18.50	33.32	24.77	45.16	83.00	65.43	12.2
06/30/14	21.08	33.72	26.40	45.63	89.10	68.63	14.2
07/01/14	23.49	36.99	28.80	47.71	89.70	70.20	13.5
07/02/14	25.14	39.44	30.42	48.67	87.80	70.40	12.2
07/03/14	23.92	39.50	29.07	44.64	91.10	74.30	13.2
07/04/14	22.00	31.44	25.06	36.35	89.80	64.94	15.6
07/05/14	18.57	30.32	23.73	38.46	73.40	53.72	12.5
07/06/14	18.80	33.26	24.97	45.03	85.40	66.50	12.6
07/07/14	22.83	35.83	28.20	44.04	78.50	62.96	13.6
07/08/14	24.08	37.16	29.39	44.64	87.30	64.77	12.9
07/09/14	23.22	33.26	27.19	54.94	90.70	77.80	12.3
07/10/14	22.17	29.92	25.71	67.88	91.40	80.60	11.1
07/11/14	21.54	32.40	25.81	57.02	89.90	75.00	12.3
07/12/14	20.98	34.55	26.63	45.89	90.60	72.90	13.3
07/13/14	22.93	36.57	28.37	51.67	89.10	74.10	12.8
07/14/14	25.34	36.57	29.26	55.54	91.30	73.80	13.5
07/15/14	23.95	33.82	27.81	61.80	92.30	79.90	13.7
07/16/14	20.35	31.18	25.50	51.07	92.80	71.70	13.3
07/17/14	18.37	31.51	24.06	42.29	86.00	65.97	11.7
07/18/14	18.34	32.47	24.40	41.07	82.60	62.56	12.8
07/19/14	20.32	27.98	24.38	54.97	82.40	68.57	13.7
07/20/14	20.91	30.65	24.77	57.15	86.40	75.10	13.1
07/21/14	20.55	31.64	25.58	54.01	85.90	71.40	12.7
07/22/14	21.51	33.79	26.92	52.30	89.50	69.83	12.6

Appendix 2
(continued)
Environmental Conditions
Scarlet Globemallow



Wildlife International Ltd. Project Number: 757P-101

Page 2 of 2
10-21-2015

Environmental Conditions Report - GEM Room/Location: 2

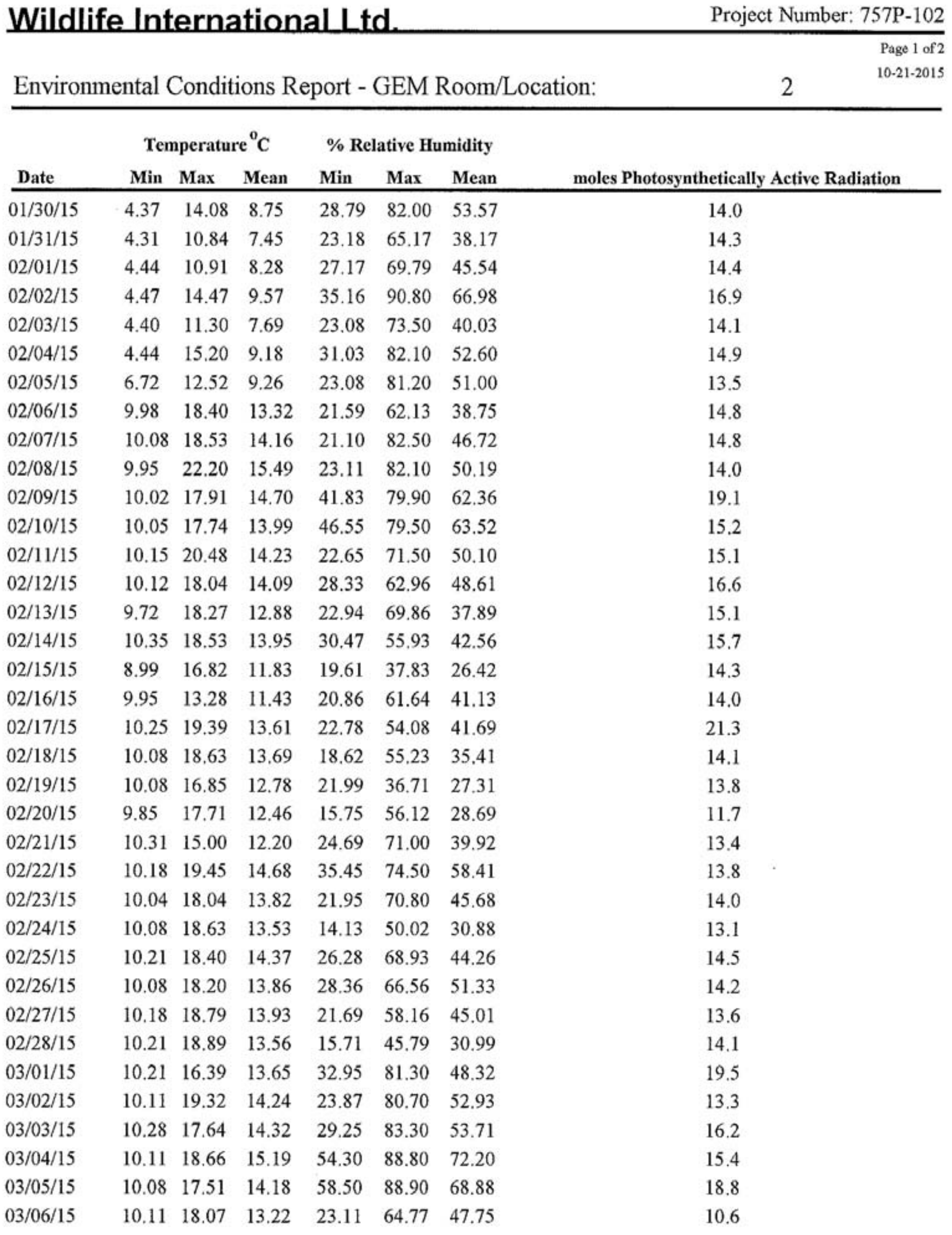
	Temperature °C			% Relative Humidity			
Date	**Min**	**Max**	**Mean**	**Min**	**Max**	**Mean**	**moles Photosynthetically Active Radiation**
07/23/14	22.73	36.76	28.73	53.22	90.80	73.20	12.2
07/24/14	21.70	30.91	25.20	53.78	92.20	76.70	13.0
07/25/14	18.01	30.85	23.68	43.15	75.80	61.96	12.0
07/26/14	19.66	34.42	25.55	46.02	85.30	72.10	13.7
07/27/14	24.05	34.48	27.41	52.43	90.50	75.80	14.2
07/28/14	23.02	31.25	27.27	45.36	86.10	66.07	12.4
07/29/14	19.00	29.16	23.51	41.73	73.50	60.86	12.1
07/30/14	17.51	30.72	22.96	37.77	80.80	63.02	12.4
07/31/14	18.60	33.56	25.14	46.06	82.20	68.31	11.7

n= 45	**Temperature °C**	**% Relative Humidity**	**moles Photosynthetically Active Radiation**
	Min: 17.51	**Min:** 36.35	**Min:** 11.1
	Max: 39.50	**Max:** 93.10	**Max:** 15.6
	Mean: 26.22	**Mean:** 69.55	**Mean:** 12.8
	s.d.: 2.04	**s.d.:** 5.49	**s.d.:** 0.8

Pots were top-watered using pH-adjusted water on the following days :

Field-Collected	Nursery-Provided
14 Jul 14	17 Jun 14
17 Jul 14	20 Jun 14
20 Jul 14	21 Jun 14
23 Jul 14	23 Jun 14
25 Jul 14	25 Jun 14
29 Jul 14	27 Jun 14
	29 Jun 14
	30 Jun 14
	01 Jul 14
	03 Jul 14
	06 Jul 14

Appendix 2
(continued)
Environmental Conditions
Tansy Aster



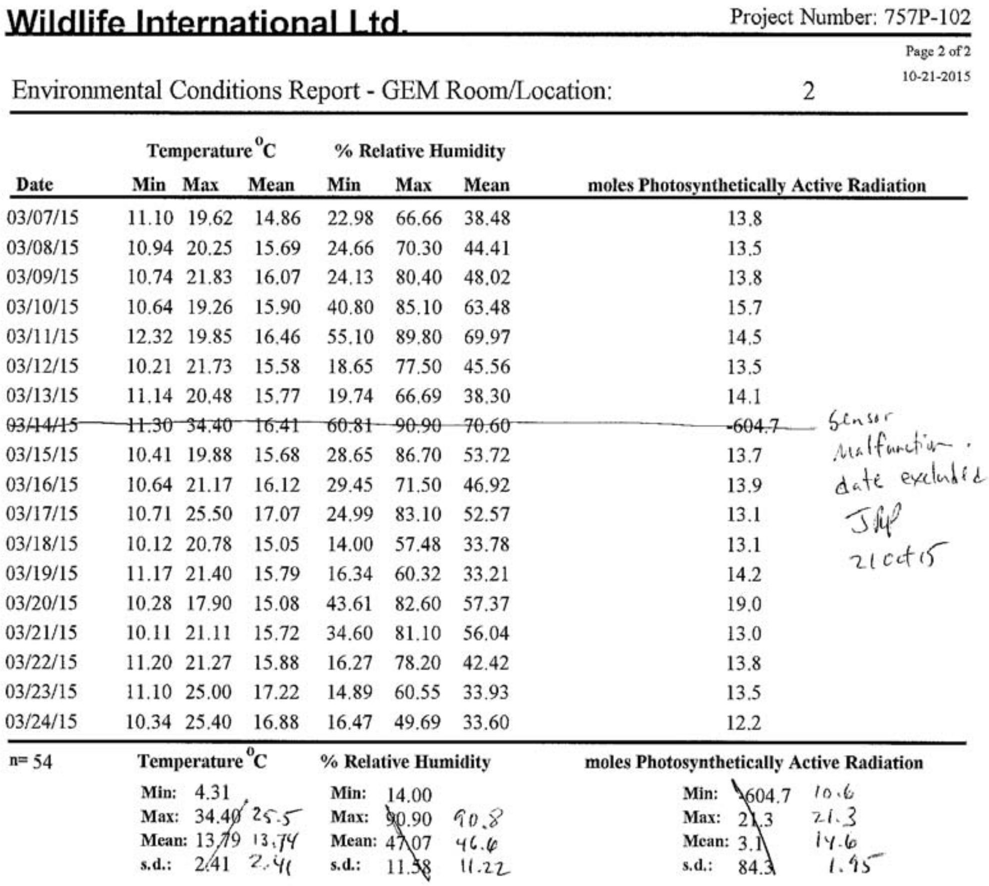
Wildlife International Ltd. Project Number: 757P-102

Page 1 of 2
10-21-2015

Environmental Conditions Report - GEM Room/Location: 2

	Temperature °C			% Relative Humidity			
Date	**Min**	**Max**	**Mean**	**Min**	**Max**	**Mean**	**moles Photosynthetically Active Radiation**
01/30/15	4.37	14.08	8.75	28.79	82.00	53.57	14.0
01/31/15	4.31	10.84	7.45	23.18	65.17	38.17	14.3
02/01/15	4.44	10.91	8.28	27.17	69.79	45.54	14.4
02/02/15	4.47	14.47	9.57	35.16	90.80	66.98	16.9
02/03/15	4.40	11.30	7.69	23.08	73.50	40.03	14.1
02/04/15	4.44	15.20	9.18	31.03	82.10	52.60	14.9
02/05/15	6.72	12.52	9.26	23.08	81.20	51.00	13.5
02/06/15	9.98	18.40	13.32	21.59	62.13	38.75	14.8
02/07/15	10.08	18.53	14.16	21.10	82.50	46.72	14.8
02/08/15	9.95	22.20	15.49	23.11	82.10	50.19	14.0
02/09/15	10.02	17.91	14.70	41.83	79.90	62.36	19.1
02/10/15	10.05	17.74	13.99	46.55	79.50	63.52	15.2
02/11/15	10.15	20.48	14.23	22.65	71.50	50.10	15.1
02/12/15	10.12	18.04	14.09	28.33	62.96	48.61	16.6
02/13/15	9.72	18.27	12.88	22.94	69.86	37.89	15.1
02/14/15	10.35	18.53	13.95	30.47	55.93	42.56	15.7
02/15/15	8.99	16.82	11.83	19.61	37.83	26.42	14.3
02/16/15	9.95	13.28	11.43	20.86	61.64	41.13	14.0
02/17/15	10.25	19.39	13.61	22.78	54.08	41.69	21.3
02/18/15	10.08	18.63	13.69	18.62	55.23	35.41	14.1
02/19/15	10.08	16.85	12.78	21.99	36.71	27.31	13.8
02/20/15	9.85	17.71	12.46	15.75	56.12	28.69	11.7
02/21/15	10.31	15.00	12.20	24.69	71.00	39.92	13.4
02/22/15	10.18	19.45	14.68	35.45	74.50	58.41	13.8
02/23/15	10.04	18.04	13.82	21.95	70.80	45.68	14.0
02/24/15	10.08	18.63	13.53	14.13	50.02	30.88	13.1
02/25/15	10.21	18.40	14.37	26.28	68.93	44.26	14.5
02/26/15	10.08	18.20	13.86	28.36	66.56	51.33	14.2
02/27/15	10.18	18.79	13.93	21.69	58.16	45.01	13.6
02/28/15	10.21	18.89	13.56	15.71	45.79	30.99	14.1
03/01/15	10.21	16.39	13.65	32.95	81.30	48.32	19.5
03/02/15	10.11	19.32	14.24	23.87	80.70	52.93	13.3
03/03/15	10.28	17.64	14.32	29.25	83.30	53.71	16.2
03/04/15	10.11	18.66	15.19	54.30	88.80	72.20	15.4
03/05/15	10.08	17.51	14.18	58.50	88.90	68.88	18.8
03/06/15	10.11	18.07	13.22	23.11	64.77	47.75	10.6

Appendix 2
(continued)
Environmental Conditions
Tansy Aster



Wildlife International Ltd. Project Number: 757P-102

Page 2 of 2
10-21-2015

Environmental Conditions Report - GEM Room/Location: 2

Date	Temperature °C Min	Temperature °C Max	Temperature °C Mean	% Relative Humidity Min	% Relative Humidity Max	% Relative Humidity Mean	moles Photosynthetically Active Radiation
03/07/15	11.10	19.62	14.86	22.98	66.66	38.48	13.8
03/08/15	10.94	20.25	15.69	24.66	70.30	44.41	13.5
03/09/15	10.74	21.83	16.07	24.13	80.40	48.02	13.8
03/10/15	10.64	19.26	15.90	40.80	85.10	63.48	15.7
03/11/15	12.32	19.85	16.46	55.10	89.80	69.97	14.5
03/12/15	10.21	21.73	15.58	18.65	77.50	45.56	13.5
03/13/15	11.14	20.48	15.77	19.74	66.69	38.30	14.1
~~03/14/15~~	~~11.30~~	~~34.40~~	~~16.41~~	~~60.81~~	~~90.90~~	~~70.60~~	~~604.7~~ Sensor malfunction. date excluded JMP 21Oct15
03/15/15	10.41	19.88	15.68	28.65	86.70	53.72	13.7
03/16/15	10.64	21.17	16.12	29.45	71.50	46.92	13.9
03/17/15	10.71	25.50	17.07	24.99	83.10	52.57	13.1
03/18/15	10.12	20.78	15.05	14.00	57.48	33.78	13.1
03/19/15	11.17	21.40	15.79	16.34	60.32	33.21	14.2
03/20/15	10.28	17.90	15.08	43.61	82.60	57.37	19.0
03/21/15	10.11	21.11	15.72	34.60	81.10	56.04	13.0
03/22/15	11.20	21.27	15.88	16.27	78.20	42.42	13.8
03/23/15	11.10	25.00	17.22	14.89	60.55	33.93	13.5
03/24/15	10.34	25.40	16.88	16.47	49.69	33.60	12.2

n= 54	Temperature °C		% Relative Humidity		moles Photosynthetically Active Radiation	
Min:	4.31		14.00		~~604.7~~	10.6
Max:	~~34.40~~	25.5	~~90.90~~	90.8	~~21.3~~	21.3
Mean:	~~13.79~~	13.74	~~47.07~~	46.6	~~3.1~~	14.6
s.d.:	~~2.41~~	2.41	~~11.58~~	11.22	~~84.3~~	1.95

Pots were top-watered using pH-adjusted water on the following days :

Field-Collected		Nursery-Provided	
30 Jan 15	01 Mar 15	29 Jan 15	01 Mar 15
02 Feb 15	03 Mar 15	02 Feb 15	03 Mar 15
05 Feb 15	09 Mar 15	05 Feb 15	09 Mar 15
07 Feb 15	12 Mar 15	07 Feb 15	12 Mar 15
09 Feb 15	16 Mar 15	09 Feb 15	16 Mar 15
13 Feb 15	20 Mar 15	13 Feb 15	20 Mar 15
16 Feb 15	23 Mar 15	16 Feb 15	
20 Feb 15		20 Feb 15	
25 Feb 15		25 Feb 15	

Appendix 3.1

Alfalfa Negative Control Emergence

Day	Rep A	Rep B	Rep C	Rep D	Rep E	Rep F	Rep G	Rep H	Rep I	Rep J	% Emergence
3	2	3	2	1	2	3	3	2	2	3	19
4	6	7	7	4	6	6	7	6	10	8	56

Appendix 3.2

Sideoats Grama (Nursery-Provided) Negative Control Emergence

Day	Rep A	Rep B	Rep C	Rep D	Rep E	Rep F	Rep G	Rep H	Rep I	Rep J	% Emergence
1	0	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0	0	0	0
5	2	2	2	0	0	0	1	0	2	1	8
6	2	4	2	6	3	1	1	2	2	1	20
7	5	9	7	8	6	2	4	5	2	2	42
8	5	10	7	8	7	2	4	5	2	2	43
10	6	11	7	8	8	3	5	7	4	5	53

Appendix 3.3

Sideoats Grama (Field-Collected) Negative Control Emergence

Day	Rep A	Rep B	Rep C	Rep D	Rep E	Rep F	Rep G	Rep H	Rep I	Rep J	% Emergence
1	0	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0	0	0	0
5	2	0	1	3	3	4	0	2	3	1	16
6	8	1	4	5	6	10	3	4	12	4	48
7	8	3	4	8	8	10	5	5	12	7	58

Appendix 3.4

Tansy Aster (Nursery-Provided) Negative Control Emergence

Day	Rep A	Rep B	Rep C	Rep D	Rep E	Rep F	Rep G	Rep H	Rep I	Rep J	% Emergence
1	0	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0	0	0	0	0
10	1	0	1	0	2	1	0	0	1	1	6
11	3	1	2	7	3	2	0	1	3	2	20
12	4	2	4	7	3	3	0	2	5	3	28
13	5	2	4	7	5	4	2	4	5	4	35
14	6	5	4	7	6	5	2	4	5	4	40
15	6	5	5	7	7	5	2	4	7	4	43

Appendix 3.4

(continued)

Tansy Aster (Nursery-Provided) Negative Control Emergence

Day	Rep A	Rep B	Rep C	Rep D	Rep E	Rep F	Rep G	Rep H	Rep I	Rep J	% Emergence
16	6	5	5	7	7	5	2	4	7	4	43
17	6	5	5	7	7	5	3	4	7	4	44
18	6	5	5	7	7	5	3	4	7	4	44
19	6	5	5	7	7	5	3	4	7	4	44
20	6	6	5	7	7	5	3	4	7	4	45
21	6	6	5	7	7	5	3	4	7	4	45
22	6	6	5	7	7	5	3	4	7	4	45
23	6	6	5	7	7	5	3	4	7	4	45
24	6	6	5	7	7	5	3	4	7	4	45
25	6	6	5	7	7	5	3	4	7	4	45
26	6	6	5	7	7	5	3	4	7	4	45
27	6	6	5	7	7	5	3	4	7	4	45
28	6	6	5	7	7	5	3	4	7	4	45
29	6	6	5	7	7	5	3	4	7	4	45
30	6	6	5	7	7	5	3	4	7	4	45

Appendix 3.4

(continued)

Tansy Aster (Nursery-Provided) Negative Control Emergence

Day	Rep A	Rep B	Rep C	Rep D	Rep E	Rep F	Rep G	Rep H	Rep I	Rep J	% Emergence
31	6	6	5	7	7	5	3	4	7	4	45
32	6	6	5	7	7	5	3	4	7	4	45
33	6	6	5	7	7	5	3	4	7	4	45
34	6	6	5	7	7	5	3	4	7	4	45
35	6	6	5	7	7	5	3	4	7	4	45
36	6	6	5	7	7	5	3	4	7	4	45
37	6	6	5	7	7	5	3	4	7	4	45
38	6	6	5	7	7	5	3	4	7	4	45[1]
39	6	6	5	7	7	5	3	4	7	4	45
40	6	6	5	7	7	5	3	4	7	4	45
41	6	6	5	7	7	5	3	4	7	4	45
42	6	6	5	7	7	5	3	4	7	4	45
43	6	6	5	7	7	5	3	4	7	4	45
44	6	6	5	7	7	5	3	4	7	4	45

[1] Day 38 (March 9, 2015) was designated to be Day 0 after determining that additional emergence was not likely. Collection of the plants was made 14 days later, on March 23, 2015.

Appendix 3.5

Tansy Aster (Field-Collected) Negative Control Emergence

Day	Rep A	Rep B	Rep C	Rep D	Rep E	Rep F	Rep G	Rep H	Rep I	Rep J	% Emergence
1	0	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0	0	0	0	0
9	0	0	0	0	0	1	1	0	1	1	3
10	2	1	1	2	2	2	3	2	2	2	16
11	2	2	1	2	3	2	3	2	2	2	18
12	3	4	1	3	3	2	3	2	2	2	21
13	3	4	3	3	3	3	3	2	2	2	23
14	3	4	4	3	3	3	4	2	4	2	27
15	3	4	4	3	3	3	4	2	4	2	27

Appendix 3.5

(continued)

Tansy Aster (Field-Collected) Negative Control Emergence

Day	Rep A	Rep B	Rep C	Rep D	Rep E	Rep F	Rep G	Rep H	Rep I	Rep J	% Emergence
16	3	4	4	3	3	3	4	2	4	2	27
17	3	4	4	3	3	3	4	2	4	2	27
18	3	4	4	3	3	3	4	2	4	2	27
19	4	4	4	3	3	3	4	2	4	2	28
20	4	4	4	3	3	3	4	2	4	2	28
21	4	4	4	3	3	3	4	2	4	2	28
22	4	4	4	3	3	3	4	2	4	2	28
23	4	4	4	3	3	3	4	2	4	2	28
24	4	4	4	3	3	3	4	2	4	2	28
25	4	4	4	3	3	3	4	2	4	2	28
26	4	4	4	3	3	3	4	2	4	2	28
27	4	4	4	3	3	3	4	2	4	2	28
28	4	4	4	3	3	3	4	2	4	2	28
29	4	4	4	3	3	3	4	2	4	2	28
30	4	4	4	3	3	3	4	2	4	2	28

Appendix 3.5
(continued)
Tansy Aster (Field-Collected) Negative Control Emergence

Day	Rep A	Rep B	Rep C	Rep D	Rep E	Rep F	Rep G	Rep H	Rep I	Rep J	% Emergence
31	4	4	4	3	3	3	4	2	4	2	28
32	4	4	4	3	3	3	4	2	4	2	28
33	4	4	4	3	3	3	4	2	4	2	28
34	4	4	4	3	3	3	4	2	4	2	28
35	4	4	4	3	3	3	4	2	4	2	28
36	4	4	4	3	3	3	4	2	4	2	28
37	4	4	4	3	3	3	4	2	4	2	28
38	4	4	4	3	3	3	4	2	4	2	28[1]
39	4	4	4	3	3	3	4	2	4	2	28
40	4	4	4	3	3	3	4	2	4	2	28
41	4	4	4	3	3	3	4	2	4	2	28
42	4	4	4	3	3	3	4	2	4	2	28
43	4	4	4	3	3	3	4	2	4	2	28

[1] Day 38 (March 10, 2015) was designated to be Day 0 after determining that additional emergence was not likely. Collection of the plants was made 14 days later, on March 24, 2015.

Appendix 3.6

Scarlet Globemallow (Nursery-Provided) Negative Control Emergence

Day	Rep A	Rep B	Rep C	Rep D	Rep E	Rep F	Rep G	Rep H	Rep I	Rep J	% Emergence
1	0	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0	0	0	0	0
11	0	0	0	0	0	0	0	0	0	0	0

Appendix 3.6
(continued)
Scarlet Globemallow (Nursery-Provided) Negative Control Emergence

Day	Rep A	Rep B	Rep C	Rep D	Rep E	Rep F	Rep G	Rep H	Rep I	Rep J	% Emergence
12	0	0	0	0	0	0	0	0	0	0	0
13	0	0	0	0	0	0	0	0	0	0	0
14	0	0	0	0	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0	0	0	0
21	0	0	0	0	0	0	0	0	0	0	0

Appendix 3.7

Scarlet Globemallow (Field-Collected) Negative Control Emergence

Day	Rep A	Rep B	Rep C	Rep D	Rep E	Rep F	Rep G	Rep H	Rep I	Rep J	% Emergence
1	0	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	1	1	0	0	0
4	0	0	0	0	0	0	1	1	0	0	0
5	0	0	0	0	0	0	1	1	0	0	0
6	0	0	0	0	0	0	1	1	0	0	0
7	0	0	0	0	0	0	1	1	0	0	0
8	0	0	0	0	0	0	1	1	0	0	0
9	0	0	0	0	0	0	1	1	0	0	0
10	0	0	0	0	0	0	1	1	0	0	0
11	0	0	0	0	0	0	1	1	0	0	0

Appendix 3.7
(continued)
Scarlet Globemallow (Field-Collected) Negative Control Emergence

Day	Rep A	Rep B	Rep C	Rep D	Rep E	Rep F	Rep G	Rep H	Rep I	Rep J	% Emergence
12	0	0	0	0	0	0	1	1	0	0	0
13	0	0	0	0	0	0	1	1	0	0	0
14	0	0	0	0	0	0	1	1	0	0	0
15	0	0	0	0	0	0	1	1	0	0	0
16	0	0	0	0	0	0	1	1	0	0	0
17	0	0	0	0	0	0	1	1	0	0	0
18	0	0	0	0	0	0	1	1	0	0	0
19	0	0	0	0	0	0	1	1	0	0	0
20	0	0	0	0	0	0	1	1	0	0	0
21	0	0	0	0	0	0	1	1	0	0	0

Appendix 4.1

Alfalfa Test Results: pH, Emergence, Survival, Root Length and Dry Weight

SOIL	REP	INIT PH	FIN PH	EM 0	EM 21	SURV	RT LGTH	TOT DWT	MN DWT
		pH	pH	per 12	per 12	per 12	cm	g	g
NC	A	5.9	5.6	6	10	10	18	0.335	0.0335
NC	B	5.9	5.4	7	11	11	28	0.766	0.0696
NC	C	5.9	5.4	7	12	12	28	0.809	0.0674
NC	D	5.9	5.4	4	11	11	22	0.457	0.0415
NC	E	5.9	5.4	6	9	8	22	0.358	0.0448
NC	F	5.9	5.5	6	9	9	22	0.496	0.0551
NC	G	5.9	5.2	7	7	6	22	0.347	0.0578
NC	H	5.9	5.3	6	6	6	18	0.226	0.0377
NC	I	5.9	5.3	10	10	9	26	0.372	0.0413
NC	J	5.9	5.5	8	11	11	25	0.667	0.0606
					9.60	9.30	23.1		0.0509
					1.90	2.11	3.60		0.0128
SOIL 1	A	4.5	5.2	6	8	8	1	0.034	0.0043
SOIL 1	B	4.5	4.8	2	7	6	1	0.023	0.0038
SOIL 1	C	4.5	4.5	4	7	6	1	0.011	0.0018
SOIL 1	D	4.5	4.6	1	5	5	2	0.011	0.0022
SOIL 1	E	4.5	4.6	1	1	1	1	0.003	0.0030
SOIL 1	F	4.5	4.6	1	8	7	2	0.017	0.0024
SOIL 1	G	4.5	5.2	6	9	7	2	0.026	0.0037
SOIL 1	H	4.5	5.1	3	6	5	1	0.016	0.0032
SOIL 1	I	4.5	5.6	2	7	5	1	0.017	0.0034
SOIL 1	J	4.5	5.8	3	5	4	1	0.020	0.0050
					6.30	5.40	1.3		0.0033
					2.26	1.96	0.48		0.0010

Appendix 4.1
(continued)
Alfalfa Test Results: pH, Emergence, Survival, Root Length and Dry Weight

SOIL	REP	INIT PH	FIN PH	EM 0	EM 21	SURV	RT LGTH	TOT DWT	MN DWT
		pH	pH	per 12	per 12	per 12	cm	g	g
SOIL 2	A	5.8	5.4	9	9	9	6	0.153	0.0170
SOIL 2	B	5.8	5.4	10	10	10	7	0.168	0.0168
SOIL 2	C	5.8	5.2	10	10	10	10	0.168	0.0168
SOIL 2	D	5.8	5.4	7	9	9	5	0.122	0.0136
SOIL 2	E	5.8	4.6	5	9	9	7	0.165	0.0183
SOIL 2	F	5.8	6.1	8	8	8	6	0.103	0.0129
SOIL 2	G	5.8	5.4	7	7	7	5	0.094	0.0134
SOIL 2	H	5.8	5.2	2	5	5	9	0.052	0.0104
SOIL 2	I	5.8	5.4	2	8	8	4	0.035	0.0044
SOIL 2	J	5.8	5.6	5	7	7	6	0.082	0.0117
					8.20	8.20	6.5		0.0135
					1.55	1.55	1.84		0.0041
SOIL 3	A	5.2	5.2	3	5	5	5	0.048	0.0096
SOIL 3	B	5.2	5.2	8	8	7	3	0.077	0.0110
SOIL 3	C	5.2	5.2	0	1	0	.	.	.
SOIL 3	D	5.2	4.9	0	3	3	3	0.024	0.0080
SOIL 3	E	5.2	4	1	2	2	1	0.020	0.0100
SOIL 3	F	5.2	3.8	2	3	3	1	0.015	0.0050
SOIL 3	G	5.2	3.7	0	2	2	3	0.017	0.0085
SOIL 3	H	5.2	3.6	0	2	2	1	0.009	0.0045
SOIL 3	I	5.2	3.7	0	1	1	0.25	0.002	0.0020
SOIL 3	J	5.2	3.6	0	3	3	1	0.015	0.0050
					3.00	2.80	2.0		0.0071
					2.11	1.99	1.54		0.0030

Appendix 4.1
(continued)
Alfalfa Test Results: pH, Emergence, Survival, Root Length and Dry Weight

SOIL	REP	INIT PH	FIN PH	EM 0	EM 21	SURV	RT LGTH	TOT DWT	MN DWT
		pH	pH	per 12	per 12	per 12	cm	g	g
SOIL 4	A	4.5	3	0	2	2	3	0.008	0.0040
SOIL 4	B	4.5	3.9	2	8	7	4	0.090	0.0129
SOIL 4	C	4.5	3.6	1	2	2	4	0.029	0.0145
SOIL 4	D	4.5	3.8	1	4	4	5	0.041	0.0103
SOIL 4	E	4.5	3.8	2	7	7	5	0.085	0.0121
SOIL 4	F	4.5	3.8	1	5	5	4	0.047	0.0094
SOIL 4	G	4.5	3.8	2	5	5	4	0.052	0.0104
SOIL 4	H	4.5	3.9	3	6	5	7	0.098	0.0196
SOIL 4	I	4.5	3.8	0	2	2	2	0.011	0.0055
SOIL 4	J	4.5	3.8	2	7	6	19	0.075	0.0125
					4.80	4.50	5.7		0.0111
					2.25	1.96	4.85		0.0044
SOIL 5	A	5.4	5.4	10	10	10	14	0.136	0.0136
SOIL 5	B	5.4	5	10	11	11	18	0.147	0.0134
SOIL 5	C	5.4	4.6	10	11	11	14	0.228	0.0207
SOIL 5	D	5.4	5.8	8	8	8	5	0.057	0.0071
SOIL 5	E	5.4	5.2	9	9	9	10	0.094	0.0104
SOIL 5	F	5.4	5.2	10	10	8	16	0.110	0.0138
SOIL 5	G	5.4	5	9	10	10	9	0.162	0.0162
SOIL 5	H	5.4	4.8	9	10	9	7	0.121	0.0134
SOIL 5	I	5.4	4.8	3	4	4	6	0.057	0.0143
SOIL 5	J	5.4	5.2	9	9	9	8	0.118	0.0131
					9.20	8.90	10.7		0.0136
					2.04	2.02	4.50		0.0035

Appendix 4.1

(continued)

Alfalfa Test Results: pH, Emergence, Survival, Root Length and Dry Weight

SOIL	REP	INIT PH	FIN PH	EM 0	EM 21	SURV	RT LGTH	TOT DWT	MN DWT
		pH	pH	per 12	per 12	per 12	cm	g	g
SOIL 6	A	4.8	4.6	10	10	10	7	0.050	0.0050
SOIL 6	B	4.8	4.2	6	8	6	2	0.031	0.0052
SOIL 6	C	4.8	4.4	6	10	10	7	0.056	0.0056
SOIL 6	D	4.8	4.4	6	10	10	3	0.078	0.0078
SOIL 6	E	4.8	4.5	5	10	10	3	0.064	0.0064
SOIL 6	F	4.8	4	10	11	10	3	0.060	0.0060
SOIL 6	G	4.8	4	7	10	9	3	0.050	0.0056
SOIL 6	H	4.8	4	5	8	7	2	0.035	0.0050
SOIL 6	I	4.8	4.2	2	9	9	2	0.047	0.0052
SOIL 6	J	4.8	4.3	6	8	8	2	0.052	0.0065
					9.40	8.90	3.4		0.0058
					1.07	1.45	1.96		0.0009
SOIL 7	A	5.0	4.3	3	3	3	2	0.011	0.0037
SOIL 7	B	5.0	3.7	6	10	6	1	0.012	0.0020
SOIL 7	C	5.0	3.7	2	7	6	1	0.016	0.0027
SOIL 7	D	5.0	3.8	3	7	4	2	0.015	0.0038
SOIL 7	E	5.0	3.5	4	8	6	1	0.004	0.0007
SOIL 7	F	5.0	3	0	1	1	1	0.003	0.0030
SOIL 7	G	5.0	3.5	0	5	3	1	0.009	0.0030
SOIL 7	H	5.0	3.5	2	6	4	1	0.010	0.0025
SOIL 7	I	5.0	3	1	3	2	1	0.004	0.0020
SOIL 7	J	5.0	3.7	0	4	2	0.25	0.002	0.0010
					5.40	3.70	1.1		0.0024
					2.72	1.83	0.52		0.0010

Appendix 4.1

(continued)

Alfalfa Test Results: pH, Emergence, Survival, Root Length and Dry Weight

SOIL	REP	INIT PH	FIN PH	EM 0	EM 21	SURV	RT LGTH	TOT DWT	MN DWT
		pH	pH	per 12	per 12	per 12	cm	g	g
SOIL 8	A	4.6	3.7	6	9	9	2	0.055	0.0061
SOIL 8	B	4.6	4	12	12	12	2	0.086	0.0072
SOIL 8	C	4.6	3.7	10	10	10	3	0.082	0.0082
SOIL 8	D	4.6	4.1	11	11	11	3	0.090	0.0082
SOIL 8	E	4.6	3.6	9	10	10	2	0.085	0.0085
SOIL 8	F	4.6	3.6	6	8	8	2	0.046	0.0058
SOIL 8	G	4.6	3.5	7	9	9	2	0.075	0.0083
SOIL 8	H	4.6	3.8	5	9	9	3	0.150	0.0167
SOIL 8	I	4.6	3.7	8	9	9	3	0.065	0.0072
SOIL 8	J	4.6	3.8	11	11	11	2	0.067	0.0061
					9.80	9.80	2.4		0.0082
					1.23	1.23	0.52		0.0031
SOIL 9	A	5.7	5.8	1	1	0	.	.	.
SOIL 9	B	5.7	5.6	0	0	.	.	.	.
SOIL 9	C	5.7	5.2	0	1	0	.	.	.
SOIL 9	D	5.7	5.2	0	1	0	.	.	.
SOIL 9	E	5.7	5.4	0	1	0	.	.	.
SOIL 9	F	5.7	5.4	1	1	0	.	.	.
SOIL 9	G	5.7	5.6	1	1	0	.	.	.
SOIL 9	H	5.7	5.3	0	0	.	.	.	.
SOIL 9	I	5.7	5.2	0	0	.	.	.	.
SOIL 9	J	5.7	5	0	1	0	.	.	.
					0.70	0.00	.		.
					0.48	0.00	.		.

Appendix 4.1

(continued)

Alfalfa Test Results: pH, Emergence, Survival, Root Length and Dry Weight

SOIL	REP	INIT PH	FIN PH	EM 0	EM 21	SURV	RT LGTH	TOT DWT	MN DWT
		pH	pH	per 12	per 12	per 12	cm	g	g
SOIL 10	A	5.2	4.5	5	7	7	1	0.012	0.0017
SOIL 10	B	5.2	4.5	4	8	8	1	0.016	0.0020
SOIL 10	C	5.2	5.4	5	9	8	1	0.028	0.0035
SOIL 10	D	5.2	5.2	3	9	8	2	0.029	0.0036
SOIL 10	E	5.2	5.6	3	7	7	1	0.019	0.0027
SOIL 10	F	5.2	5.5	1	8	8	2	0.036	0.0045
SOIL 10	G	5.2	5	3	6	5	2	0.018	0.0036
SOIL 10	H	5.2	5.7	0	7	7	2	0.024	0.0034
SOIL 10	I	5.2	5.8	0	7	7	2	0.028	0.0040
SOIL 10	J	5.2	6.3	0	1	1	1	0.002	0.0020
					6.90	6.60	1.5		0.0031
					2.28	2.17	0.53		0.0009
SOIL 11	A	5.6	6.2	3	4	3	2	0.025	0.0083
SOIL 11	B	5.6	6.2	4	4	3	2	0.011	0.0037
SOIL 11	C	5.6	5.8	3	9	9	1	0.036	0.0040
SOIL 11	D	5.6	5.4	3	7	4	2	0.021	0.0053
SOIL 11	E	5.6	5.5	0	6	1	1	0.017	0.0170
SOIL 11	F	5.6	5.7	1	4	4	2	0.018	0.0045
SOIL 11	G	5.6	6	2	4	3	3	0.014	0.0047
SOIL 11	H	5.6	5.4	0	4	4	2	0.012	0.0030
SOIL 11	I	5.6	5.9	0	4	4	1	0.024	0.0060
SOIL 11	J	5.6	5.6	1	6	5	1	0.028	0.0056
					5.20	4.00	1.7		0.0062
					1.75	2.05	0.67		0.0041

Appendix 4.1

(continued)

Alfalfa Test Results: pH, Emergence, Survival, Root Length and Dry Weight

SOIL	REP	INIT PH	FIN PH	EM 0	EM 21	SURV	RT LGTH	TOT DWT	MN DWT
		pH	pH	per 12	per 12	per 12	cm	g	g
SOIL 12	A	6.2	3.8	8	9	9	14	0.120	0.0133
SOIL 12	B	6.2	3.6	8	8	8	20	0.080	0.0100
SOIL 12	C	6.2	4.8	7	8	8	15	0.121	0.0151
SOIL 12	D	6.2	4.4	2	5	5	5	0.054	0.0108
SOIL 12	E	6.2	4.6	3	6	6	18	0.065	0.0108
SOIL 12	F	6.2	5	6	8	7	18	0.094	0.0134
SOIL 12	G	6.2	5.2	6	7	7	19	0.057	0.0081
SOIL 12	H	6.2	4.8	4	7	7	18	0.060	0.0086
SOIL 12	I	6.2	5.9	7	8	8	21	0.096	0.0120
SOIL 12	J	6.2	5.2	8	9	9	20	0.119	0.0132
					7.50	7.40	16.8		0.0115
					1.27	1.26	4.69		0.0023
SOIL 13	A	5.8	5	6	10	10	4	0.098	0.0098
SOIL 13	B	5.8	4.6	6	6	6	5	0.062	0.0103
SOIL 13	C	5.8	5	8	10	9	3	0.081	0.0090
SOIL 13	D	5.8	4.6	9	10	8	3	0.079	0.0099
SOIL 13	E	5.8	5.6	9	10	9	3	0.108	0.0120
SOIL 13	F	5.8	5.1	7	8	8	4	0.087	0.0109
SOIL 13	G	5.8	5	6	11	9	3	0.100	0.0111
SOIL 13	H	5.8	5.2	5	7	6	4	0.075	0.0125
SOIL 13	I	5.8	5.4	7	8	7	4	0.099	0.0141
SOIL 13	J	5.8	4.5	7	8	8	3	0.077	0.0096
					8.80	8.00	3.6		0.0109
					1.62	1.33	0.70		0.0016

Appendix 4.1

(continued)

Alfalfa Test Results: pH, Emergence, Survival, Root Length and Dry Weight

SOIL	REP	INIT PH	FIN PH	EM 0	EM 21	SURV	RT LGTH	TOT DWT	MN DWT
		pH	pH	per 12	per 12	per 12	cm	g	g
SOIL 14	A	5.0	3.5	3	4	4	1	0.020	0.0050
SOIL 14	B	5.0	3.6	1	2	1	1	0.007	0.0070
SOIL 14	C	5.0	3.5	0	5	3	1	0.010	0.0033
SOIL 14	D	5.0	3	1	1	1	1	0.004	0.0040
SOIL 14	E	5.0	3.8	1	2	2	1	0.008	0.0040
SOIL 14	F	5.0	3.4	2	4	2	1	0.002	0.0010
SOIL 14	G	5.0	3.8	0	4	2	1	0.007	0.0035
SOIL 14	H	5.0	3.2	1	5	3	2	0.009	0.0030
SOIL 14	I	5.0	3.6	0	5	2	1	0.020	0.0100
SOIL 14	J	5.0	3.7	3	4	3	1	0.006	0.0020
					3.60	2.30	1.1		0.0043
					1.43	0.95	0.32		0.0026
SOIL 15	A	5.3	4.2	3	4	1	1	0.006	0.0060
SOIL 15	B	5.3	3.9	7	7	5	2	0.023	0.0046
SOIL 15	C	5.3	3.8	6	6	3	2	0.014	0.0047
SOIL 15	D	5.3	4.2	2	2	1	1	0.018	0.0180
SOIL 15	E	5.3	5.2	7	7	3	2	0.029	0.0097
SOIL 15	F	5.3	4	9	9	8	2	0.045	0.0056
SOIL 15	G	5.3	3.8	10	12	11	2	0.085	0.0077
SOIL 15	H	5.3	3.9	5	9	8	2	0.042	0.0053
SOIL 15	I	5.3	3.7	0	2	2	1	0.011	0.0055
SOIL 15	J	5.3	3.8	3	3	3	2	0.028	0.0093
					6.10	4.50	1.7		0.0076
					3.35	3.41	0.48		0.0041

Appendix 4.1
(continued)
Alfalfa Test Results: pH, Emergence, Survival, Root Length and Dry Weight

SOIL	REP	INIT PH	FIN PH	EM 0	EM 21	SURV	RT LGTH	TOT DWT	MN DWT
		pH	pH	per 12	per 12	per 12	cm	g	g
SOIL 16	A	6.2	3.6	8	9	9	2	0.053	0.0059
SOIL 16	B	6.2	3.4	7	10	9	3	0.053	0.0059
SOIL 16	C	6.2	4	3	8	6	2	0.029	0.0048
SOIL 16	D	6.2	3.5	8	9	9	2	0.054	0.0060
SOIL 16	E	6.2	3.8	6	8	8	2	0.043	0.0054
SOIL 16	F	6.2	3.4	9	9	9	2	0.052	0.0058
SOIL 16	G	6.2	3.6	5	7	7	2	0.048	0.0069
SOIL 16	H	6.2	3	9	11	9	3	0.054	0.0060
SOIL 16	I	6.2	3.5	9	10	10	2	0.048	0.0048
SOIL 16	J	6.2	3.6	3	8	8	3	0.047	0.0059
					8.90	8.40	2.3		0.0057
					1.20	1.17	0.48		0.0006
SOIL 17	A	5.8	5.9	5	10	9	3	0.125	0.0139
SOIL 17	B	5.8	6	1	7	7	6	0.075	0.0107
SOIL 17	C	5.8	5.8	8	11	11	12	0.152	0.0138
SOIL 17	D	5.8	5.8	7	8	8	8	0.119	0.0149
SOIL 17	E	5.8	5.8	7	8	8	8	0.116	0.0145
SOIL 17	F	5.8	5.8	6	12	11	17	0.123	0.0112
SOIL 17	G	5.8	5.8	6	11	10	18	0.105	0.0105
SOIL 17	H	5.8	6.4	11	12	11	9	0.161	0.0146
SOIL 17	I	5.8	5.5	8	9	9	10	0.136	0.0151
SOIL 17	J	5.8	6	11	11	11	9	0.201	0.0183
					9.90	9.50	10.0		0.0137
					1.79	1.51	4.62		0.0024

Appendix 4.1
(continued)
Alfalfa Test Results: pH, Emergence, Survival, Root Length and Dry Weight

SOIL	REP	INIT PH	FIN PH	EM 0	EM 21	SURV	RT LGTH	TOT DWT	MN DWT
		pH	pH	per 12	per 12	per 12	cm	g	g
SOIL 19	A	4.1	5.6	2	2	0	.	.	.
SOIL 19	B	4.1	6.2	0	3	0	.	.	.
SOIL 19	C	4.1	6.6	0	0	0	.	.	.
SOIL 19	D	4.1	6.2	0	2	1	0.25	0.003	0.0030
SOIL 19	E	4.1	6.4	1	1	0	.	.	.
SOIL 19	F	4.1	6	1	5	3	0.25	0.007	0.0023
SOIL 19	G	4.1	6.3	1	3	2	0.25	0.012	0.0060
SOIL 19	H	4.1	6.4	1	2	1	0.25	0.004	0.0040
SOIL 19	I	4.1	6	1	3	3	1	0.015	0.0050
SOIL 19	J	4.1	6.4	0	1	1	0.25	0.004	0.0040
					2.20	1.10	0.4		0.0041
					1.40	1.20	0.31		0.0013
SOIL 20	A	6.5	5.8	6	8	8	18	0.070	0.0088
SOIL 20	B	6.5	5.4	8	9	9	8	0.107	0.0119
SOIL 20	C	6.5	6.4	7	9	9	10	0.108	0.0120
SOIL 20	D	6.5	5.8	1	8	8	4	0.040	0.0050
SOIL 20	E	6.5	5.7	0	4	4	2	0.016	0.0040
SOIL 20	F	6.5	5.6	4	8	7	7	0.079	0.0113
SOIL 20	G	6.5	6.4	11	11	11	9	0.145	0.0132
SOIL 20	H	6.5	5.8	6	8	8	8	0.084	0.0105
SOIL 20	I	6.5	6.5	9	9	9	8	0.121	0.0134
SOIL 20	J	6.5	5.8	2	7	7	3	0.071	0.0101
					8.10	8.00	7.7		0.0100
					1.79	1.83	4.50		0.0032

Appendix 4.1
(continued)
Alfalfa Test Results: pH, Emergence, Survival, Root Length and Dry Weight

SOIL	REP	INIT PH	FIN PH	EM 0	EM 21	SURV	RT LGTH	TOT DWT	MN DWT
		pH	pH	per 12	per 12	per 12	cm	g	g
SOIL 21	A	5.5	5.5	4	4	1	0.25	0.002	0.0020
SOIL 21	B	5.5	5.7	5	5	0	.	.	.
SOIL 21	C	5.5	5.4	2	4	4	1	0.016	0.0040
SOIL 21	D	5.5	5.4	4	4	4	1	0.018	0.0045
SOIL 21	E	5.5	5.4	0	1	1	2	0.007	0.0070
SOIL 21	F	5.5	5	3	8	6	1	0.031	0.0052
SOIL 21	G	5.5	5.2	5	5	4	1	0.025	0.0063
SOIL 21	H	5.5	5.2	2	4	3	0.25	0.014	0.0047
SOIL 21	I	5.5	4.9	1	3	3	0.25	0.015	0.0050
SOIL 21	J	5.5	5.4	2	7	7	1	0.063	0.0090
					4.50	3.30	0.9		0.0053
					1.96	2.21	0.56		0.0020
SOIL 22	A	6.3	4.2	8	9	7	1	0.014	0.0020
SOIL 22	B	6.3	4.6	8	8	7	1	0.059	0.0084
SOIL 22	C	6.3	4.6	7	7	5	0.25	0.002	0.0004
SOIL 22	D	6.3	4.8	7	10	10	1	0.055	0.0055
SOIL 22	E	6.3	5.7	3	5	5	1	0.028	0.0056
SOIL 22	F	6.3	6.1	6	11	11	1	0.068	0.0062
SOIL 22	G	6.3	5.4	4	8	8	1	0.043	0.0054
SOIL 22	H	6.3	5	3	4	4	1	0.027	0.0068
SOIL 22	I	6.3	5.7	3	7	7	1	0.045	0.0064
SOIL 22	J	6.3	5.6	5	8	8	1	0.050	0.0063
					7.70	7.20	0.9		0.0053
					2.11	2.20	0.24		0.0024

Appendix 4.1

(continued)

Alfalfa Test Results: pH, Emergence, Survival, Root Length and Dry Weight

SOIL	REP	INIT PH	FIN PH	EM 0	EM 21	SURV	RT LGTH	TOT DWT	MN DWT
		pH	pH	per 12	per 12	per 12	cm	g	g
SOIL 23	A	6.2	6.8	3	5	3	0.25	0.008	0.0027
SOIL 23	B	6.2	6.2	5	8	2	1	0.012	0.0060
SOIL 23	C	6.2	6.7	3	6	6	1	0.024	0.0040
SOIL 23	D	6.2	6.7	5	7	7	3	0.030	0.0043
SOIL 23	E	6.2	6.8	1	7	6	3	0.028	0.0047
SOIL 23	F	6.2	6.3	6	9	8	2	0.033	0.0041
SOIL 23	G	6.2	6.7	6	7	7	2	0.029	0.0041
SOIL 23	H	6.2	6	5	9	8	2	0.037	0.0046
SOIL 23	I	6.2	6.2	4	6	5	1	0.027	0.0054
SOIL 23	J	6.2	5.9	8	10	10	1	0.044	0.0044
					7.40	6.20	1.6		0.0044
					1.58	2.39	0.92		0.0009
SOIL 24	A	4.8	3.5	6	10	10	10	0.223	0.0223
SOIL 24	B	4.8	3.4	4	8	8	16	0.189	0.0236
SOIL 24	C	4.8	3.8	4	8	8	21	0.155	0.0194
SOIL 24	D	4.8	3.6	6	7	7	23	0.171	0.0244
SOIL 24	E	4.8	4.1	6	10	10	24	0.233	0.0233
SOIL 24	F	4.8	3.8	8	8	8	23	0.224	0.0280
SOIL 24	G	4.8	4.1	5	8	8	13	0.214	0.0268
SOIL 24	H	4.8	4.2	0	0	.	.	.	.
SOIL 24	I	4.8	4.4	1	7	7	18	0.129	0.0184
SOIL 24	J	4.8	4.2	8	8	8	20	0.258	0.0323
					7.40	8.22	18.7		0.0243
					2.80	1.09	4.85		0.0043

Appendix 4.1
(continued)
Alfalfa Test Results: pH, Emergence, Survival, Root Length and Dry Weight

SOIL	REP	INIT PH	FIN PH	EM 0	EM 21	SURV	RT LGTH	TOT DWT	MN DWT
		pH	pH	per 12	per 12	per 12	cm	g	g
SOIL 25	A	6.0	4.8	8	9	9	18	0.145	0.0161
SOIL 25	B	6.0	5.1	7	10	10	13	0.146	0.0146
SOIL 25	C	6.0	6	10	12	12	16	0.173	0.0144
SOIL 25	D	6.0	6.2	3	9	9	15	0.101	0.0112
SOIL 25	E	6.0	5.9	7	11	11	11	0.222	0.0202
SOIL 25	F	6.0	6.4	9	9	9	16	0.131	0.0146
SOIL 25	G	6.0	6	9	11	11	18	0.186	0.0169
SOIL 25	H	6.0	6.7	4	9	9	21	0.122	0.0136
SOIL 25	I	6.0	6.3	7	9	9	19	0.141	0.0157
SOIL 25	J	6.0	6.7	6	11	11	7	0.179	0.0163
					10.00	10.00	15.4		0.0153
					1.15	1.15	4.14		0.0023
SOIL 26	A	6.3	5.4	10	11	11	20	0.156	0.0142
SOIL 26	B	6.3	4.9	9	12	12	17	0.137	0.0114
SOIL 26	C	6.3	5.5	7	9	9	20	0.122	0.0136
SOIL 26	D	6.3	5.4	8	9	9	15	0.142	0.0158
SOIL 26	E	6.3	6	8	11	11	19	0.116	0.0105
SOIL 26	F	6.3	5.4	8	11	11	18	0.146	0.0133
SOIL 26	G	6.3	5.9	6	8	8	21	0.114	0.0143
SOIL 26	H	6.3	5.8	7	10	10	21	0.150	0.0150
SOIL 26	I	6.3	6.2	8	9	9	12	0.135	0.0150
SOIL 26	J	6.3	6.1	10	10	10	23	0.166	0.0166
					10.00	10.00	18.6		0.0140
					1.25	1.25	3.24		0.0019

Appendix 4.1

(continued)

Alfalfa Test Results: pH, Emergence, Survival, Root Length and Dry Weight

SOIL	REP	INIT PH	FIN PH	EM 0	EM 21	SURV	RT LGTH	TOT DWT	MN DWT
		pH	pH	per 12	per 12	per 12	cm	g	g
SOIL 27	A	6.0	4.9	7	10	10	3	0.070	0.0070
SOIL 27	B	6.0	5.5	5	10	10	2	0.083	0.0083
SOIL 27	C	6.0	4.9	6	9	9	2	0.070	0.0078
SOIL 27	D	6.0	5.8	1	5	4	2	0.023	0.0058
SOIL 27	E	6.0	4.2	4	11	11	3	0.073	0.0066
SOIL 27	F	6.0	5.4	9	11	11	2	0.083	0.0075
SOIL 27	G	6.0	4.6	8	9	9	1	0.060	0.0067
SOIL 27	H	6.0	4.7	3	12	12	2	0.072	0.0060
SOIL 27	I	6.0	4.1	6	9	9	2	0.058	0.0064
SOIL 27	J	6.0	5	5	10	7	2	0.029	0.0041
					9.60	9.20	2.1		0.0066
					1.90	2.30	0.57		0.0012
SOIL 28	A	7.0	5.8	7	7	6	6	0.096	0.0160
SOIL 28	B	7.0	5.4	8	8	8	9	0.156	0.0195
SOIL 28	C	7.0	6	10	10	10	26	0.104	0.0104
SOIL 28	D	7.0	5.8	9	9	9	35	0.137	0.0152
SOIL 28	E	7.0	6	3	4	4	25	0.073	0.0183
SOIL 28	F	7.0	6	10	11	10	26	0.171	0.0171
SOIL 28	G	7.0	6.1	2	3	3	15	0.051	0.0170
SOIL 28	H	7.0	6.4	5	7	7	30	0.098	0.0140
SOIL 28	I	7.0	6.4	4	4	4	19	0.066	0.0165
SOIL 28	J	7.0	6.4	7	7	7	28	0.111	0.0159
					7.00	6.80	21.9		0.0160
					2.67	2.53	9.39		0.0025

Appendix 4.1
(continued)
Alfalfa Test Results: pH, Emergence, Survival, Root Length and Dry Weight

SOIL	REP	INIT PH	FIN PH	EM 0	EM 21	SURV	RT LGTH	TOT DWT	MN DWT
		pH	pH	per 12	per 12	per 12	cm	g	g
SOIL 29	A	5.0	6.2	8	9	8	2	0.042	0.0053
SOIL 29	B	5.0	6.4	7	7	5	2	0.020	0.0040
SOIL 29	C	5.0	5.9	8	9	9	2	0.052	0.0058
SOIL 29	D	5.0	6	5	9	8	2	0.031	0.0039
SOIL 29	E	5.0	5.8	8	8	7	1	0.038	0.0054
SOIL 29	F	5.0	5.5	4	7	7	3	0.029	0.0041
SOIL 29	G	5.0	5.6	2	5	5	3	0.034	0.0068
SOIL 29	H	5.0	5.4	5	7	7	2	0.040	0.0057
SOIL 29	I	5.0	5.2	3	6	6	2	0.032	0.0053
SOIL 29	J	5.0	5.2	1	2	2	2	0.014	0.0070
					6.90	6.40	2.1		0.0053
					2.18	2.01	0.57		0.0011
SOIL 30	A	4.6	4.8	1	3	3	1	0.024	0.0080
SOIL 30	B	4.6	4.8	2	3	3	2	0.022	0.0073
SOIL 30	C	4.6	4.4	3	5	4	2	0.017	0.0043
SOIL 30	D	4.6	4.2	2	4	3	2	0.013	0.0043
SOIL 30	E	4.6	4.4	3	4	3	2	0.018	0.0060
SOIL 30	F	4.6	4.4	1	1	1	3	0.004	0.0040
SOIL 30	G	4.6	3.9	1	1	0	.	.	.
SOIL 30	H	4.6	3.9	0	2	2	2	0.020	0.0100
SOIL 30	I	4.6	4	0	0	.	.	.	.
SOIL 30	J	4.6	4.8	1	1	1	0.25	0.007	0.0070
					2.40	2.22	1.8		0.0064
					1.65	1.30	0.82		0.0021

Appendix 4.1
(continued)
Alfalfa Test Results: pH, Emergence, Survival, Root Length and Dry Weight

SOIL	REP	INIT PH	FIN PH	EM 0	EM 21	SURV	RT LGTH	TOT DWT	MN DWT
		pH	pH	per 12	per 12	per 12	cm	g	g
SOIL 31	A	6.4	4.1	4	5	4	5	0.074	0.0185
SOIL 31	B	6.4	4.6	7	10	9	5	0.099	0.0110
SOIL 31	C	6.4	3.7	9	9	9	4	0.123	0.0137
SOIL 31	D	6.4	4.3	9	9	9	5	0.137	0.0152
SOIL 31	E	6.4	4.1	6	8	8	4	0.098	0.0123
SOIL 31	F	6.4	4.2	9	11	11	4	0.075	0.0068
SOIL 31	G	6.4	4.1	9	11	11	3	0.129	0.0117
SOIL 31	H	6.4	4.9	4	5	5	4	0.097	0.0194
SOIL 31	I	6.4	4.2	10	10	10	4	0.149	0.0149
SOIL 31	J	6.4	4.4	10	10	8	4	0.113	0.0141
					8.80	8.40	4.2		0.0138
					2.20	2.32	0.63		0.0037
SOIL 32	A	6.0	5.6	0	4	3	1	0.006	0.0020
SOIL 32	B	6.0	6.5	1	4	2	2	0.066	0.0330
SOIL 32	C	6.0	5.4	5	7	5	0.25	0.018	0.0036
SOIL 32	D	6.0	6	4	9	7	2	0.023	0.0033
SOIL 32	E	6.0	4.9	6	11	10	2	0.033	0.0033
SOIL 32	F	6.0	6.2	3	8	7	2	0.019	0.0027
SOIL 32	G	6.0	5	0	6	5	1	0.014	0.0028
SOIL 32	H	6.0	5.8	2	7	4	0.25	0.020	0.0050
SOIL 32	I	6.0	5.2	8	9	8	2	0.037	0.0046
SOIL 32	J	6.0	6	8	10	10	2	0.039	0.0039
					7.50	6.10	1.5		0.0064
					2.37	2.77	0.75		0.0094

Appendix 4.1
(continued)
Alfalfa Test Results: pH, Emergence, Survival, Root Length and Dry Weight

SOIL	REP	INIT PH	FIN PH	EM 0	EM 21	SURV	RT LGTH	TOT DWT	MN DWT
		pH	pH	per 12	per 12	per 12	cm	g	g
SOIL 35	A	4.8	3.7	0	0	.	.	.	.
SOIL 35	B	4.8	3.6	0	0	.	.	.	.
SOIL 35	C	4.8	4.1	1	1	0	.	.	.
SOIL 35	D	4.8	3.7	0	1	0	.	.	.
SOIL 35	E	4.8	4.2	0	1	0	.	.	.
SOIL 35	F	4.8	5.1	0	0	.	.	.	.
SOIL 35	G	4.8	6.1	0	1	0	.	.	.
SOIL 35	H	4.8	5.1	0	2	0	.	.	.
SOIL 35	I	4.8	5.5	0	0	.	.	.	.
SOIL 35	J	4.8	5	0	0	.	.	.	.
					0.60	0.00	#DIV/0!		#DIV/0!
					0.70	0.00	#DIV/0!		#DIV/0!
SOIL 36	A	5.5	4.3	1	1	0	.	.	.
SOIL 36	B	5.5	4.2	0	0	.	.	.	.
SOIL 36	C	5.5	3.9	0	0	.	.	.	.
SOIL 36	D	5.5	5	2	2	1	1	0.007	0.0070
SOIL 36	E	5.5	4	1	1	0	.	.	.
SOIL 36	F	5.5	3.8	0	0	.	.	.	.
SOIL 36	G	5.5	3.9	0	1	1	1	0.006	0.0060
SOIL 36	H	5.5	3.8	0	0	.	.	.	.
SOIL 36	I	5.5	4.4	2	4	2	0.25	0.008	0.0040
SOIL 36	J	5.5	4.4	0	0	.	.	.	.
					0.90	0.80	0.8		0.0057
					1.29	0.84	0.43		0.0015

Appendix 4.2

Alfalfa Test Results: Height

SOIL	REP	MN HT	HT1	HT2	HT3	HT4	HT5	HT6	HT7	HT8	HT9	HT10	HT11	HT12
		cm	cm											
NC	A	7.6	13	9	11	6	7	6	8	3	6	7	.	.
NC	B	8.0	12	9	10	7	11	7	4	6	4	7	11	.
NC	C	7.6	10	6	7	6	8	7	5	6	12	8	4	12
NC	D	10.7	10	8	10	4	8	6	9	5	43	9	6	.
NC	E	9.1	13	12	3	12	12	7	6	8	.	.	.	.
NC	F	7.4	6	6	8	6	6	11	7	4	13	.	.	.
NC	G	11.2	11	8	11	14	10	13	.	.	.	.	.	.
NC	H	7.2	8	6	7	10	6	6	.	.	.	.	.	.
NC	I	8.8	11	8	6	7	8	10	12	5	12	.	.	.
NC	J	9.5	13	11	13	15	5	8	9	9	7	6	9	.
		8.7												
		1.41												
SOIL 1	A	0.3	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	.	.	.	.
SOIL 1	B	0.3	0.25	0.25	0.25	0.25	0.25	0.25	.	.	.	.	.	.
SOIL 1	C	0.5	0.25	0.25	0.25	0.25	1	1	.	.	.	.	.	.
SOIL 1	D	1.1	0.25	1	1	1	2	.	.	.	.	.	.	.
SOIL 1	E	1.0	1	.	.	.	.	.	.	.	.	.	.	.
SOIL 1	F	0.5	0.25	0.25	0.25	0.25	0.25	1	1	.	.	.	.	.
SOIL 1	G	0.8	0.25	0.25	0.25	1	2	1	1	.	.	.	.	.
SOIL 1	H	0.7	0.25	0.25	1	1	1	.	.	.	.	.	.	.
SOIL 1	I	0.4	0.25	0.25	0.25	0.25	1	.	.	.	.	.	.	.
SOIL 1	J	0.4	0.25	0.25	0.25	1	.	.	.	.	.	.	.	.
		0.6												
		0.29												

Appendix 4.2

(continued)

Alfalfa Test Results: Height

SOIL	REP	MN HT	HT1	HT2	HT3	HT4	HT5	HT6	HT7	HT8	HT9	HT10	HT11	HT12
		cm	cm											
SOIL 2	A	5.1	7	4	5	4	7	7	3	6	3	.	.	.
SOIL 2	B	5.2	7	5	3	6	3	5	4	6	6	7	.	.
SOIL 2	C	4.7	6	5	6	4	5	3	3	4	6	5	.	.
SOIL 2	D	4.2	6	5	4	5	4	5	4	3	2	.	.	.
SOIL 2	E	4.6	5	6	4	5	3	2	6	5	5	.	.	.
SOIL 2	F	4.0	5	6	4	4	5	1	2	5	.	.	.	.
SOIL 2	G	4.3	4	4	4	5	4	5	4	.	.	.	.	.
SOIL 2	H	4.0	5	4	6	2	3	.	.	.	.	.	.	.
SOIL 2	I	1.8	2	1	2	0.25	1	3	2	3	.	.	.	.
SOIL 2	J	4.0	4	4	3	3	5	4	5	.	.	.	.	.
		4.2												
		0.95												
SOIL 3	A	2.6	5	1	2	4	1	.	.	.	.	.	.	.
SOIL 3	B	3.1	3	3	3	3	3	3	4	.	.	.	.	.
SOIL 3	C	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 3	D	2.8	3	5	0.25	.	.	.	.	.	.	.	.	.
SOIL 3	E	2.0	2	2	.	.	.	.	.	.	.	.	.	.
SOIL 3	F	1.4	1	0.25	3	.	.	.	.	.	.	.	.	.
SOIL 3	G	3.5	2	5	.	.	.	.	.	.	.	.	.	.
SOIL 3	H	1.1	2	0.25	.	.	.	.	.	.	.	.	.	.
SOIL 3	I	1.0	1	.	.	.	.	.	.	.	.	.	.	.
SOIL 3	J	1.3	2	1	1	.	.	.	.	.	.	.	.	.
		2.1												
		0.93												

Appendix 4.2
(continued)
Alfalfa Test Results: Height

SOIL	REP	MN HT	HT1	HT2	HT3	HT4	HT5	HT6	HT7	HT8	HT9	HT10	HT11	HT12
		cm	cm											
SOIL 4	A	1.0	1	1	.	.	.	.	.	.	.	.	.	.
SOIL 4	B	4.3	5	4	5	3	5	3	5	.	.	.	.	.
SOIL 4	C	6.0	5	7	.	.	.	.	.	.	.	.	.	.
SOIL 4	D	4.5	4	5	6	3	.	.	.	.	.	.	.	.
SOIL 4	E	4.1	4	9	5	5	2	2	2	.	.	.	.	.
SOIL 4	F	3.4	7	1	3	5	1	.	.	.	.	.	.	.
SOIL 4	G	2.3	4	5	1	0.25	1	.	.	.	.	.	.	.
SOIL 4	H	4.6	5	6	1	6	5	.	.	.	.	.	.	.
SOIL 4	I	1.5	2	1	.	.	.	.	.	.	.	.	.	.
SOIL 4	J	4.2	6	4	4	3	2	6	.	.	.	.	.	.
		3.6												
		1.55												
SOIL 5	A	4.1	3	5	4	4	3	4	5	3	5	5	.	.
SOIL 5	B	4.0	4	4	4	3	4	6	3	4	4	5	3	.
SOIL 5	C	4.3	4	5	5	4	3	4	6	4	5	3	4	.
SOIL 5	D	4.3	6	3	4	5	4	6	4	2	.	.	.	.
SOIL 5	E	4.9	5	5	4	5	4	4	5	6	6	.	.	.
SOIL 5	F	3.9	3	3	5	4	4	3	5	4	.	.	.	.
SOIL 5	G	4.7	5	4	4	6	5	4	5	5	3	6	.	.
SOIL 5	H	3.8	4	4	2	3	4	5	3	4	5	.	.	.
SOIL 5	I	4.0	3	3	5	5	.	.	.	.	.	.	.	.
SOIL 5	J	4.1	4	4	3	4	3	6	4	5	4	.	.	.
		4.2												
		0.35												

Appendix 4.2
(continued)
Alfalfa Test Results: Height

SOIL	REP	MN HT	HT1	HT2	HT3	HT4	HT5	HT6	HT7	HT8	HT9	HT10	HT11	HT12
		cm	cm											
SOIL 6	A	1.7	2	1	2	2	2	2	1	2	2	1	.	.
SOIL 6	B	1.7	2	1	1	2	2	2	.	.	.	.	.	.
SOIL 6	C	1.8	2	2	2	2	1	2	3	1	1	2	.	.
SOIL 6	D	1.9	2	2	2	2	2	2	1	2	2	2	.	.
SOIL 6	E	1.6	2	1	2	1	2	2	1	2	2	1	.	.
SOIL 6	F	1.7	3	1	1	2	1	2	1	2	2	2	.	.
SOIL 6	G	1.8	2	1	2	2	2	1	2	2	2	.	.	.
SOIL 6	H	1.4	1	2	1	1	2	2	1	.	.	.	.	.
SOIL 6	I	1.9	2	2	2	1	2	2	2	2	2	.	.	.
SOIL 6	J	1.8	1	2	2	2	1	3	1	2	.	.	.	.
		1.7												
		0.14												
SOIL 7	A	0.8	2	0.25	0.25	.	.	.	.	.	.	.	.	.
SOIL 7	B	0.4	1	0.25	0.25	0.25	0.25	0.25	.	.	.	.	.	.
SOIL 7	C	0.6	1	1	0.25	0.25	1	0.25	.	.	.	.	.	.
SOIL 7	D	0.9	2	0.25	1	0.25	.	.	.	.	.	.	.	.
SOIL 7	E	0.5	1	1	0.25	0.25	0.25	0.25	.	.	.	.	.	.
SOIL 7	F	0.3	0.25	.	.	.	.	.	.	.	.	.	.	.
SOIL 7	G	0.5	1	0.25	0.25	.	.	.	.	.	.	.	.	.
SOIL 7	H	0.4	1	0.25	0.25	0.25	.	.	.	.	.	.	.	.
SOIL 7	I	1.0	1	1	.	.	.	.	.	.	.	.	.	.
SOIL 7	J	0.6	1	0.25	.	.	.	.	.	.	.	.	.	.
		0.6												
		0.24												

Appendix 4.2

(continued)

Alfalfa Test Results: Height

SOIL	REP	MN HT	HT1	HT2	HT3	HT4	HT5	HT6	HT7	HT8	HT9	HT10	HT11	HT12
		cm	cm											
SOIL 8	A	1.6	.	.	.	2	2	2	2	1	1	2	1	1
SOIL 8	B	2.1	2	2	2	2	1	2	2	3	2	2	2	3
SOIL 8	C	2.1	.	.	1	2	3	1	3	2	2	3	2	2
SOIL 8	D	2.4	.	2	2	2	2	2	2	2	2	3	4	3
SOIL 8	E	2.2	2	2	3	3	3	2	2	1	2	2	.	.
SOIL 8	F	2.3	.	.	.	.	3	3	3	2	2	2	2	1
SOIL 8	G	2.1	.	.	.	3	2	2	2	2	3	1	3	1
SOIL 8	H	2.2	.	.	.	2	3	2	2	2	2	2	3	2
SOIL 8	I	2.3	.	.	.	2	3	2	2	3	1	3	3	2
SOIL 8	J	1.8	.	3	2	1	1	2	2	2	1	1	2	3
		2.1												
		0.25												
SOIL 9	A	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 9	B	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 9	C	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 9	D	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 9	E	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 9	F	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 9	G	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 9	H	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 9	I	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 9	J	.	.	.	.	.	.	.	.	.	.	.	.	.
		.												
		.												

Appendix 4.2

(continued)

Alfalfa Test Results: Height

SOIL	REP	MN HT	HT1	HT2	HT3	HT4	HT5	HT6	HT7	HT8	HT9	HT10	HT11	HT12
		cm	cm											
SOIL 10	A	0.8	.	.	.	.	.	0.25	0.25	0.25	1	1	1	2
SOIL 10	B	1.1	.	.	.	.	0.25	0.25	2	1	2	1	1	1
SOIL 10	C	0.9	.	.	.	.	2	1	0.25	0.25	1	1	1	1
SOIL 10	D	0.7	.	.	.	.	0.25	0.25	1	1	1	1	1	0.25
SOIL 10	E	0.9	.	.	.	.	.	2	1	0.25	1	1	1	0.25
SOIL 10	F	1.4	.	.	.	.	1	2	2	1	1	2	2	0.25
SOIL 10	G	1.1	.	.	.	.	.	.	.	0.25	1	1	2	1
SOIL 10	H	1.0	.	.	.	.	.	2	1	2	0.25	1	0.25	0.25
SOIL 10	I	1.0	.	.	.	.	.	1	2	1	0.25	1	1	1
SOIL 10	J	0.3	.	.	.	.	.	.	.	.	.	.	.	0.25
		0.9												
		0.30												
SOIL 11	A	1.0	.	.	.	.	.	.	.	.	.	1	1	1
SOIL 11	B	1.0	.	.	.	.	.	.	.	.	.	1	1	1
SOIL 11	C	1.0	.	.	.	1	0.25	1	1	1	1	2	1	1
SOIL 11	D	0.6	.	.	.	.	.	.	.	.	1	1	0.25	0.25
SOIL 11	E	1.0	.	.	.	.	.	.	.	.	.	.	.	1
SOIL 11	F	1.1	.	.	.	.	.	.	.	.	1	2	1	0.25
SOIL 11	G	0.8	.	.	.	.	.	.	.	.	.	1	0.25	1
SOIL 11	H	1.3	.	.	.	.	.	.	.	.	1	1	2	1
SOIL 11	I	1.0	.	.	.	.	.	.	.	.	1	1	1	1
SOIL 11	J	1.4	.	.	.	.	.	.	.	1	2	2	1	1
		1.0												
		0.22												

Appendix 4.2

(continued)

Alfalfa Test Results: Height

SOIL	REP	MN HT	HT1	HT2	HT3	HT4	HT5	HT6	HT7	HT8	HT9	HT10	HT11	HT12
		cm	cm											
SOIL 12	A	4.2	.	.	.	4	4	4	4	5	2	4	5	6
SOIL 12	B	4.1	.	.	.	.	4	4	4	4	5	3	4	5
SOIL 12	C	4.3	.	.	.	.	5	5	5	3	4	4	4	4
SOIL 12	D	3.4	.	.	.	.	.	.	.	3	3	5	3	3
SOIL 12	E	3.5	.	.	.	.	.	.	4	3	2	4	3	5
SOIL 12	F	3.9	.	.	.	.	.	4	4	4	4	4	4	3
SOIL 12	G	4.1	.	.	.	.	.	6	5	4	3	3	4	4
SOIL 12	H	3.4	.	.	.	.	.	3	3	3	3	4	4	4
SOIL 12	I	3.8	.	.	.	.	4	4	2	4	4	5	4	3
SOIL 12	J	3.4	.	.	.	3	3	3	4	3	3	3	5	4
		3.8												
		0.35												
SOIL 13	A	2.8	3	2	3	2	4	3	4	2	3	2	.	.
SOIL 13	B	2.7	3	2	3	3	3	2	.	.	.	.	.	.
SOIL 13	C	1.9	2	2	2	1	2	2	2	2	2	.	.	.
SOIL 13	D	2.3	2	2	1	3	2	3	3	2	.	.	.	.
SOIL 13	E	2.6	4	2	2	3	2	2	3	2	3	.	.	.
SOIL 13	F	2.9	4	3	0.25	3	3	3	4	3	.	.	.	.
SOIL 13	G	2.7	2	3	2	2	3	2	3	4	3	.	.	.
SOIL 13	H	3.0	3	4	3	2	3	3	.	.	.	.	.	.
SOIL 13	I	2.9	3	2	3	3	3	3	3	.	.	.	.	.
SOIL 13	J	2.3	2	3	3	2	0.25	1	4	3	.	.	.	.
		2.6												
		0.35												

Appendix 4.2
(continued)
Alfalfa Test Results: Height

SOIL	REP	MN HT	HT1	HT2	HT3	HT4	HT5	HT6	HT7	HT8	HT9	HT10	HT11	HT12
		cm	cm											
SOIL 14	A	0.4	.	.	.	.	.	.	.	.	1	0.25	0.25	0.25
SOIL 14	B	1.0	.	.	.	.	.	.	.	.	.	.	.	1
SOIL 14	C	0.3	.	.	.	.	.	.	.	.	.	0.25	0.25	0.25
SOIL 14	D	1.0	.	.	.	.	.	.	.	.	.	.	.	1
SOIL 14	E	0.3	.	.	.	.	.	.	.	.	.	.	0.25	0.25
SOIL 14	F	0.3	.	.	.	.	.	.	.	.	.	.	0.25	0.25
SOIL 14	G	0.6	.	.	.	.	.	.	.	.	.	.	1	0.25
SOIL 14	H	0.3	.	.	.	.	.	.	.	.	.	0.25	0.25	0.25
SOIL 14	I	0.6	.	.	.	.	.	.	.	.	.	.	1	0.25
SOIL 14	J	0.3	.	.	.	.	.	.	.	.	.	0.25	0.25	0.25
		0.5												
		0.31												
SOIL 15	A	0.3	0.25	.	.	.	.	.	.	.	.	.	.	.
SOIL 15	B	0.9	2	1	1	0.25	0.25	.	.	.	.	.	.	.
SOIL 15	C	1.3	2	1	1	.	.	.	.	.	.	.	.	.
SOIL 15	D	2.0	2	.	.	.	.	.	.	.	.	.	.	.
SOIL 15	E	1.1	2	1	0.25	.	.	.	.	.	.	.	.	.
SOIL 15	F	1.8	1	2	3	2	1	1	2	2	.	.	.	.
SOIL 15	G	2.3	2	3	3	2	2	2	3	2	2	2	2	.
SOIL 15	H	1.3	2	2	2	1	1	2	0.25	0.25	.	.	.	.
SOIL 15	I	2.5	3	2	.	.	.	.	.	.	.	.	.	.
SOIL 15	J	1.7	2	2	1	.	.	.	.	.	.	.	.	.
		1.5												
		0.67												

Appendix 4.2
(continued)
Alfalfa Test Results: Height

SOIL	REP	MN HT	HT1	HT2	HT3	HT4	HT5	HT6	HT7	HT8	HT9	HT10	HT11	HT12
		cm	cm											
SOIL 16	A	0.9	1	1	0.25	1	0.25	0.25	1	1	2	.	.	.
SOIL 16	B	1.5	1	1	2	0.25	1	1	2	2	3	.	.	.
SOIL 16	C	1.0	1	1	1	2	1	0.25	.	.	.	.	.	.
SOIL 16	D	1.4	1	2	1	1	1	2	1	2	2	.	.	.
SOIL 16	E	1.3	1	1	2	0.25	1	2	1	2	.	.	.	.
SOIL 16	F	1.7	1	2	2	1	3	2	1	1	2	.	.	.
SOIL 16	G	1.3	1	2	2	2	1	1	0.25	.	.	.	.	.
SOIL 16	H	1.9	3	1	1	2	2	2	2	2	2	.	.	.
SOIL 16	I	1.2	1	1	1	1	2	1	2	1	2	0.25	.	.
SOIL 16	J	1.5	3	1	1	2	2	2	1	0.25	.	.	.	.
		1.4												
		0.30												
SOIL 17	A	4.0	5	5	4	5	5	3	4	4	1	.	.	.
SOIL 17	B	3.4	1	3	3	4	5	5	3	.	.	.	.	.
SOIL 17	C	4.0	4	4	4	4	4	4	5	5	5	5	0.25	.
SOIL 17	D	4.6	5	4	5	4	4	6	5	4	.	.	.	.
SOIL 17	E	4.5	5	5	5	4	4	5	5	3	.	.	.	.
SOIL 17	F	3.8	5	3	4	3	4	3	3	5	4	4	4	.
SOIL 17	G	3.6	4	3	4	3	4	3	4	5	1	5	.	.
SOIL 17	H	4.3	4	4	5	4	6	4	4	3	4	4	5	.
SOIL 17	I	4.3	5	5	5	4	5	4	5	5	0.25	.	.	.
SOIL 17	J	4.9	5	5	5	4	4	4	5	5	6	5	6	.
		4.1												
		0.46												

Appendix 4.2

(continued)

Alfalfa Test Results: Height

SOIL	REP	MN HT	HT1	HT2	HT3	HT4	HT5	HT6	HT7	HT8	HT9	HT10	HT11	HT12
		cm	cm											
SOIL 19	A	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 19	B	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 19	C	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 19	D	0.3	0.25	.	.	.	.	.	.	.	.	.	.	.
SOIL 19	E	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 19	F	0.3	0.25	0.25	0.25	.	.	.	.	.	.	.	.	.
SOIL 19	G	0.3	0.25	0.25	.	.	.	.	.	.	.	.	.	.
SOIL 19	H	1.0	1	.	.	.	.	.	.	.	.	.	.	.
SOIL 19	I	1.0	1	1	1	.	.	.	.	.	.	.	.	.
SOIL 19	J	1.0	1	.	.	.	.	.	.	.	.	.	.	.
		0.6												
		0.41												
SOIL 20	A	3.4	4	4	0.25	3	3	4	4	5	.	.	.	.
SOIL 20	B	4.0	3	3	4	3	3	4	6	5	5	.	.	.
SOIL 20	C	4.0	4	4	4	5	3	4	5	3	4	.	.	.
SOIL 20	D	1.9	1	1	0.25	4	2	2	3	2	.	.	.	.
SOIL 20	E	1.1	0.25	0.25	1	3	.	.	.	.	.	.	.	.
SOIL 20	F	3.9	5	6	5	5	1	1	4	.	.	.	.	.
SOIL 20	G	3.9	5	4	4	4	4	4	3	3	4	4	4	.
SOIL 20	H	4.5	4	5	6	3	4	4	5	5	.	.	.	.
SOIL 20	I	4.3	4	5	4	5	4	3	5	4	5	.	.	.
SOIL 20	J	2.8	3	4	0.25	2	5	1	4	.	.	.	.	.
		3.4												
		1.11												

Appendix 4.2
(continued)
Alfalfa Test Results: Height

SOIL	REP	MN HT	HT1	HT2	HT3	HT4	HT5	HT6	HT7	HT8	HT9	HT10	HT11	HT12
		cm	cm											
SOIL 21	A	1.0	1	.	.	.	.	.	.	.	.	.	.	.
SOIL 21	B	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 21	C	0.4	1	0.25	0.25	0.25	.	.	.	.	.	.	.	.
SOIL 21	D	0.4	1	0.25	0.25	0.25	.	.	.	.	.	.	.	.
SOIL 21	E	1.0	1	.	.	.	.	.	.	.	.	.	.	.
SOIL 21	F	0.9	1	1	1	1	1	0.25	.	.	.	.	.	.
SOIL 21	G	1.5	1	2	1	2	.	.	.	.	.	.	.	.
SOIL 21	H	1.7	2	1	2	.	.	.	.	.	.	.	.	.
SOIL 21	I	0.8	1	1	0.25	.	.	.	.	.	.	.	.	.
SOIL 21	J	1.6	1	2	1	1	3	1	2	.	.	.	.	.
		1.0												
		0.46												
SOIL 22	A	1.1	1	1	1	1	1	2	1	.	.	.	.	.
SOIL 22	B	1.2	2	0.25	2	1	1	1	1	.	.	.	.	.
SOIL 22	C	0.9	1	1	1	0.25	1	.	.	.	.	.	.	.
SOIL 22	D	1.2	1	1	1	1	2	1	2	1	1	1	.	.
SOIL 22	E	1.2	2	1	1	1	1	.	.	.	.	.	.	.
SOIL 22	F	1.0	1	2	1	1	1	1	1	1	0.25	0.25	2	.
SOIL 22	G	1.1	1	2	1	0.25	1	1	2	0.25	.	.	.	.
SOIL 22	H	1.3	2	1	1	1	.	.	.	.	.	.	.	.
SOIL 22	I	1.3	1	2	2	2	1	1	0.25	.	.	.	.	.
SOIL 22	J	1.1	2	1	2	1	1	0.25	0.25	1	.	.	.	.
		1.1												
		0.13												

Appendix 4.2
(continued)
Alfalfa Test Results: Height

SOIL	REP	MN HT	HT1	HT2	HT3	HT4	HT5	HT6	HT7	HT8	HT9	HT10	HT11	HT12
		cm	cm											
SOIL 23	A	0.8	1	0.25	1	.	.	.	.	.	.	.	.	.
SOIL 23	B	1.0	1	1	.	.	.	.	.	.	.	.	.	.
SOIL 23	C	0.4	1	0.25	0.25	0.25	0.25	0.25	.	.	.	.	.	.
SOIL 23	D	1.1	2	1	1	1	1	1	1	.	.	.	.	.
SOIL 23	E	0.9	1	1	1	1	0.25	1	.	.	.	.	.	.
SOIL 23	F	1.0	2	1	1	1	1	1	0.25	1	.	.	.	.
SOIL 23	G	0.9	1	0.25	1	1	1	0.25	2	.	.	.	.	.
SOIL 23	H	1.5	2	1	2	1	1	1	2	2	.	.	.	.
SOIL 23	I	1.2	2	1	1	1	1	.	.	.	.	.	.	.
SOIL 23	J	0.9	1	1	2	0.25	0.25	0.25	1	1	1	1	.	.
		1.0												
		0.30												
SOIL 24	A	5.6	6	6	5	5	5	1	8	6	7	7	.	.
SOIL 24	B	6.3	6	5	5	5	7	8	6	8	.	.	.	.
SOIL 24	C	4.9	7	2	4	6	5	9	1	5	.	.	.	.
SOIL 24	D	6.4	4	10	8	6	5	5	7	.	.	.	.	.
SOIL 24	E	6.0	6	6	5	6	2	8	7	6	6	8	.	.
SOIL 24	F	5.8	5	3	6	5	6	6	8	7	.	.	.	.
SOIL 24	G	5.2	8	0.25	1	9	7	7	8	1	.	.	.	.
SOIL 24	H	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 24	I	5.6	6	7	3	4	6	9	4	.	.	.	.	.
SOIL 24	J	6.9	6	7	8	5	8	6	8	7	.	.	.	.
		5.8												
		0.63												

Appendix 4.2
(continued)
Alfalfa Test Results: Height

SOIL	REP	MN HT	HT1	HT2	HT3	HT4	HT5	HT6	HT7	HT8	HT9	HT10	HT11	HT12
		cm	cm											
SOIL 25	A	4.2	4	4	3	4	4	4	4	6	5	.	.	.
SOIL 25	B	3.9	3	3	4	3	4	5	4	4	5	4	.	.
SOIL 25	C	4.4	5	5	4	3	5	5	4	3	3	5	7	4
SOIL 25	D	4.4	5	4	7	2	5	3	5	4	5	.	.	.
SOIL 25	E	4.5	6	4	4	4	5	4	5	4	5	5	4	.
SOIL 25	F	4.4	4	5	4	5	4	5	5	3	5	.	.	.
SOIL 25	G	4.3	6	5	4	4	3	4	5	3	5	4	4	.
SOIL 25	H	4.1	4	3	3	4	3	4	6	5	5	.	.	.
SOIL 25	I	4.3	4	4	4	5	4	5	5	4	4	.	.	.
SOIL 25	J	4.5	6	4	4	4	5	5	3	4	5	5	5	.
		4.3												
		0.20												
SOIL 26	A	3.6	.	4	4	5	4	3	1	4	3	3	4	5
SOIL 26	B	3.9	5	5	4	4	4	4	3	3	2	5	4	4
SOIL 26	C	3.9	.	.	.	4	4	5	4	4	4	4	3	3
SOIL 26	D	3.9	.	.	.	4	2	3	5	3	4	4	6	4
SOIL 26	E	3.5	.	3	4	4	4	4	3	3	3	4	3	4
SOIL 26	F	3.8	.	6	3	1	4	5	3	3	4	4	5	4
SOIL 26	G	4.4	.	.	.	.	5	5	5	5	3	5	3	4
SOIL 26	H	4.0	.	.	6	4	4	3	3	4	3	5	4	4
SOIL 26	I	4.1	.	.	.	3	4	3	4	5	4	5	5	4
SOIL 26	J	4.8	.	.	4	4	5	5	5	6	6	5	4	4
		4.0												
		0.36												

Appendix 4.2

(continued)

Alfalfa Test Results: Height

SOIL	REP	MN HT	HT1	HT2	HT3	HT4	HT5	HT6	HT7	HT8	HT9	HT10	HT11	HT12
		cm	cm											
SOIL 27	A	1.4	1	2	2	1	2	1	0.25	2	2	1	.	.
SOIL 27	B	2.0	3	2	1	2	2	2	2	2	2	2	.	.
SOIL 27	C	1.4	1	2	1	0.25	2	1	2	1	2	.	.	.
SOIL 27	D	2.0	3	1	2	2	.	.	.	.	.	.	.	.
SOIL 27	E	1.6	2	2	1	2	2	0.25	2	2	1	1	2	.
SOIL 27	F	1.6	2	2	1	1	2	0.25	2	1	2	2	2	.
SOIL 27	G	1.5	2	1	1	2	2	0.25	2	2	1	.	.	.
SOIL 27	H	1.5	1	2	1	1	2	2	0.25	2	2	1	2	2
SOIL 27	I	1.4	2	1	1	1	2	1	2	2	1	.	.	.
SOIL 27	J	1.4	1	1	2	1	2	2	1	.	.	.	.	.
		1.6												
		0.23												
SOIL 28	A	4.3	.	.	.	.	.	.	3	4	5	3	5	6
SOIL 28	B	5.0	.	.	.	.	4	6	4	7	4	5	5	5
SOIL 28	C	4.1	.	.	5	6	4	2	2	5	5	4	4	4
SOIL 28	D	5.4	.	.	.	6	7	4	5	5	8	5	6	3
SOIL 28	E	4.5	.	.	.	.	.	.	.	.	3	4	5	6
SOIL 28	F	4.3	.	.	5	4	5	5	3	4	3	4	6	4
SOIL 28	G	4.7	.	.	.	.	.	.	.	.	.	4	5	5
SOIL 28	H	4.3	.	.	.	.	.	4	4	5	4	5	5	3
SOIL 28	I	4.8	.	.	.	.	.	.	.	.	5	5	4	5
SOIL 28	J	4.4	.	.	.	.	.	4	4	6	3	5	5	4
		4.6												
		0.40												

Appendix 4.2

(continued)

Alfalfa Test Results: Height

SOIL	REP	MN HT	HT1	HT2	HT3	HT4	HT5	HT6	HT7	HT8	HT9	HT10	HT11	HT12
		cm	cm											
SOIL 29	A	0.9	.	.	.	.	1	1	1	0.25	1	1	1	1
SOIL 29	B	0.7	.	.	.	.	.	.	.	1	1	1	0.25	0.25
SOIL 29	C	0.8	.	.	.	1	1	1	0.25	0.25	1	0.25	1	1
SOIL 29	D	0.6	.	.	.	.	1	0.25	0.25	0.25	0.25	1	1	1
SOIL 29	E	0.3	.	.	.	.	.	0.25	0.25	0.25	0.25	0.25	0.25	0.25
SOIL 29	F	0.7	.	.	.	.	.	2	1	1	0.25	0.25	0.25	0.25
SOIL 29	G	0.8	.	.	.	.	.	.	.	2	1	0.25	0.25	0.25
SOIL 29	H	0.7	.	.	.	.	.	1	1	1	1	0.25	0.25	0.25
SOIL 29	I	0.6	.	.	.	.	.	.	1	1	1	0.25	0.25	0.25
SOIL 29	J	1.0	.	.	.	.	.	.	.	.	.	.	1	1
		0.7												
		0.20												
SOIL 30	A	1.0	1	1	1	.	.	.	.	.	.	.	.	.
SOIL 30	B	0.5	0.25	0.25	1	.	.	.	.	.	.	.	.	.
SOIL 30	C	1.0	1	1	1	1	.	.	.	.	.	.	.	.
SOIL 30	D	0.5	1	0.25	0.25	.	.	.	.	.	.	.	.	.
SOIL 30	E	1.0	1	1	1	.	.	.	.	.	.	.	.	.
SOIL 30	F	1.0	1	.	.	.	.	.	.	.	.	.	.	.
SOIL 30	G	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 30	H	0.6	0.25	1	.	.	.	.	.	.	.	.	.	.
SOIL 30	I	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 30	J	1.0	1	.	.	.	.	.	.	.	.	.	.	.
		0.8												
		0.24												

Appendix 4.2

(continued)

Alfalfa Test Results: Height

SOIL	REP	MN HT	HT1	HT2	HT3	HT4	HT5	HT6	HT7	HT8	HT9	HT10	HT11	HT12
		cm	cm											
SOIL 31	A	5.0	.	.	.	.	.	.	.	.	5	6	5	4
SOIL 31	B	4.0	.	.	.	5	4	3	4	4	4	5	4	3
SOIL 31	C	4.8	.	.	.	5	5	5	4	3	5	5	6	5
SOIL 31	D	4.2	.	.	.	5	4	5	3	6	4	4	4	3
SOIL 31	E	4.3	.	.	.	.	5	3	3	5	4	5	4	5
SOIL 31	F	4.7	.	6	2	4	4	5	5	4	4	5	7	6
SOIL 31	G	4.1	.	3	2	5	3	5	5	4	4	6	4	4
SOIL 31	H	4.6	.	.	.	.	.	.	.	5	4	4	5	5
SOIL 31	I	4.9	.	.	4	5	6	6	5	3	5	5	5	5
SOIL 31	J	4.6	.	.	.	.	5	4	3	3	4	8	5	5
		4.5												
		0.35												
SOIL 32	A	0.3	.	.	.	.	.	.	.	.	.	0.25	0.25	0.25
SOIL 32	B	0.6	.	.	.	.	.	.	.	.	.	.	1	0.25
SOIL 32	C	0.9	.	.	.	.	.	.	.	1	0.25	0.25	1	2
SOIL 32	D	0.8	.	.	.	.	.	2	1	1	1	0.25	0.25	0.25
SOIL 32	E	0.7	.	.	2	1	1	1	1	0.25	0.25	0.25	0.25	0.25
SOIL 32	F	0.4	.	.	.	.	.	1	0.25	0.25	0.25	0.25	0.25	0.25
SOIL 32	G	0.4	.	.	.	.	.	.	.	1	0.25	0.25	0.25	0.25
SOIL 32	H	0.4	.	.	.	.	.	.	.	.	1	0.25	0.25	0.25
SOIL 32	I	1.1	.	.	.	.	2	2	1	1	1	1	0.25	0.25
SOIL 32	J	0.7	.	.	1	1	1	2	0.25	0.25	0.25	0.25	0.25	0.25
		0.6												
		0.26												

Appendix 4.2
(continued)
Alfalfa Test Results: Height

SOIL	REP	MN HT	HT1	HT2	HT3	HT4	HT5	HT6	HT7	HT8	HT9	HT10	HT11	HT12
		cm	cm											
SOIL 35	A	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 35	B	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 35	C	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 35	D	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 35	E	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 35	F	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 35	G	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 35	H	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 35	I	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 35	J	.	.	.	.	.	.	.	.	.	.	.	.	.
		.												
		.												
SOIL 36	A	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 36	B	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 36	C	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 36	D	0.3	.	.	.	.	.	.	.	.	.	.	.	0.25
SOIL 36	E	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 36	F	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 36	G	0.3	.	.	.	.	.	.	.	.	.	.	.	0.25
SOIL 36	H	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 36	I	0.3	.	.	.	.	.	.	.	.	.	.	0.25	0.25
SOIL 36	J	.	.	.	.	.	.	.	.	.	.	.	.	.
		0.3												
		0.00												

Appendix 4.3

Alfalfa Test Results: Condition

SOIL	REP	Condition Score	Symptom(s) Observed		SOIL	REP	Condition Score	Symptom(s) Observed		SOIL	REP	Condition Score	Symptom(s) Observed
NC	A	0	none		SOIL 2	A	0	none		SOIL 4	A	30	N
NC	B	0	none		SOIL 2	B	0	none		SOIL 4	B	10	N
NC	C	0	none		SOIL 2	C	0	none		SOIL 4	C	10	CL
NC	D	0	none		SOIL 2	D	10	N		SOIL 4	D	20	CL
NC	E	10	M		SOIL 2	E	10	CL		SOIL 4	E	20	CL,N
NC	F	0	none		SOIL 2	F	10	N		SOIL 4	F	20	CL,N
NC	G	10	M		SOIL 2	G	0	none		SOIL 4	G	40	CL,N
NC	H	0	none		SOIL 2	H	0	none		SOIL 4	H	20	N,M
NC	I	10	M		SOIL 2	I	0	none		SOIL 4	I	60	CL,N
NC	J	0	none		SOIL 2	J	0	none		SOIL 4	J	30	CL,N,M
SOIL 1	A	80	CL,N		SOIL 3	A	40	CL,N		SOIL 5	A	0	none
SOIL 1	B	80	CL,N,M		SOIL 3	B	30	CL,N		SOIL 5	B	0	none
SOIL 1	C	80	CL,N,M		SOIL 3	C	100	M		SOIL 5	C	10	CL
SOIL 1	D	70	N		SOIL 3	D	10	N		SOIL 5	D	0	none
SOIL 1	E	80	N		SOIL 3	E	30	CL,N		SOIL 5	E	0	none
SOIL 1	F	80	CL,N,M		SOIL 3	F	60	CL,N		SOIL 5	F	20	CL,M
SOIL 1	G	80	CL,N,M		SOIL 3	G	20	CL		SOIL 5	G	0	none
SOIL 1	H	80	CL,N,M		SOIL 3	H	60	CL,N		SOIL 5	H	30	CL,N,M
SOIL 1	I	80	CL,N,M		SOIL 3	I	80	N		SOIL 5	I	10	CL
SOIL 1	J	80	CL,N,M		SOIL 3	J	60	N		SOIL 5	J	20	CL

M – Mortality; CL – Chlorosis; N – Necrosis

Appendix 4.3

(continued)

Alfalfa Test Results: Condition

SOIL	REP	Condition Score	Symptom(s) Observed		SOIL	REP	Condition Score	Symptom(s) Observed		SOIL	REP	Condition Score	Symptom(s) Observed
SOIL 6	A	60	CL,N		SOIL 8	A	60	CL,N		SOIL 10	A	80	CL,N,CC
SOIL 6	B	70	CL,N,M		SOIL 8	B	70	CL,N,CC		SOIL 10	B	70	CL,N
SOIL 6	C	60	CL,N		SOIL 8	C	80	CL,N,CC		SOIL 10	C	80	CL,N,CC,M
SOIL 6	D	70	CL,N		SOIL 8	D	70	CL,N,CC		SOIL 10	D	80	CL,N,M
SOIL 6	E	70	CL,N		SOIL 8	E	70	CL,N		SOIL 10	E	80	CL,N
SOIL 6	F	70	CL,N,M		SOIL 8	F	80	CL,N		SOIL 10	F	70	CL,N
SOIL 6	G	70	CL,N,M		SOIL 8	G	80	CL,N,CC		SOIL 10	G	80	CL,N,M
SOIL 6	H	80	CL,N,CC		SOIL 8	H	80	CL,N,CC		SOIL 10	H	80	CL,N
SOIL 6	I	80	CL,N		SOIL 8	I	80	CL,N,CC		SOIL 10	I	80	CL,N
SOIL 6	J	80	CL,N,CC		SOIL 8	J	70	CL,N		SOIL 10	J	90	N
SOIL 7	A	80	CL,N,CC		SOIL 9	A	100	M		SOIL 11	A	80	CL,N,M
SOIL 7	B	80	CL,N,M		SOIL 9	B	.	NE		SOIL 11	B	80	CL,N,M
SOIL 7	C	90	CL,N,M		SOIL 9	C	100	M		SOIL 11	C	80	CL,N,M
SOIL 7	D	80	CL,N,M		SOIL 9	D	100	M		SOIL 11	D	90	CL,N,M
SOIL 7	E	80	CL,N,M		SOIL 9	E	100	M		SOIL 11	E	80	CL,N,M
SOIL 7	F	90	CL,N		SOIL 9	F	100	M		SOIL 11	F	80	CL,N
SOIL 7	G	90	CL,N,M		SOIL 9	G	100	M		SOIL 11	G	80	CL,N,M
SOIL 7	H	80	CL,N,M		SOIL 9	H	.	NE		SOIL 11	H	80	CL,N
SOIL 7	I	80	CL,N,M		SOIL 9	I	.	NE		SOIL 11	I	90	CL,N
SOIL 7	J	90	CL,N,M		SOIL 9	J	100	M		SOIL 11	J	80	CL,N,M

M – Mortality; CL – Chlorosis; N – Necrosis; CC – Color Change; NE – None Emerged

Appendix 4.3
(continued)
Alfalfa Test Results: Condition

SOIL	REP	Condition Score	Symptom(s) Observed		SOIL	REP	Condition Score	Symptom(s) Observed		SOIL	REP	Condition Score	Symptom(s) Observed
SOIL 12	A	10	CL		SOIL 14	A	90	CL,N		SOIL 16	A	90	CL,N,CC
SOIL 12	B	10	CL		SOIL 14	B	90	N,M		SOIL 16	B	80	CL,N,M
SOIL 12	C	0	none		SOIL 14	C	90	CL.N,CC,M		SOIL 16	C	90	CL,N,M
SOIL 12	D	0	none		SOIL 14	D	90	CL,N		SOIL 16	D	80	CL,N
SOIL 12	E	10	CL		SOIL 14	E	90	CL,N		SOIL 16	E	80	CL,N,CC
SOIL 12	F	10	CL		SOIL 14	F	90	N,M,CC		SOIL 16	F	80	CL,N,CC
SOIL 12	G	10	CL		SOIL 14	G	90	CL,N,M		SOIL 16	G	80	CL,N,CC
SOIL 12	H	10	CL		SOIL 14	H	90	CL.N,CC,M		SOIL 16	H	80	CL,N,M
SOIL 12	I	10	CL		SOIL 14	I	90	CL,N,M		SOIL 16	I	80	CL,N,CC
SOIL 12	J	20	CL,N		SOIL 14	J	90	CL,N,M		SOIL 16	J	80	CL,N,CC
SOIL 13	A	30	CL,N		SOIL 15	A	70	CL,N,M		SOIL 17	A	20	CL,M
SOIL 13	B	30	CL,N,CC		SOIL 15	B	70	CL,N,M		SOIL 17	B	10	CL,M
SOIL 13	C	60	CL,N,CC,M		SOIL 15	C	80	CL,N,M		SOIL 17	C	10	CL,N
SOIL 13	D	60	CL,N,CC,M		SOIL 15	D	80	CL,N,M		SOIL 17	D	10	CL
SOIL 13	E	50	CL,N,CC,M		SOIL 15	E	80	CL,N,M		SOIL 17	E	0	none
SOIL 13	F	60	CL,N		SOIL 15	F	70	CL,N,M,CC		SOIL 17	F	10	CL,M
SOIL 13	G	60	CL,N,M		SOIL 15	G	70	CL,N,M,CC		SOIL 17	G	20	CL,M
SOIL 13	H	60	CL,N,M		SOIL 15	H	80	CL,N,M		SOIL 17	H	10	CL,N,M
SOIL 13	I	60	CL,N,M		SOIL 15	I	70	CL,N		SOIL 17	I	20	CL
SOIL 13	J	60	CL,N,CC		SOIL 15	J	80	CL,N		SOIL 17	J	0	none

M – Mortality; CL – Chlorosis; N – Necrosis; CC – Color Change; NE – None Emerged

Appendix 4.3

(continued)

Alfalfa Test Results: Condition

SOIL	REP	Condition Score	Symptom(s) Observed		SOIL	REP	Condition Score	Symptom(s) Observed		SOIL	REP	Condition Score	Symptom(s) Observed
SOIL 19	A	100	M		SOIL 21	A	90	N,M		SOIL 23	A	90	CL,N,M
SOIL 19	B	100	M		SOIL 21	B	100	M		SOIL 23	B	80	CL,N,M
SOIL 19	C	.	NE		SOIL 21	C	90	CL,N,CC		SOIL 23	C	90	N
SOIL 19	D	90	CL,N		SOIL 21	D	90	CL,N,CC		SOIL 23	D	80	CL,N,CC
SOIL 19	E	100	M		SOIL 21	E	90	N,M		SOIL 23	E	80	CL,N,M
SOIL 19	F	90	CL,N,CC		SOIL 21	F	90	CL,N,M,CC		SOIL 23	F	80	CL,N,M,CC
SOIL 19	G	90	CL,N,M,CC		SOIL 21	G	80	CL,N,M,CC		SOIL 23	G	80	CL,N,CC
SOIL 19	H	90	N,M,CC		SOIL 21	H	80	CL,N,M,CC		SOIL 23	H	80	CL,N,M,CC
SOIL 19	I	90	CL,N,CC		SOIL 21	I	90	CL,N,CC		SOIL 23	I	80	CL,N,M,CC
SOIL 19	J	80	CL,N,CC		SOIL 21	J	80	CL,N		SOIL 23	J	80	CL,N,CC
SOIL 20	A	40	CL,N		SOIL 22	A	80	CL,N,M,CC		SOIL 24	A	0	none
SOIL 20	B	30	CL,N		SOIL 22	B	90	CL,N,M,CC		SOIL 24	B	0	none
SOIL 20	C	30	CL,N		SOIL 22	C	90	CL,N,M,CC		SOIL 24	C	20	N,CC
SOIL 20	D	20	N		SOIL 22	D	80	CL,N,CC		SOIL 24	D	0	none
SOIL 20	E	40	CL,N		SOIL 22	E	80	CL,N,CC		SOIL 24	E	0	none
SOIL 20	F	30	CL,N,M		SOIL 22	F	90	CL,N,CC		SOIL 24	F	20	N,CC
SOIL 20	G	30	CL,N		SOIL 22	G	90	CL,N,CC		SOIL 24	G	20	CL,N
SOIL 20	H	10	CL		SOIL 22	H	90	CL,N,CC		SOIL 24	H	.	NE
SOIL 20	I	20	CL		SOIL 22	I	90	CL,N,CC		SOIL 24	I	10	CL
SOIL 20	J	30	CL,N		SOIL 22	J	80	CL,N		SOIL 24	J	0	none

M – Mortality; CL – Chlorosis; N – Necrosis; CC – Color Change; NE – None Emerged

Appendix 4.3
(continued)
Alfalfa Test Results: Condition

SOIL	REP	Condition Score	Symptom(s) Observed		SOIL	REP	Condition Score	Symptom(s) Observed		SOIL	REP	Condition Score	Symptom(s) Observed
SOIL 25	A	20	CL		SOIL 27	A	70	CL,N,CC		SOIL 29	A	80	CL,N,CC,M
SOIL 25	B	10	CL		SOIL 27	B	70	CL,N,CC		SOIL 29	B	90	CL,N,CC,M
SOIL 25	C	10	CL		SOIL 27	C	80	CL,N,CC		SOIL 29	C	90	CL,N,CC
SOIL 25	D	0	none		SOIL 27	D	80	CL,N,M		SOIL 29	D	90	CL,N,M
SOIL 25	E	0	none		SOIL 27	E	80	CL,N,CC		SOIL 29	E	90	CL,N,M
SOIL 25	F	20	CL		SOIL 27	F	80	CL,N,CC		SOIL 29	F	90	CL,N,CC
SOIL 25	G	0	none		SOIL 27	G	80	CL,N,CC		SOIL 29	G	90	CL,N
SOIL 25	H	0	none		SOIL 27	H	70	CL,N,CC		SOIL 29	H	80	CL,N,CC
SOIL 25	I	0	none		SOIL 27	I	80	CL,N,CC		SOIL 29	I	90	CL,N,CC
SOIL 25	J	10	CL		SOIL 27	J	80	CL,N,CC,M		SOIL 29	J	90	CL,N,CC
SOIL 26	A	10	CL		SOIL 28	A	10	M		SOIL 30	A	90	CL,N
SOIL 26	B	0	none		SOIL 28	B	10	CL		SOIL 30	B	90	CL,N
SOIL 26	C	0	none		SOIL 28	C	20	CL,N		SOIL 30	C	90	CL,N,M
SOIL 26	D	10	CL		SOIL 28	D	20	CL		SOIL 30	D	90	CL,N,M,CC
SOIL 26	E	20	CL		SOIL 28	E	10	CL		SOIL 30	E	80	CL,N,M,CC
SOIL 26	F	10	CL,N		SOIL 28	F	20	CL,M		SOIL 30	F	90	CL,N,CC
SOIL 26	G	10	CL		SOIL 28	G	10	CL		SOIL 30	G	100	M
SOIL 26	H	10	CL		SOIL 28	H	10	CL		SOIL 30	H	90	CL,N
SOIL 26	I	20	CL		SOIL 28	I	10	CL		SOIL 30	I	.	NE
SOIL 26	J	0	none		SOIL 28	J	10	CL		SOIL 30	J	80	CL,N,CC

M – Mortality; CL – Chlorosis; N – Necrosis; CC – Color Change; NE – None Emerged

Appendix 4.3
(continued)
Alfalfa Test Results: Condition

SOIL	REP	Condition Score	Symptom(s) Observed		SOIL	REP	Condition Score	Symptom(s) Observed
SOIL 31	A	20	CL,M		SOIL 35	A	.	NE
SOIL 31	B	40	CL,N,M		SOIL 35	B	.	NE
SOIL 31	C	30	CL		SOIL 35	C	100	M
SOIL 31	D	30	CL,N		SOIL 35	D	100	M
SOIL 31	E	30	CL,N		SOIL 35	E	100	M
SOIL 31	F	30	CL,N		SOIL 35	F	.	NE
SOIL 31	G	30	CL,N		SOIL 35	G	100	M
SOIL 31	H	30	N		SOIL 35	H	100	M
SOIL 31	I	30	CL,N		SOIL 35	I	.	NE
SOIL 31	J	30	CL,N,M		SOIL 35	J	.	NE
SOIL 32	A	90	N,M,CC		SOIL 36	A	100	M
SOIL 32	B	90	N,M,CC		SOIL 36	B	.	NE
SOIL 32	C	90	CL,N,M,CC		SOIL 36	C	.	NE
SOIL 32	D	80	CL,N,M,CC		SOIL 36	D	90	N,M
SOIL 32	E	90	CL,N,M,CC		SOIL 36	E	100	M
SOIL 32	F	90	N,M,CC		SOIL 36	F	.	NE
SOIL 32	G	90	N,M		SOIL 36	G	90	N
SOIL 32	H	90	CL,N,M,CC		SOIL 36	H	.	NE
SOIL 32	I	80	CL,N,M		SOIL 36	I	90	N,M
SOIL 32	J	90	CL,N,CC		SOIL 36	J	.	NE

M – Mortality; CL – Chlorosis; N – Necrosis; CC – Color Change; NE – None Emerged

Appendix 5.1

Sideoats Grama (Nursery-Provided) Test Results: pH, Emergence, Survival, Root Length and Dry Weight

SOIL	REP	INIT PH	FIN PH	EM 0	EM 21	SURV	RT LGTH	TOT DWT	MN DWT
		pH	pH	per 12	per 12	per 12	cm	g	g
NC	A	5.9	3.4	6	7	7	17	0.0433	0.0062
NC	B	5.9	3.8	11	12	12	25	0.1838	0.0153
NC	C	5.9	3.8	7	7	7	14	0.0875	0.0125
NC	D	5.9	3.8	8	8	8	25	0.2141	0.0268
NC	E	5.9	4	8	8	7	20	0.1432	0.0205
NC	F	5.9	3	3	3	2	11	0.0332	0.0166
NC	G	5.9	3	5	5	4	13	0.0449	0.0112
NC	H	5.9	3.4	7	7	7	12	0.0684	0.0098
NC	I	5.9	3.5	4	4	2	13	0.0123	0.0062
NC	J	5.9	4.2	5	5	5	25	0.0636	0.0127
					6.60	6.10	17.5		0.0138
					2.55	3.00	5.78		0.0064
SOIL 1	A	5.6	3.9	0	0	.	.	.	.
SOIL 1	B	5.6	5.1	0	1	0	.	.	.
SOIL 1	C	5.6	4	1	1	0	.	.	.
SOIL 1	D	5.6	4.3	0	2	0	.	.	.
SOIL 1	E	5.6	4	0	1	1	3	0.0004	0.0004
SOIL 1	F	5.6	5.2	2	4	0	.	.	.
SOIL 1	G	5.6	4.7	0	1	0	.	.	.
SOIL 1	H	5.6	3.8	0	1	1	2	0.0002	0.0002
SOIL 1	I	5.6	4.2	1	3	0	.	.	.
SOIL 1	J	5.6	4.4	0	0	.	.	.	.
					1.40	0.25	2.5		0.0003
					1.26	0.46	0.71		0.0001

Appendix 5.1

(continued)

Sideoats Grama (Nursery-Provided) Test Results: pH, Emergence, Survival, Root Length and Dry Weight

SOIL	REP	INIT PH	FIN PH	EM 0	EM 21	SURV	RT LGTH	TOT DWT	MN DWT
		pH	pH	per 12	per 12	per 12	cm	g	g
SOIL 2	A	6.1	4.8	0	0	.	.	.	.
SOIL 2	B	6.1	4.3	0	0	.	.	.	.
SOIL 2	C	6.1	4.4	2	2	2	9	0.0071	0.0036
SOIL 2	D	6.1	4.2	0	0	.	.	.	.
SOIL 2	E	6.1	4	9	9	9	13	0.0573	0.0064
SOIL 2	F	6.1	4.7	12	12	12	14	0.1035	0.0086
SOIL 2	G	6.1	4.7	8	9	9	12	0.0577	0.0064
SOIL 2	H	6.1	5	8	8	8	12	0.0631	0.0079
SOIL 2	I	6.1	5.1	4	4	4	13	0.0272	0.0068
SOIL 2	J	6.1	4.7	0	0	.	.	.	.
					4.40	7.33	12.2		0.0066
					4.67	3.67	1.72		0.0017
SOIL 3	A	5.4	3.6	3	3	2	4	0.0045	0.0023
SOIL 3	B	5.4	3.6	7	8	7	21	0.0440	0.0063
SOIL 3	C	5.4	3.4	6	6	4	7	0.0227	0.0057
SOIL 3	D	5.4	3.4	7	8	8	15	0.0413	0.0052
SOIL 3	E	5.4	3.5	5	5	5	8	0.0200	0.0040
SOIL 3	F	5.4	3.7	4	8	7	12	0.0362	0.0052
SOIL 3	G	5.4	4	4	7	7	4	0.0201	0.0029
SOIL 3	H	5.4	3.5	7	10	10	15	0.0355	0.0036
SOIL 3	I	5.4	3.5	6	7	7	15	0.0304	0.0043
SOIL 3	J	5.4	3.6	5	6	6	14	0.0320	0.0053
					6.80	6.30	11.5		0.0045
					1.93	2.21	5.56		0.0013

Appendix 5.1

(continued)

Sideoats Grama (Nursery-Provided) Test Results: pH, Emergence, Survival, Root Length and Dry Weight

SOIL	REP	INIT PH	FIN PH	EM 0	EM 21	SURV	RT LGTH	TOT DWT	MN DWT
		pH	pH	per 12	per 12	per 12	cm	g	g
SOIL 4	A	4.9	3.5	2	2	1	7	0.0034	0.0034
SOIL 4	B	4.9	3.5	4	4	0	.	.	.
SOIL 4	C	4.9	3.4	5	5	5	11	0.0418	0.0084
SOIL 4	D	4.9	3.6	2	2	2	12	0.0068	0.0034
SOIL 4	E	4.9	3.5	1	2	1	16	0.0111	0.0111
SOIL 4	F	4.9	4.4	9	10	10	19	0.0900	0.0090
SOIL 4	G	4.9	3.5	10	10	9	13	0.0838	0.0093
SOIL 4	H	4.9	3.4	7	7	7	21	0.0655	0.0094
SOIL 4	I	4.9	3.5	6	7	7	6	0.0390	0.0056
SOIL 4	J	4.9	3.9	7	7	7	8	0.0534	0.0076
					5.60	4.90	12.6		0.0075
					3.10	3.63	5.27		0.0027
SOIL 5	A	5.8	3.5	9	10	9	12	0.0531	0.0059
SOIL 5	B	5.8	3.5	10	10	10	13	0.0632	0.0063
SOIL 5	C	5.8	3.4	11	11	11	13	0.0721	0.0066
SOIL 5	D	5.8	3.4	7	8	8	12	0.0335	0.0042
SOIL 5	E	5.8	3.6	8	8	8	12	0.0565	0.0071
SOIL 5	F	5.8	3.5	8	10	9	13	0.0585	0.0065
SOIL 5	G	5.8	3.5	8	9	8	13	0.0350	0.0044
SOIL 5	H	5.8	3.5	8	8	8	14	0.0413	0.0052
SOIL 5	I	5.8	3.4	8	10	10	12	0.0514	0.0051
SOIL 5	J	5.8	3.6	8	10	10	9	0.0355	0.0036
					9.40	9.10	12.3		0.0055
					1.07	1.10	1.34		0.0012

Appendix 5.1
(continued)
Sideoats Grama (Nursery-Provided) Test Results: pH, Emergence, Survival, Root Length and Dry Weight

SOIL	REP	INIT PH	FIN PH	EM 0	EM 21	SURV	RT LGTH	TOT DWT	MN DWT
		pH	pH	per 12	per 12	per 12	cm	g	g
SOIL 6	A	6.0	3.7	0	3	1	1	0.0016	0.0016
SOIL 6	B	6.0	5.1	1	3	0	.	.	.
SOIL 6	C	6.0	4.4	0	1	0	.	.	.
SOIL 6	D	6.0	5.6	1	2	1	2	0.0003	0.0003
SOIL 6	E	6.0	4.8	1	3	2	2	0.0015	0.0008
SOIL 6	F	6.0	5	2	5	1	2	0.0017	0.0017
SOIL 6	G	6.0	5.4	1	4	2	2	0.0031	0.0016
SOIL 6	H	6.0	5.4	1	4	1	1	0.0011	0.0011
SOIL 6	I	6.0	5.6	2	3	0	.	.	.
SOIL 6	J	6.0	5.8	4	5	2	1	0.0012	0.0006
					3.30	1.00	1.6		0.0011
					1.25	0.82	0.53		0.0006
SOIL 7	A	5.5	3.6	0	0	0	.	.	.
SOIL 7	B	5.5	5.3	0	0	0	.	.	.
SOIL 7	C	5.5	3.6	0	0	0	.	.	.
SOIL 7	D	5.5	3.6	0	0	0	.	.	.
SOIL 7	E	5.5	6	0	0	0	.	.	.
SOIL 7	F	5.5	3.8	0	0	0	.	.	.
SOIL 7	G	5.5	5.1	0	0	0	.	.	.
SOIL 7	H	5.5	5.1	0	0	0	.	.	.
SOIL 7	I	5.5	4.2	0	0	0	.	.	.
SOIL 7	J	5.5	5.6	0	0	0	.	.	.
					0.00	0.00	.		.
					0.00	0.00	.		.

Appendix 5.1
(continued)
Sideoats Grama (Nursery-Provided) Test Results: pH, Emergence, Survival, Root Length and Dry Weight

SOIL	REP	INIT PH	FIN PH	EM 0	EM 21	SURV	RT LGTH	TOT DWT	MN DWT
		pH	pH	per 12	per 12	per 12	cm	g	g
SOIL 8	A	6.3	3	6	6	0	.	.	.
SOIL 8	B	6.3	3.6	8	8	0	.	.	.
SOIL 8	C	6.3	3.5	3	3	0	.	.	.
SOIL 8	D	6.3	3	7	7	0	.	.	.
SOIL 8	E	6.3	3.4	7	7	1	1	0.0006	0.0006
SOIL 8	F	6.3	3	7	7	0	.	.	.
SOIL 8	G	6.3	3.8	7	9	0	.	.	.
SOIL 8	H	6.3	3.4	4	6	0	.	.	.
SOIL 8	I	6.3	3.2	7	7	0	.	.	.
SOIL 8	J	6.3	3.5	5	5	0	.	.	.
					6.50	0.10	1.0		0.0006
					1.65	0.32	.		.
SOIL 9	A	6.0	5.4	0	0	0	.	.	.
SOIL 9	B	6.0	5	0	0	0	.	.	.
SOIL 9	C	6.0	3.6	0	0	0	.	.	.
SOIL 9	D	6.0	3.8	0	0	0	.	.	.
SOIL 9	E	6.0	4	0	0	0	.	.	.
SOIL 9	F	6.0	3.8	0	0	0	.	.	.
SOIL 9	G	6.0	5.6	0	0	0	.	.	.
SOIL 9	H	6.0	5.2	0	0	0	.	.	.
SOIL 9	I	6.0	4.4	0	0	0	.	.	.
SOIL 9	J	6.0	5.4	0	0	0	.	.	.
					0.00	0.00	.		#DIV/0!
					0.00	0.00	.		#DIV/0!

Appendix 5.1

(continued)

Sideoats Grama (Nursery-Provided) Test Results: pH, Emergence, Survival, Root Length and Dry Weight

SOIL	REP	INIT PH	FIN PH	EM 0	EM 21	SURV	RT LGTH	TOT DWT	MN DWT
		pH	pH	per 12	per 12	per 12	cm	g	g
SOIL 10	A	5.8	6.2	0	2	1	1	0.0004	0.0004
SOIL 10	B	5.8	6.1	0	3	1	2	0.0028	0.0028
SOIL 10	C	5.8	4.8	0	4	0	.	.	.
SOIL 10	D	5.8	4.8	1	4	2	2	0.0048	0.0024
SOIL 10	E	5.8	5.1	0	3	0	.	.	.
SOIL 10	F	5.8	5.4	2	2	0	.	.	.
SOIL 10	G	5.8	5	1	2	1	2	0.0006	0.0006
SOIL 10	H	5.8	3.7	0	0	.	.	.	.
SOIL 10	I	5.8	4.1	1	1	0	.	.	.
SOIL 10	J	5.8	5.1	3	3	1	1	0.0021	0.0021
					2.40	0.67	1.6		0.0017
					1.26	0.71	0.55		0.0011
SOIL 11	A	5.7	6.1	1	1	1	1	0.0004	0.0004
SOIL 11	B	5.7	5.9	1	2	1	2	0.0014	0.0014
SOIL 11	C	5.7	5	0	3	0	.	.	.
SOIL 11	D	5.7	5.6	0	0	.	.	.	.
SOIL 11	E	5.7	5.8	0	0	.	.	.	.
SOIL 11	F	5.7	5.2	1	1	0	.	.	.
SOIL 11	G	5.7	5.4	1	4	0	.	.	.
SOIL 11	H	5.7	4.9	0	2	0	.	.	.
SOIL 11	I	5.7	5	0	2	0	.	.	.
SOIL 11	J	5.7	5.8	0	0	.	.	.	.
					1.50	0.29	1.5		0.0009
					1.35	0.49	0.71		0.0007

Appendix 5.1
(continued)

Sideoats Grama (Nursery-Provided) Test Results: pH, Emergence, Survival, Root Length and Dry Weight

SOIL	REP	INIT PH	FIN PH	EM 0	EM 21	SURV	RT LGTH	TOT DWT	MN DWT
		pH	pH	per 12	per 12	per 12	cm	g	g
SOIL 12	A	6.0	4.4	10	10	10	21	0.0570	0.0057
SOIL 12	B	6.0	4.3	10	10	10	23	0.0481	0.0048
SOIL 12	C	6.0	4	10	10	9	21	0.0575	0.0064
SOIL 12	D	6.0	4.2	11	11	11	19	0.0513	0.0047
SOIL 12	E	6.0	4.2	9	11	9	22	0.0509	0.0057
SOIL 12	F	6.0	4.9	10	11	11	22	0.0454	0.0041
SOIL 12	G	6.0	5.1	8	9	9	20	0.0499	0.0055
SOIL 12	H	6.0	4.8	9	11	9	21	0.0494	0.0055
SOIL 12	I	6.0	5	7	10	10	23	0.0466	0.0047
SOIL 12	J	6.0	4.6	8	8	8	18	0.0378	0.0047
					10.10	9.60	21.0		0.0052
					0.99	0.97	1.63		0.0007
SOIL 13	A	5.5	3	4	6	5	6	0.0165	0.0033
SOIL 13	B	5.5	3.8	9	11	9	4	0.0501	0.0056
SOIL 13	C	5.5	3.5	10	11	9	3	0.0377	0.0042
SOIL 13	D	5.5	3.5	12	12	11	4	0.0563	0.0051
SOIL 13	E	5.5	3.5	7	10	9	6	0.0327	0.0036
SOIL 13	F	5.5	3.6	6	7	3	4	0.0107	0.0036
SOIL 13	G	5.5	3.6	6	6	3	3	0.0081	0.0027
SOIL 13	H	5.5	3.4	11	11	9	4	0.0404	0.0045
SOIL 13	I	5.5	3.5	8	8	6	4	0.0219	0.0037
SOIL 13	J	5.5	3.6	8	9	9	4	0.0328	0.0036
					9.10	7.30	4.2		0.0040
					2.23	2.83	1.03		0.0009

Appendix 5.1
(continued)
Sideoats Grama (Nursery-Provided) Test Results: pH, Emergence, Survival, Root Length and Dry Weight

SOIL	REP	INIT PH	FIN PH	EM 0	EM 21	SURV	RT LGTH	TOT DWT	MN DWT
		pH	pH	per 12	per 12	per 12	cm	g	g
SOIL 14	A	5.4	3	0	0	.	.	.	.
SOIL 14	B	5.4	3	0	1	0	.	.	.
SOIL 14	C	5.4	3.4	0	0	.	.	.	.
SOIL 14	D	5.4	3	0	0	.	.	.	.
SOIL 14	E	5.4	3	0	0	.	.	.	.
SOIL 14	F	5.4	3	0	1	0	.	.	.
SOIL 14	G	5.4	3	0	1	0	.	.	.
SOIL 14	H	5.4	3.4	1	1	0	.	.	.
SOIL 14	I	5.4	3	0	0	.	.	.	.
SOIL 14	J	5.4	3	0	0	.	.	.	.
					0.40	0.00	.		.
					0.52	0.00	.		.
SOIL 15	A	5.7	3.7	0	1	0	.	.	.
SOIL 15	B	5.7	3.6	7	9	2	1	0.0022	0.0011
SOIL 15	C	5.7	3.4	7	8	0	.	.	.
SOIL 15	D	5.7	3.8	11	12	1	1	0.0034	0.0034
SOIL 15	E	5.7	3.5	9	9	1	0.25	0.0022	0.0022
SOIL 15	F	5.7	3.6	5	5	1	1	0.0021	0.0021
SOIL 15	G	5.7	3.8	5	6	1	1	0.0044	0.0044
SOIL 15	H	5.7	3.9	4	5	1	1	0.0013	0.0013
SOIL 15	I	5.7	4.2	0	0	.	.	.	.
SOIL 15	J	5.7	3.5	0	0	.	.	.	.
					5.50	0.88	0.9		0.0024
					4.14	0.64	0.31		0.0013

Appendix 5.1
(continued)
Sideoats Grama (Nursery-Provided) Test Results: pH, Emergence, Survival, Root Length and Dry Weight

SOIL	REP	INIT PH	FIN PH	EM 0	EM 21	SURV	RT LGTH	TOT DWT	MN DWT
		pH	pH	per 12	per 12	per 12	cm	g	g
SOIL 16	A	5.8	3.4	1	2	0	.	.	.
SOIL 16	B	5.8	3	2	3	2	0.25	0.0008	0.0004
SOIL 16	C	5.8	3.4	4	7	3	1	0.0026	0.0009
SOIL 16	D	5.8	3.4	2	6	3	1	0.0022	0.0007
SOIL 16	E	5.8	3	3	8	3	1	0.0025	0.0008
SOIL 16	F	5.8	3	5	9	6	1	0.0075	0.0013
SOIL 16	G	5.8	3	5	6	4	1	0.0037	0.0009
SOIL 16	H	5.8	3.4	5	7	5	0.25	0.0034	0.0007
SOIL 16	I	5.8	3.4	3	6	4	1	0.0036	0.0009
SOIL 16	J	5.8	3	0	0	.	.	.	.
					5.40	3.33	0.8		0.0008
					2.84	1.73	0.35		0.0002
SOIL 17	A	5.3	4.6	10	10	10	18	0.0309	0.0031
SOIL 17	B	5.3	4.3	9	9	9	19	0.0324	0.0036
SOIL 17	C	5.3	4.4	10	10	10	5	0.0539	0.0054
SOIL 17	D	5.3	4.4	11	12	12	11	0.0480	0.0040
SOIL 17	E	5.3	4.6	8	8	8	9	0.0419	0.0052
SOIL 17	F	5.3	4.8	8	8	8	21	0.0288	0.0036
SOIL 17	G	5.3	4.4	5	8	8	20	0.0232	0.0029
SOIL 17	H	5.3	4.4	6	7	7	23	0.0313	0.0045
SOIL 17	I	5.3	4.6	10	10	10	15	0.0275	0.0028
SOIL 17	J	5.3	4.4	10	11	11	21	0.0329	0.0030
					9.30	9.30	16.2		0.0038
					1.57	1.57	6.00		0.0010

Appendix 5.1

(continued)

Sideoats Grama (Nursery-Provided) Test Results: pH, Emergence, Survival, Root Length and Dry Weight

SOIL	REP	INIT PH	FIN PH	EM 0	EM 21	SURV	RT LGTH	TOT DWT	MN DWT
		pH	pH	per 12	per 12	per 12	cm	g	g
SOIL 19	A	6.3	5.1	0	0	.	.	.	.
SOIL 19	B	6.3	5.8	0	2	0	.	.	.
SOIL 19	C	6.3	5.2	0	0	.	.	.	.
SOIL 19	D	6.3	5.6	0	1	0	.	.	.
SOIL 19	E	6.3	5.6	0	0	.	.	.	.
SOIL 19	F	6.3	4.7	0	0	.	.	.	.
SOIL 19	G	6.3	5.2	0	1	0	.	.	.
SOIL 19	H	6.3	4.5	0	0	.	.	.	.
SOIL 19	I	6.3	3.8	0	1	1	1	0.0005	0.0005
SOIL 19	J	6.3	5.4	0	0	.	.	.	.
					0.50	0.25	1.0		0.0005
					0.71	0.50	.		.
SOIL 20	A	6.2	5.2	7	8	6	6	0.0234	0.0039
SOIL 20	B	6.2	5.2	10	11	10	12	0.0433	0.0043
SOIL 20	C	6.2	5.2	9	10	9	17	0.0381	0.0042
SOIL 20	D	6.2	5.2	10	10	10	14	0.0426	0.0043
SOIL 20	E	6.2	5	7	10	9	11	0.0313	0.0035
SOIL 20	F	6.2	5.4	7	11	11	13	0.0601	0.0055
SOIL 20	G	6.2	5.4	7	8	7	15	0.0294	0.0042
SOIL 20	H	6.2	5	10	10	10	13	0.0574	0.0057
SOIL 20	I	6.2	5.2	10	11	10	23	0.0697	0.0070
SOIL 20	J	6.2	5.4	10	12	12	16	0.0660	0.0055
					10.10	9.40	14.0		0.0048
					1.29	1.78	4.40		0.0011

Appendix 5.1
(continued)
Sideoats Grama (Nursery-Provided) Test Results: pH, Emergence, Survival, Root Length and Dry Weight

SOIL	REP	INIT PH	FIN PH	EM 0	EM 21	SURV	RT LGTH	TOT DWT	MN DWT
		pH	pH	per 12	per 12	per 12	cm	g	g
SOIL 21	A	6.0	4.2	0	2	0	.	.	.
SOIL 21	B	6.0	5.2	2	11	3	2	0.0042	0.0014
SOIL 21	C	6.0	4.2	0	1	0	.	.	.
SOIL 21	D	6.0	4.5	0	4	0	.	.	.
SOIL 21	E	6.0	4.2	0	1	1	1	0.0006	0.0006
SOIL 21	F	6.0	4.8	0	1	0	.	.	.
SOIL 21	G	6.0	5.8	0	2	0	.	.	.
SOIL 21	H	6.0	5.8	0	0	.	.	.	.
SOIL 21	I	6.0	4.4	0	2	2	1	0.0032	0.0016
SOIL 21	J	6.0	4.6	0	0	.	.	.	.
					2.40	0.75	1.3		0.0012
					3.24	1.16	0.58		0.0005
SOIL 22	A	6.1	4.3	0	1	0	.	.	.
SOIL 22	B	6.1	5.8	0	2	1	0.25	0.0005	0.0005
SOIL 22	C	6.1	5.4	0	2	0	.	.	.
SOIL 22	D	6.1	5.2	2	3	0	.	.	.
SOIL 22	E	6.1	4.8	0	1	0	.	.	.
SOIL 22	F	6.1	6	0	0	.	.	.	.
SOIL 22	G	6.1	4.9	0	0	.	.	.	.
SOIL 22	H	6.1	5.9	0	2	1	0.25	0.0003	0.0003
SOIL 22	I	6.1	4.7	1	3	0	.	.	.
SOIL 22	J	6.1	5.7	0	0	.	.	.	.
					1.40	0.29	0.3		0.0004
					1.17	0.49	0.00		0.0001

Appendix 5.1

(continued)

Sideoats Grama (Nursery-Provided) Test Results: pH, Emergence, Survival, Root Length and Dry Weight

SOIL	REP	INIT PH	FIN PH	EM 0	EM 21	SURV	RT LGTH	TOT DWT	MN DWT
		pH	pH	per 12	per 12	per 12	cm	g	g
SOIL 23	A	6.4	6.4	1	2	1	2	0.0008	0.0008
SOIL 23	B	6.4	5.8	2	5	1	2	0.0010	0.0010
SOIL 23	C	6.4	6.5	1	2	0	.	.	.
SOIL 23	D	6.4	6.2	0	2	0	.	.	.
SOIL 23	E	6.4	6.4	1	3	1	2	0.0010	0.0010
SOIL 23	F	6.4	6.6	0	4	1	1	0.0001	0.0001
SOIL 23	G	6.4	6	0	3	0	.	.	.
SOIL 23	H	6.4	6.2	0	2	0	.	.	.
SOIL 23	I	6.4	6.1	0	2	2	1	0.0011	0.0006
SOIL 23	J	6.4	6.2	0	2	0	.	.	.
					2.70	0.60	1.6		0.0007
					1.06	0.70	0.55		0.0004
SOIL 24	A	6.0	4.3	9	10	10	31	0.0841	0.0084
SOIL 24	B	6.0	4.6	7	9	9	23	0.0594	0.0066
SOIL 24	C	6.0	5	4	8	8	24	0.0504	0.0063
SOIL 24	D	6.0	4.4	6	6	6	25	0.0652	0.0109
SOIL 24	E	6.0	4.6	8	10	10	26	0.0728	0.0073
SOIL 24	F	6.0	5.1	8	9	8	26	0.0931	0.0116
SOIL 24	G	6.0	5	6	10	10	13	0.0786	0.0079
SOIL 24	H	6.0	5.1	5	5	5	27	0.0364	0.0073
SOIL 24	I	6.0	4.7	7	8	8	19	0.0676	0.0085
SOIL 24	J	6.0	5.1	9	10	9	15	0.0841	0.0093
					8.50	8.30	22.9		0.0084
					1.78	1.70	5.61		0.0018

Appendix 5.1
(continued)
Sideoats Grama (Nursery-Provided) Test Results: pH, Emergence, Survival, Root Length and Dry Weight

SOIL	REP	INIT PH	FIN PH	EM 0	EM 21	SURV	RT LGTH	TOT DWT	MN DWT
		pH	pH	per 12	per 12	per 12	cm	g	g
SOIL 25	A	5.3	5.3	11	11	11	24	0.0890	0.0081
SOIL 25	B	5.3	5.4	8	9	9	15	0.1022	0.0114
SOIL 25	C	5.3	5.6	10	10	10	22	0.0579	0.0058
SOIL 25	D	5.3	5.8	7	8	8	19	0.0623	0.0078
SOIL 25	E	5.3	5.4	8	9	9	16	0.0456	0.0051
SOIL 25	F	5.3	5.8	10	11	10	20	0.0958	0.0096
SOIL 25	G	5.3	5.2	11	11	10	12	0.0725	0.0073
SOIL 25	H	5.3	5.6	11	11	11	18	0.0783	0.0071
SOIL 25	I	5.3	5.7	8	9	8	32	0.0531	0.0066
SOIL 25	J	5.3	5.4	10	10	10	24	0.0678	0.0068
					9.90	9.60	20.2		0.0075
					1.10	1.07	5.67		0.0018
SOIL 26	A	6.0	4	10	11	11	15	0.0385	0.0035
SOIL 26	B	6.0	4.2	11	11	9	24	0.0456	0.0051
SOIL 26	C	6.0	4	9	9	8	11	0.0338	0.0042
SOIL 26	D	6.0	3.8	10	10	9	18	0.0551	0.0061
SOIL 26	E	6.0	3.7	10	10	9	19	0.0683	0.0076
SOIL 26	F	6.0	5.2	8	8	8	21	0.0405	0.0051
SOIL 26	G	6.0	5.2	9	9	9	22	0.0427	0.0047
SOIL 26	H	6.0	5.2	10	10	10	13	0.0489	0.0049
SOIL 26	I	6.0	5	10	11	10	20	0.0538	0.0054
SOIL 26	J	6.0	4.8	9	10	9	14	0.0466	0.0052
					9.90	9.20	17.7		0.0052
					0.99	0.92	4.27		0.0011

Appendix 5.1
(continued)
Sideoats Grama (Nursery-Provided) Test Results: pH, Emergence, Survival, Root Length and Dry Weight

SOIL	REP	INIT PH	FIN PH	EM 0	EM 21	SURV	RT LGTH	TOT DWT	MN DWT
		pH	pH	per 12	per 12	per 12	cm	g	g
SOIL 27	A	6.2	5.8	3	6	5	1	0.0058	0.0012
SOIL 27	B	6.2	4.8	3	7	6	1	0.0135	0.0023
SOIL 27	C	6.2	4.4	4	10	8	1	0.0126	0.0016
SOIL 27	D	6.2	4.3	6	9	7	2	0.0143	0.0020
SOIL 27	E	6.2	5.1	7	10	8	2	0.0163	0.0020
SOIL 27	F	6.2	5.8	8	10	9	1	0.0235	0.0026
SOIL 27	G	6.2	4	4	5	3	1	0.0035	0.0012
SOIL 27	H	6.2	4.3	6	9	5	1	0.0101	0.0020
SOIL 27	I	6.2	4.2	9	11	7	1	0.0160	0.0023
SOIL 27	J	6.2	5.4	7	7	6	2	0.0127	0.0021
					8.40	6.40	1.3		0.0019
					2.01	1.78	0.48		0.0005
SOIL 28	A	6.8	4	10	10	10	23	0.0555	0.0056
SOIL 28	B	6.8	4	6	8	8	24	0.0500	0.0063
SOIL 28	C	6.8	4.2	9	9	9	22	0.0517	0.0057
SOIL 28	D	6.8	3.8	7	8	8	12	0.0408	0.0051
SOIL 28	E	6.8	4	9	10	10	27	0.0554	0.0055
SOIL 28	F	6.8	4.6	9	10	10	24	0.0800	0.0080
SOIL 28	G	6.8	5	10	11	10	22	0.0593	0.0059
SOIL 28	H	6.8	4.3	9	10	10	22	0.0533	0.0053
SOIL 28	I	6.8	4.3	11	11	11	21	0.0543	0.0049
SOIL 28	J	6.8	4.6	11	11	11	18	0.0659	0.0060
					9.80	9.70	21.5		0.0058
					1.14	1.06	4.06		0.0009

Appendix 5.1

(continued)

Sideoats Grama (Nursery-Provided) Test Results: pH, Emergence, Survival, Root Length and Dry Weight

SOIL	REP	INIT PH	FIN PH	EM 0	EM 21	SURV	RT LGTH	TOT DWT	MN DWT
		pH	pH	per 12	per 12	per 12	cm	g	g
SOIL 29	A	5.4	5.5	1	8	6	1	0.0074	0.0012
SOIL 29	B	5.4	6.2	3	7	6	1	0.0038	0.0006
SOIL 29	C	5.4	5.6	3	4	4	2	0.0070	0.0018
SOIL 29	D	5.4	5.3	5	7	4	1	0.0038	0.0010
SOIL 29	E	5.4	5.7	6	7	5	2	0.0052	0.0010
SOIL 29	F	5.4	6	5	8	4	1	0.0033	0.0008
SOIL 29	G	5.4	5.2	6	8	4	1	0.0049	0.0012
SOIL 29	H	5.4	5.1	0	3	0	.	.	.
SOIL 29	I	5.4	5.4	4	5	3	1	0.0026	0.0009
SOIL 29	J	5.4	6.5	6	8	0	.	.	.
					6.50	3.60	1.3		0.0011
					1.84	2.12	0.46		0.0003
SOIL 30	A	4.2	6.8	0	0	.	.	.	.
SOIL 30	B	4.2	6	0	0	.	.	.	.
SOIL 30	C	4.2	6.2	0	0	.	.	.	.
SOIL 30	D	4.2	6	0	1	0	.	.	.
SOIL 30	E	4.2	6.2	0	0	.	.	.	.
SOIL 30	F	4.2	6.5	0	0	.	.	.	.
SOIL 30	G	4.2	6	0	1	0	.	.	.
SOIL 30	H	4.2	5.8	0	0	.	.	.	.
SOIL 30	I	4.2	5	0	0	.	.	.	.
SOIL 30	J	4.2	5.4	0	0	.	.	.	.
					0.20	0.00	.		.
					0.42	0.00	.		.

Appendix 5.1
(continued)
Sideoats Grama (Nursery-Provided) Test Results: pH, Emergence, Survival, Root Length and Dry Weight

SOIL	REP	INIT PH	FIN PH	EM 0	EM 21	SURV	RT LGTH	TOT DWT	MN DWT
		pH	pH	per 12	per 12	per 12	cm	g	g
SOIL 31	A	6.3	5	6	8	8	15	0.0369	0.0046
SOIL 31	B	6.3	4	4	5	4	6	0.0194	0.0049
SOIL 31	C	6.3	4.4	6	8	7	9	0.0198	0.0028
SOIL 31	D	6.3	4.2	6	6	4	6	0.0146	0.0037
SOIL 31	E	6.3	4.3	8	8	7	11	0.0280	0.0040
SOIL 31	F	6.3	4.7	7	7	5	4	0.0174	0.0035
SOIL 31	G	6.3	3.7	5	8	7	10	0.0294	0.0042
SOIL 31	H	6.3	4.2	5	8	7	13	0.0271	0.0039
SOIL 31	I	6.3	4	4	5	5	8	0.0229	0.0046
SOIL 31	J	6.3	4.2	7	8	7	7	0.0184	0.0026
					7.10	6.10	8.9		0.0039
					1.29	1.45	3.41		0.0007
SOIL 32	A	6.6	4	1	3	3	1	0.0034	0.0011
SOIL 32	B	6.6	3.6	3	6	5	2	0.0048	0.0010
SOIL 32	C	6.6	4.4	0	5	5	1	0.0017	0.0003
SOIL 32	D	6.6	4.6	1	2	1	1	0.0018	0.0018
SOIL 32	E	6.6	5.2	1	5	2	1	0.0016	0.0008
SOIL 32	F	6.6	3.5	4	6	0	.	.	.
SOIL 32	G	6.6	3.5	2	5	4	1	0.0028	0.0007
SOIL 32	H	6.6	3.6	1	6	1	0.25	0.0002	0.0002
SOIL 32	I	6.6	3.8	0	2	2	2	0.0005	0.0003
SOIL 32	J	6.6	4	4	8	2	1	0.0012	0.0006
					4.80	2.50	1.1		0.0008
					1.93	1.72	0.55		0.0005

Appendix 5.1

(continued)

Sideoats Grama (Nursery-Provided) Test Results: pH, Emergence, Survival, Root Length and Dry Weight

SOIL	REP	INIT PH	FIN PH	EM 0	EM 21	SURV	RT LGTH	TOT DWT	MN DWT
		pH	pH	per 12	per 12	per 12	cm	g	g
SOIL 35	A	4.9	3.9	0	0	.	.	.	.
SOIL 35	B	4.9	4.1	0	0	.	.	.	.
SOIL 35	C	4.9	3	0	0	.	.	.	.
SOIL 35	D	4.9	3.9	0	0	.	.	.	.
SOIL 35	E	4.9	3.4	0	0	.	.	.	.
SOIL 35	F	4.9	4.7	0	0	.	.	.	.
SOIL 35	G	4.9	4.5	0	0	.	.	.	.
SOIL 35	H	4.9	3.9	0	0	.	.	.	.
SOIL 35	I	4.9	3.9	0	0	.	.	.	.
SOIL 35	J	4.9	3.5	0	0	.	.	.	.
					0.00	.	.		.
					0.00	.	.		.
SOIL 36	A	5.1	5	0	0	.	.	.	.
SOIL 36	B	5.1	4.6	0	1	0	.	.	.
SOIL 36	C	5.1	4.8	0	0	.	.	.	.
SOIL 36	D	5.1	5.4	0	0	.	.	.	.
SOIL 36	E	5.1	5.7	0	0	.	.	.	.
SOIL 36	F	5.1	5.9	0	0	.	.	.	.
SOIL 36	G	5.1	6	0	0	.	.	.	.
SOIL 36	H	5.1	5	0	0	.	.	.	.
SOIL 36	I	5.1	6.2	0	0	.	.	.	.
SOIL 36	J	5.1	4.6	0	0	.	.	.	.
					0.10	0.00	.		.
					0.32	.	.		.

Appendix 5.2

Sideoats Grama (Nursery-Provided) Test Results: Height

SOIL	REP	MN HT	HT1	HT2	HT3	HT4	HT5	HT6	HT7	HT8	HT9	HT10	HT11	HT12
		cm	cm											
NC	A	7.7	10	20	3	4	7	7	3	.	.	.	.	.
NC	B	11.5	21	12	11	10	14	14	11	15	11	4	8	7
NC	C	10.7	4	13	12	13	15	11	7	.	.	.	.	.
NC	D	13.0	15	11	15	7	12	13	24	7	.	.	.	.
NC	E	12.4	11	14	14	14	6	9	19	.	.	.	.	.
NC	F	10.0	5	15	.	.	.	.	.	.	.	.	.	.
NC	G	10.0	7	12	12	9	.	.	.	.	.	.	.	.
NC	H	9.1	8	11	10	8	4	14	9	.	.	.	.	.
NC	I	7.0	8	6	.	.	.	.	.	.	.	.	.	.
NC	J	9.8	14	10	13	8	4	.	.	.	.	.	.	.
		10.1												
		1.90												
SOIL 1	A	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 1	B	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 1	C	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 1	D	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 1	E	0.3	0.25	.	.	.	.	.	.	.	.	.	.	.
SOIL 1	F	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 1	G	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 1	H	1.0	1	.	.	.	.	.	.	.	.	.	.	.
SOIL 1	I	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 1	J	.	.	.	.	.	.	.	.	.	.	.	.	.
		0.6												
		0.53												

Appendix 5.2

(continued)

Sideoats Grama (Nursery-Provided) Test Results: Height

SOIL	REP	MN HT	HT1	HT2	HT3	HT4	HT5	HT6	HT7	HT8	HT9	HT10	HT11	HT12
		cm	cm											
SOIL 2	A	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 2	B	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 2	C	6.0	5	7	.	.	.	.	.	.	.	.	.	.
SOIL 2	D	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 2	E	5.7	8	3	5	5	6	6	8	4	6	.	.	.
SOIL 2	F	7.1	3	9	7	8	6	5	8	8	9	6	7	9
SOIL 2	G	7.6	8	7	8	10	7	7	7	7	.	.	.	.
SOIL 2	H	7.8	5	8	7	6	8	9	11	8	.	.	.	.
SOIL 2	I	6.5	7	10	6	3	.	.	.	.	.	.	.	.
SOIL 2	J	.	.	.	.	.	.	.	.	.	.	.	.	.
		6.8												
		0.86												
SOIL 3	A	4.5	1	8	.	.	.	.	.	.	.	.	.	.
SOIL 3	B	6.7	7	7	4	5	6	9	9	.	.	.	.	.
SOIL 3	C	4.5	4	6	4	4	.	.	.	.	.	.	.	.
SOIL 3	D	5.3	7	5	4	5	6	8	5	2	.	.	.	.
SOIL 3	E	4.8	5	7	4	2	6	.	.	.	.	.	.	.
SOIL 3	F	5.6	4	6	6	5	7	5	6	.	.	.	.	.
SOIL 3	G	4.1	4	4	4	4	5	4	4	.	.	.	.	.
SOIL 3	H	3.8	3	4	4	2	1	2	6	5	5	6	.	.
SOIL 3	I	5.0	6	4	5	4	5	5	6	.	.	.	.	.
SOIL 3	J	5.5	4	5	4	9	5	6	.	.	.	.	.	.
		5.0												
		0.84												

Appendix 5.2
(continued)
Sideoats Grama (Nursery-Provided) Test Results: Height

SOIL	REP	MN HT	HT1	HT2	HT3	HT4	HT5	HT6	HT7	HT8	HT9	HT10	HT11	HT12
		cm	cm											
SOIL 4	A	1.0	1	.	.	.	.	.	.	.	.	.	.	.
SOIL 4	B	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 4	C	8.0	7	8	8	11	6	.	.	.	.	.	.	.
SOIL 4	D	4.0	6	2	.	.	.	.	.	.	.	.	.	.
SOIL 4	E	9.0	9	.	.	.	.	.	.	.	.	.	.	.
SOIL 4	F	6.8	12	6	3	7	6	6	8	7	5	8	.	.
SOIL 4	G	8.2	6	5	10	12	7	9	8	7	10	.	.	.
SOIL 4	H	9.1	5	11	8	10	12	12	6	.	.	.	.	.
SOIL 4	I	6.0	6	9	2	4	4	7	10	.	.	.	.	.
SOIL 4	J	6.6	10	5	6	6	4	10	5	.	.	.	.	.
		6.5												
		2.63												
SOIL 5	A	6.2	7	6	6	8	4	5	7	6	7	.	.	.
SOIL 5	B	6.1	4	5	8	6	7	7	5	6	5	8	.	.
SOIL 5	C	6.0	5	6	4	4	7	8	6	7	5	8	6	.
SOIL 5	D	5.6	7	4	6	2	6	10	5	5	.	.	.	.
SOIL 5	E	7.1	5	11	6	9	6	7	6	7	.	.	.	.
SOIL 5	F	5.1	6	6	4	3	6	6	4	7	4	.	.	.
SOIL 5	G	5.5	7	6	6	3	5	5	7	5	.	.	.	.
SOIL 5	H	5.1	4	5	7	5	5	5	4	6	.	.	.	.
SOIL 5	I	6.0	7	2	4	8	5	8	8	7	8	3	.	.
SOIL 5	J	4.6	4	6	4	4	7	4	4	4	4	5	.	.
		5.7												
		0.71												

Appendix 5.2

(continued)

Sideoats Grama (Nursery-Provided) Test Results: Height

SOIL	REP	MN HT	HT1	HT2	HT3	HT4	HT5	HT6	HT7	HT8	HT9	HT10	HT11	HT12
		cm	cm											
SOIL 6	A	2.0	2	.	.	.	.	.	.	.	.	.	.	.
SOIL 6	B	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 6	C	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 6	D	1.0	1	.	.	.	.	.	.	.	.	.	.	.
SOIL 6	E	1.1	0.25	2	.	.	.	.	.	.	.	.	.	.
SOIL 6	F	3.0	3	.	.	.	.	.	.	.	.	.	.	.
SOIL 6	G	2.0	2	2	.	.	.	.	.	.	.	.	.	.
SOIL 6	H	1.0	1	.	.	.	.	.	.	.	.	.	.	.
SOIL 6	I	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 6	J	1.5	2	1	.	.	.	.	.	.	.	.	.	.
		1.7												
		0.73												
SOIL 7	A	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 7	B	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 7	C	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 7	D	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 7	E	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 7	F	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 7	G	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 7	H	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 7	I	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 7	J	.	.	.	.	.	.	.	.	.	.	.	.	.
		.												
		.												

Appendix 5.2

(continued)

Sideoats Grama (Nursery-Provided) Test Results: Height

SOIL	REP	MN HT	HT1	HT2	HT3	HT4	HT5	HT6	HT7	HT8	HT9	HT10	HT11	HT12
		cm	cm											
SOIL 8	A	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 8	B	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 8	C	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 8	D	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 8	E	1.0	1	.	.	.	.	.	.	.	.	.	.	.
SOIL 8	F	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 8	G	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 8	H	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 8	I	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 8	J	.	.	.	.	.	.	.	.	.	.	.	.	.
		1.0												
		.												
SOIL 9	A	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 9	B	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 9	C	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 9	D	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 9	E	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 9	F	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 9	G	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 9	H	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 9	I	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 9	J	.	.	.	.	.	.	.	.	.	.	.	.	.
		#DIV/0!												
		#DIV/0!												

Appendix 5.2
(continued)
Sideoats Grama (Nursery-Provided) Test Results: Height

SOIL	REP	MN HT	HT1	HT2	HT3	HT4	HT5	HT6	HT7	HT8	HT9	HT10	HT11	HT12
		cm	cm											
SOIL 10	A	1.0	1	.	.	.	.	.	.	.	.	.	.	.
SOIL 10	B	1.0	1	.	.	.	.	.	.	.	.	.	.	.
SOIL 10	C	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 10	D	1.5	2	1	.	.	.	.	.	.	.	.	.	.
SOIL 10	E	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 10	F	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 10	G	1.0	1	.	.	.	.	.	.	.	.	.	.	.
SOIL 10	H	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 10	I	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 10	J	1.0	1	.	.	.	.	.	.	.	.	.	.	.
		1.1												
		0.22												
SOIL 11	A	1.0	1	.	.	.	.	.	.	.	.	.	.	.
SOIL 11	B	2.0	2	.	.	.	.	.	.	.	.	.	.	.
SOIL 11	C	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 11	D	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 11	E	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 11	F	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 11	G	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 11	H	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 11	I	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 11	J	.	.	.	.	.	.	.	.	.	.	.	.	.
		1.5												
		0.71												

Appendix 5.2

(continued)

Sideoats Grama (Nursery-Provided) Test Results: Height

SOIL	REP	MN HT	HT1	HT2	HT3	HT4	HT5	HT6	HT7	HT8	HT9	HT10	HT11	HT12
		cm	cm											
SOIL 12	A	5.6	8	3	4	5	7	5	7	8	4	5	.	.
SOIL 12	B	5.8	8	6	6	4	2	7	5	8	7	5	.	.
SOIL 12	C	5.8	5	5	7	5	5	7	7	6	5	.	.	.
SOIL 12	D	5.9	5	7	6	7	5	4	7	6	7	6	5	.
SOIL 12	E	5.4	9	5	6	6	4	6	5	3	5	.	.	.
SOIL 12	F	5.6	8	5	7	5	5	2	5	6	6	7	6	.
SOIL 12	G	6.6	6	6	4	9	6	7	7	9	5	.	.	.
SOIL 12	H	6.8	8	8	6	7	6	5	8	6	7	.	.	.
SOIL 12	I	5.1	7	7	6	2	7	4	5	6	6	1	.	.
SOIL 12	J	6.1	7	2	6	6	7	6	8	7	.	.	.	.
		5.9												
		0.50												
SOIL 13	A	2.8	2	5	4	1	2	.	.	.	.	.	.	.
SOIL 13	B	4.6	3	5	5	5	4	5	5	5	4	.	.	.
SOIL 13	C	3.7	4	3	2	3	5	3	4	5	4	.	.	.
SOIL 13	D	3.9	3	6	4	4	2	5	2	5	4	5	3	.
SOIL 13	E	4.1	3	2	3	4	2	4	7	3	9	.	.	.
SOIL 13	F	3.3	4	4	2	.	.	.	.	.	.	.	.	.
SOIL 13	G	2.3	2	1	4	.	.	.	.	.	.	.	.	.
SOIL 13	H	3.8	4	3	5	3	6	2	4	3	4	.	.	.
SOIL 13	I	4.0	4	4	4	5	3	4	.	.	.	.	.	.
SOIL 13	J	3.7	3	3	2	3	4	7	4	4	3	.	.	.
		3.6												
		0.65												

Appendix 5.2
(continued)
Sideoats Grama (Nursery-Provided) Test Results: Height

SOIL	REP	MN HT	HT1	HT2	HT3	HT4	HT5	HT6	HT7	HT8	HT9	HT10	HT11	HT12
		cm	cm											
SOIL 14	A	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 14	B	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 14	C	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 14	D	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 14	E	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 14	F	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 14	G	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 14	H	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 14	I	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 14	J	.	.	.	.	.	.	.	.	.	.	.	.	.
		.												
		.												
SOIL 15	A	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 15	B	2.0	1	3	.	.	.	.	.	.	.	.	.	.
SOIL 15	C	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 15	D	3.0	3	.	.	.	.	.	.	.	.	.	.	.
SOIL 15	E	2.0	2	.	.	.	.	.	.	.	.	.	.	.
SOIL 15	F	2.0	2	.	.	.	.	.	.	.	.	.	.	.
SOIL 15	G	3.0	3	.	.	.	.	.	.	.	.	.	.	.
SOIL 15	H	2.0	2	.	.	.	.	.	.	.	.	.	.	.
SOIL 15	I	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 15	J	.	.	.	.	.	.	.	.	.	.	.	.	.
		2.3												
		0.52												

Appendix 5.2
(continued)
Sideoats Grama (Nursery-Provided) Test Results: Height

SOIL	REP	MN HT	HT1	HT2	HT3	HT4	HT5	HT6	HT7	HT8	HT9	HT10	HT11	HT12
		cm	cm											
SOIL 16	A	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 16	B	1.0	1	1	.	.	.	.	.	.	.	.	.	.
SOIL 16	C	1.0	1	1	1	.	.	.	.	.	.	.	.	.
SOIL 16	D	0.5	1	0.25	0.25	.	.	.	.	.	.	.	.	.
SOIL 16	E	1.1	2	0.25	1	.	.	.	.	.	.	.	.	.
SOIL 16	F	1.4	1	1	0.25	2	2	2	.	.	.	.	.	.
SOIL 16	G	1.3	1	1	1	2	.	.	.	.	.	.	.	.
SOIL 16	H	0.9	0.25	1	0.25	2	1	.	.	.	.	.	.	.
SOIL 16	I	1.5	2	1	1	2	.	.	.	.	.	.	.	.
SOIL 16	J	.	.	.	.	.	.	.	.	.	.	.	.	.
		1.1												
		0.31												
SOIL 17	A	6.2	7	6	7	6	5	6	7	7	7	4	.	.
SOIL 17	B	5.7	8	5	6	5	5	9	4	3	6	.	.	.
SOIL 17	C	5.9	5	5	6	7	4	5	6	7	6	8	.	.
SOIL 17	D	5.0	6	3	6	5	4	5	6	6	5	6	5	3
SOIL 17	E	4.6	4	5	7	2	2	5	6	6	.	.	.	.
SOIL 17	F	5.3	7	4	4	4	5	6	7	5	.	.	.	.
SOIL 17	G	4.3	3	6	4	5	3	4	5	4	.	.	.	.
SOIL 17	H	5.6	6	5	4	6	6	8	4	.	.	.	.	.
SOIL 17	I	4.5	4	2	7	2	6	4	7	3	4	6	.	.
SOIL 17	J	4.9	6	5	2	5	4	7	2	8	6	4	5	.
		5.2												
		0.64												

Appendix 5.2
(continued)
Sideoats Grama (Nursery-Provided) Test Results: Height

SOIL	REP	MN HT	HT1	HT2	HT3	HT4	HT5	HT6	HT7	HT8	HT9	HT10	HT11	HT12
		cm	cm											
SOIL 19	A	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 19	B	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 19	C	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 19	D	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 19	E	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 19	F	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 19	G	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 19	H	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 19	I	0.3	0.25	.	.	.	.	.	.	.	.	.	.	.
SOIL 19	J	.	.	.	.	.	.	.	.	.	.	.	.	.
		0.3												
		.												
SOIL 20	A	5.7	5	4	5	9	6	5	.	.	.	.	.	.
SOIL 20	B	5.9	3	7	4	6	7	7	5	8	6	6	.	.
SOIL 20	C	6.8	7	4	7	4	8	5	10	8	8	.	.	.
SOIL 20	D	5.9	8	5	5	6	5	9	6	5	5	5	.	.
SOIL 20	E	5.6	7	2	4	6	6	6	5	8	6	.	.	.
SOIL 20	F	5.7	7	8	6	5	4	8	5	6	6	6	2	.
SOIL 20	G	4.7	4	3	6	6	2	4	8	.	.	.	.	.
SOIL 20	H	6.6	10	6	8	7	2	6	6	8	5	8	.	.
SOIL 20	I	6.8	5	10	7	3	9	7	9	8	6	4	.	.
SOIL 20	J	7.0	7	8	8	8	7	7	6	8	5	8	8	4
		6.1												
		0.72												

Appendix 5.2

(continued)

Sideoats Grama (Nursery-Provided) Test Results: Height

SOIL	REP	MN HT	HT1	HT2	HT3	HT4	HT5	HT6	HT7	HT8	HT9	HT10	HT11	HT12
		cm	cm											
SOIL 21	A	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 21	B	1.7	1	2	2	.	.	.	.	.	.	.	.	.
SOIL 21	C	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 21	D	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 21	E	1.0	1	.	.	.	.	.	.	.	.	.	.	.
SOIL 21	F	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 21	G	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 21	H	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 21	I	0.6	1	0.25	.	.	.	.	.	.	.	.	.	.
SOIL 21	J	.	.	.	.	.	.	.	.	.	.	.	.	.
		1.1												
		0.53												
SOIL 22	A	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 22	B	2.0	2	.	.	.	.	.	.	.	.	.	.	.
SOIL 22	C	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 22	D	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 22	E	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 22	F	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 22	G	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 22	H	0.3	0.25	.	.	.	.	.	.	.	.	.	.	.
SOIL 22	I	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 22	J	.	.	.	.	.	.	.	.	.	.	.	.	.
		1.1												
		1.24												

Appendix 5.2

(continued)

Sideoats Grama (Nursery-Provided) Test Results: Height

SOIL	REP	MN HT	HT1	HT2	HT3	HT4	HT5	HT6	HT7	HT8	HT9	HT10	HT11	HT12
		cm	cm											
SOIL 23	A	1.0	1	.	.	.	.	.	.	.	.	.	.	.
SOIL 23	B	0.3	0.25	.	.	.	.	.	.	.	.	.	.	.
SOIL 23	C	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 23	D	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 23	E	2.0	2	.	.	.	.	.	.	.	.	.	.	.
SOIL 23	F	0.3	0.25	.	.	.	.	.	.	.	.	.	.	.
SOIL 23	G	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 23	H	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 23	I	0.6	1	0.25	.	.	.	.	.	.	.	.	.	.
SOIL 23	J	.	.	.	.	.	.	.	.	.	.	.	.	.
		0.8												
		0.73												
SOIL 24	A	8.9	10	10	6	5	9	8	10	7	6	18	.	.
SOIL 24	B	5.8	9	5	4	9	5	2	5	7	6	.	.	.
SOIL 24	C	8.3	10	8	5	9	10	8	8	8	.	.	.	.
SOIL 24	D	11.0	15	6	11	9	10	15	.	.	.	.	.	.
SOIL 24	E	8.8	10	2	10	11	7	12	9	11	3	13	.	.
SOIL 24	F	6.5	8	8	3	10	8	7	7	1	.	.	.	.
SOIL 24	G	7.0	10	4	9	8	7	10	1	8	6	7	.	.
SOIL 24	H	7.2	7	4	8	5	12	.	.	.	.	.	.	.
SOIL 24	I	8.3	10	8	9	9	8	7	7	8	.	.	.	.
SOIL 24	J	8.1	8	5	8	11	4	8	9	10	10	.	.	.
		8.0												
		1.47												

Appendix 5.2
(continued)
Sideoats Grama (Nursery-Provided) Test Results: Height

SOIL	REP	MN HT	HT1	HT2	HT3	HT4	HT5	HT6	HT7	HT8	HT9	HT10	HT11	HT12
		cm	cm											
SOIL 25	A	8.2	10	7	10	12	8	6	9	6	2	11	9	.
SOIL 25	B	9.6	7	7	11	9	11	12	11	10	8	.	.	.
SOIL 25	C	7.6	9	8	5	9	4	8	8	6	10	9	.	.
SOIL 25	D	8.1	8	12	10	7	7	8	9	4	.	.	.	.
SOIL 25	E	5.6	1	9	6	6	5	5	5	8	5	.	.	.
SOIL 25	F	11.0	8	9	10	12	13	11	13	11	10	13	.	.
SOIL 25	G	8.0	10	8	5	9	7	6	9	5	10	11	.	.
SOIL 25	H	8.0	8	8	11	7	9	7	5	9	10	7	7	.
SOIL 25	I	7.4	11	5	7	8	4	7	10	7	.	.	.	.
SOIL 25	J	8.3	11	9	5	9	10	7	7	9	6	10	.	.
		8.2												
		1.41												
SOIL 26	A	5.0	6	3	8	1	3	3	6	6	8	7	4	.
SOIL 26	B	5.0	5	6	6	2	4	8	2	7	5	.	.	.
SOIL 26	C	4.8	3	6	6	6	5	1	5	6	.	.	.	.
SOIL 26	D	6.2	6	10	6	4	5	7	4	7	7	.	.	.
SOIL 26	E	5.8	7	5	6	3	6	7	7	6	5	.	.	.
SOIL 26	F	5.3	2	7	2	5	7	7	7	5	.	.	.	.
SOIL 26	G	5.0	7	6	6	5	5	3	3	5	5	.	.	.
SOIL 26	H	5.9	8	6	5	6	6	5	4	6	6	7	.	.
SOIL 26	I	6.4	6	7	6	4	7	6	6	6	9	7	.	.
SOIL 26	J	6.7	5	6	7	8	7	5	9	6	7	.	.	.
		5.6												
		0.68												

Appendix 5.2

(continued)

Sideoats Grama (Nursery-Provided) Test Results: Height

SOIL	REP	MN HT	HT1	HT2	HT3	HT4	HT5	HT6	HT7	HT8	HT9	HT10	HT11	HT12
		cm	cm											
SOIL 27	A	2.1	0.25	2	2	4	2	.	.	.	.	.	.	.
SOIL 27	B	2.8	3	2	3	2	2	5	.	.	.	.	.	.
SOIL 27	C	2.5	4	4	1	3	1	3	2	2	.	.	.	.
SOIL 27	D	2.7	4	1	2	2	3	3	4	.	.	.	.	.
SOIL 27	E	3.0	4	4	1	2	3	3	4	3	.	.	.	.
SOIL 27	F	2.6	3	3	2	4	2	1	2	3	3	.	.	.
SOIL 27	G	2.3	3	2	2	.	.	.	.	.	.	.	.	.
SOIL 27	H	2.4	2	3	2	3	2	.	.	.	.	.	.	.
SOIL 27	I	3.0	4	3	3	0.25	3	4	4	.	.	.	.	.
SOIL 27	J	2.8	4	1	2	2	4	4	.	.	.	.	.	.
		2.6												
		0.31												
SOIL 28	A	6.2	10	5	5	7	4	6	7	4	7	7	.	.
SOIL 28	B	6.9	7	7	12	3	9	5	5	7	.	.	.	.
SOIL 28	C	5.6	3	4	6	8	4	5	6	9	5	.	.	.
SOIL 28	D	6.8	6	8	10	4	5	8	9	4	.	.	.	.
SOIL 28	E	6.7	3	8	7	6	7	6	7	9	6	8	.	.
SOIL 28	F	5.9	7	8	8	2	6	8	6	1	3	10	.	.
SOIL 28	G	6.1	4	7	6	5	5	5	6	6	7	10	.	.
SOIL 28	H	6.5	0.25	8	7	8	8	6	7	7	9	5	.	.
SOIL 28	I	6.5	12	3	10	8	6	5	4	4	6	6	8	.
SOIL 28	J	6.2	5	7	6	3	6	9	6	5	6	8	7	.
		6.3												
		0.42												

Appendix 5.2

(continued)

Sideoats Grama (Nursery-Provided) Test Results: Height

SOIL	REP	MN HT	HT1	HT2	HT3	HT4	HT5	HT6	HT7	HT8	HT9	HT10	HT11	HT12
		cm	cm											
SOIL 29	A	1.5	2	3	1	0.25	1	2	.	.	.	.	.	.
SOIL 29	B	1.1	2	0.25	0.25	1	1	2	.	.	.	.	.	.
SOIL 29	C	1.8	2	0.25	2	3	.	.	.	.	.	.	.	.
SOIL 29	D	1.3	2	2	0.25	1	.	.	.	.	.	.	.	.
SOIL 29	E	1.1	0.25	0.25	1	2	2	.	.	.	.	.	.	.
SOIL 29	F	1.5	2	1	1	2	.	.	.	.	.	.	.	.
SOIL 29	G	2.0	2	2	2	2	.	.	.	.	.	.	.	.
SOIL 29	H	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 29	I	1.0	1	1	1	.	.	.	.	.	.	.	.	.
SOIL 29	J	.	.	.	.	.	.	.	.	.	.	.	.	.
		1.4												
		0.36												
SOIL 30	A	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 30	B	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 30	C	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 30	D	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 30	E	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 30	F	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 30	G	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 30	H	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 30	I	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 30	J	.	.	.	.	.	.	.	.	.	.	.	.	.
		.												
		.												

Appendix 5.2
(continued)
Sideoats Grama (Nursery-Provided) Test Results: Height

SOIL	REP	MN HT	HT1	HT2	HT3	HT4	HT5	HT6	HT7	HT8	HT9	HT10	HT11	HT12
		cm	cm											
SOIL 31	A	5.0	5	3	5	6	5	6	5	5	.	.	.	.
SOIL 31	B	5.3	5	6	6	4	.	.	.	.	.	.	.	.
SOIL 31	C	4.0	3	3	5	5	2	6	4	.	.	.	.	.
SOIL 31	D	4.3	5	4	4	4	.	.	.	.	.	.	.	.
SOIL 31	E	4.6	4	5	5	4	6	3	5	.	.	.	.	.
SOIL 31	F	3.0	2	3	5	2	3	.	.	.	.	.	.	.
SOIL 31	G	5.0	3	4	7	7	4	7	3	.	.	.	.	.
SOIL 31	H	4.3	7	5	6	2	2	3	5	.	.	.	.	.
SOIL 31	I	4.4	5	4	2	5	6	.	.	.	.	.	.	.
SOIL 31	J	3.3	5	2	4	6	3	1	2	.	.	.	.	.
		4.3												
		0.73												
SOIL 32	A	0.8	0.25	0.25	2	.	.	.	.	.	.	.	.	.
SOIL 32	B	1.1	1	0.25	1	1	2	.	.	.	.	.	.	.
SOIL 32	C	1.3	2	1	2	1	0.25	.	.	.	.	.	.	.
SOIL 32	D	1.0	1	.	.	.	.	.	.	.	.	.	.	.
SOIL 32	E	1.0	1	1	.	.	.	.	.	.	.	.	.	.
SOIL 32	F	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 32	G	0.6	1	1	0.25	0.25	.	.	.	.	.	.	.	.
SOIL 32	H	1.0	1	.	.	.	.	.	.	.	.	.	.	.
SOIL 32	I	1.0	1	1	.	.	.	.	.	.	.	.	.	.
SOIL 32	J	0.6	0.25	1	.	.	.	.	.	.	.	.	.	.
		0.9												
		0.20												

Appendix 5.2

(continued)

Sideoats Grama (Nursery-Provided) Test Results: Height

SOIL	REP	MN HT	HT1	HT2	HT3	HT4	HT5	HT6	HT7	HT8	HT9	HT10	HT11	HT12
		cm	cm											
SOIL 35	A	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 35	B	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 35	C	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 35	D	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 35	E	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 35	F	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 35	G	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 35	H	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 35	I	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 35	J	.	.	.	.	.	.	.	.	.	.	.	.	.
		.												
		.												
SOIL 36	A	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 36	B	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 36	C	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 36	D	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 36	E	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 36	F	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 36	G	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 36	H	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 36	I	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 36	J	.	.	.	.	.	.	.	.	.	.	.	.	.
		.												
		.												

Appendix 5.3

Sideoats Grama (Nursery-Provided) Test Results: Condition

SOIL	REP	Condition Score	Symptom(s) Observed		SOIL	REP	Condition Score	Symptom(s) Observed		SOIL	REP	Condition Score	Symptom(s) Observed
NC	A	10	N		SOIL 2	A	.	NE		SOIL 4	A	80	N,M
NC	B	0	none		SOIL 2	B	.	NE		SOIL 4	B	100	M
NC	C	0	none		SOIL 2	C	10	CL,N		SOIL 4	C	10	N
NC	D	0	none		SOIL 2	D	.	NE		SOIL 4	D	40	N,LC
NC	E	10	M		SOIL 2	E	10	N,LC		SOIL 4	E	50	M
NC	F	30	M		SOIL 2	F	10	N		SOIL 4	F	30	N,CL
NC	G	10	M		SOIL 2	G	10	N		SOIL 4	G	10	N,M
NC	H	0	none		SOIL 2	H	20	N,LC		SOIL 4	H	0	none
NC	I	50	M		SOIL 2	I	10	CL,N		SOIL 4	I	20	N,CC
NC	J	0	none		SOIL 2	J	.	NE		SOIL 4	J	10	N
SOIL 1	A	.	NE		SOIL 3	A	50	CL,N,M		SOIL 5	A	10	N,M
SOIL 1	B	100	M		SOIL 3	B	20	N,M,CC		SOIL 5	B	10	N,CL
SOIL 1	C	100	M		SOIL 3	C	40	CL,N,M		SOIL 5	C	20	N,CL
SOIL 1	D	100	M		SOIL 3	D	30	CL,N,CC		SOIL 5	D	20	CL,LC
SOIL 1	E	90	N		SOIL 3	E	30	N,CC		SOIL 5	E	20	CL,N,CC
SOIL 1	F	100	M		SOIL 3	F	20	N,M,CC		SOIL 5	F	20	CL,M
SOIL 1	G	100	M		SOIL 3	G	30	N,CC		SOIL 5	G	30	CL,N,M,CC
SOIL 1	H	80	CL,N		SOIL 3	H	40	N,CC		SOIL 5	H	20	CL,N,CC
SOIL 1	I	100	M		SOIL 3	I	20	N		SOIL 5	I	20	CL,N
SOIL 1	J	.	.		SOIL 3	J	20	CL,N		SOIL 5	J	40	CL,N

M – Mortality; CL – Chlorosis; N – Necrosis; CC – Color Change; NE – None Emerged; LC – Leaf Curl

Appendix 5.3

(continued)

Sideoats Grama (Nursery-Provided) Test Results: Condition

SOIL	REP	Condition Score	Symptom(s) Observed		SOIL	REP	Condition Score	Symptom(s) Observed		SOIL	REP	Condition Score	Symptom(s) Observed
SOIL 6	A	90	CL,N,M		SOIL 8	A	100	M		SOIL 10	A	90	N,M
SOIL 6	B	100	M		SOIL 8	B	100	M		SOIL 10	B	90	N,M
SOIL 6	C	100	M		SOIL 8	C	100	M		SOIL 10	C	100	M
SOIL 6	D	90	N,M		SOIL 8	D	100	M		SOIL 10	D	90	CL,N,M
SOIL 6	E	90	N,M		SOIL 8	E	90	N,M,CC		SOIL 10	E	100	M
SOIL 6	F	90	N,M,CC		SOIL 8	F	100	M		SOIL 10	F	100	M
SOIL 6	G	80	N,M,CC		SOIL 8	G	100	M		SOIL 10	G	90	N,M
SOIL 6	H	90	N,M		SOIL 8	H	100	M		SOIL 10	H	.	NE
SOIL 6	I	100	M		SOIL 8	I	100	M		SOIL 10	I	100	M
SOIL 6	J	90	CL,N,M,CC		SOIL 8	J	100	M		SOIL 10	J	90	N,M,CC
SOIL 7	A	.	NE		SOIL 9	A	.	NE		SOIL 11	A	90	CL,N
SOIL 7	B	.	NE		SOIL 9	B	.	NE		SOIL 11	B	90	N,M
SOIL 7	C	.	NE		SOIL 9	C	.	NE		SOIL 11	C	100	M
SOIL 7	D	.	NE		SOIL 9	D	.	NE		SOIL 11	D	.	NE
SOIL 7	E	.	NE		SOIL 9	E	.	NE		SOIL 11	E	.	NE
SOIL 7	F	.	NE		SOIL 9	F	.	NE		SOIL 11	F	100	M
SOIL 7	G	.	NE		SOIL 9	G	.	NE		SOIL 11	G	100	M
SOIL 7	H	.	NE		SOIL 9	H	.	NE		SOIL 11	H	100	M
SOIL 7	I	.	NE		SOIL 9	I	.	NE		SOIL 11	I	100	M
SOIL 7	J	.	NE		SOIL 9	J	.	NE		SOIL 11	J	.	NE

M – Mortality; CL – Chlorosis; N – Necrosis; CC – Color Change; NE – None Emerged

Appendix 5.3
(continued)
Sideoats Grama (Nursery-Provided) Test Results: Condition

SOIL	REP	Condition Score	Symptom(s) Observed	SOIL	REP	Condition Score	Symptom(s) Observed	SOIL	REP	Condition Score	Symptom(s) Observed
SOIL 12	A	0	none	SOIL 14	A	.	NE	SOIL 16	A	100	M
SOIL 12	B	10	N	SOIL 14	B	100	M	SOIL 16	B	90	N,M
SOIL 12	C	20	N,M	SOIL 14	C	.	NE	SOIL 16	C	90	N,M
SOIL 12	D	0	none	SOIL 14	D	.	NE	SOIL 16	D	90	N,M
SOIL 12	E	20	N,M	SOIL 14	E	.	NE	SOIL 16	E	90	N,M
SOIL 12	F	10	N	SOIL 14	F	100	M	SOIL 16	F	80	CL,N,M
SOIL 12	G	10	N	SOIL 14	G	100	M	SOIL 16	G	90	N,M
SOIL 12	H	20	N,M	SOIL 14	H	100	M	SOIL 16	H	90	N,M
SOIL 12	I	20	CL,N	SOIL 14	I	.	NE	SOIL 16	I	90	N,M,CC
SOIL 12	J	20	CL,N,LC	SOIL 14	J	.	NE	SOIL 16	J	.	NE
SOIL 13	A	60	CL,N,M	SOIL 15	A	100	M	SOIL 17	A	10	CL,N
SOIL 13	B	40	CL,N,M	SOIL 15	B	90	N,M	SOIL 17	B	10	CL,N
SOIL 13	C	50	CL,N,M,CC	SOIL 15	C	100	M	SOIL 17	C	20	CL,CC
SOIL 13	D	40	CL,N,M,CC	SOIL 15	D	90	N,M	SOIL 17	D	10	CL,CC
SOIL 13	E	40	CL,N,M	SOIL 15	E	90	N,M	SOIL 17	E	10	CL,N
SOIL 13	F	60	N,M,CC	SOIL 15	F	90	N,M	SOIL 17	F	0	none
SOIL 13	G	70	N,M,CC	SOIL 15	G	80	CL,N,M	SOIL 17	G	10	CL,N
SOIL 13	H	40	CL,N,M,CC	SOIL 15	H	90	CL,N,M	SOIL 17	H	10	N
SOIL 13	I	40	CL,N,M	SOIL 15	I	.	NE	SOIL 17	I	20	CL,N
SOIL 13	J	50	CL,N	SOIL 15	J	.	NE	SOIL 17	J	20	CL,N

M – Mortality; CL – Chlorosis; N – Necrosis; CC – Color Change; NE – None Emerged; LC – Leaf Curl

Appendix 5.3

(continued)

Sideoats Grama (Nursery-Provided) Test Results: Condition

SOIL	REP	Condition Score	Symptom(s) Observed	SOIL	REP	Condition Score	Symptom(s) Observed	SOIL	REP	Condition Score	Symptom(s) Observed
SOIL 19	A	.	NE	SOIL 21	A	100	M	SOIL 23	A	90	N,M
SOIL 19	B	100	M	SOIL 21	B	80	N,M,CC	SOIL 23	B	90	N,M
SOIL 19	C	.	NE	SOIL 21	C	100	M	SOIL 23	C	100	M
SOIL 19	D	100	M	SOIL 21	D	100	M	SOIL 23	D	100	M
SOIL 19	E	100	M	SOIL 21	E	90	N	SOIL 23	E	90	N,M
SOIL 19	F	.	NE	SOIL 21	F	100	M	SOIL 23	F	90	N,M
SOIL 19	G	100	M	SOIL 21	G	100	M	SOIL 23	G	100	M
SOIL 19	H	.	NE	SOIL 21	H	.	NE	SOIL 23	H	100	M
SOIL 19	I	90	N	SOIL 21	I	90	N	SOIL 23	I	90	N
SOIL 19	J	.	NE	SOIL 21	J	.	NE	SOIL 23	J	100	M
SOIL 20	A	20	CL,N,M	SOIL 22	A	100	M	SOIL 24	A	0	none
SOIL 20	B	10	CL,N,M	SOIL 22	B	90	N,M	SOIL 24	B	0	none
SOIL 20	C	10	CL,N,M	SOIL 22	C	100	M	SOIL 24	C	0	none
SOIL 20	D	10	CL,N	SOIL 22	D	100	M	SOIL 24	D	10	M
SOIL 20	E	20	CL,N,M	SOIL 22	E	100	M	SOIL 24	E	0	none
SOIL 20	F	0	none	SOIL 22	F	.	NE	SOIL 24	F	20	N,LC,M
SOIL 20	G	30	CL,N,M	SOIL 22	G	.	NE	SOIL 24	G	10	LC
SOIL 20	H	10	N	SOIL 22	H	90	N,M	SOIL 24	H	0	none
SOIL 20	I	10	CL,N,M	SOIL 22	I	100	M	SOIL 24	I	0	none
SOIL 20	J	0	none	SOIL 22	J	.	NE	SOIL 24	J	10	M

M – Mortality; CL – Chlorosis; N – Necrosis; CC – Color Change; NE – None Emerged; LC – Leaf Curl

Appendix 5.3

(continued)

Sideoats Grama (Nursery-Provided) Test Results: Condition

SOIL	REP	Condition Score	Symptom(s) Observed		SOIL	REP	Condition Score	Symptom(s) Observed		SOIL	REP	Condition Score	Symptom(s) Observed
SOIL 25	A	0	none		SOIL 27	A	70	CL,N,M		SOIL 29	A	70	CL,N,M
SOIL 25	B	0	none		SOIL 27	B	50	CL,N,M		SOIL 29	B	80	CL,N,M
SOIL 25	C	0	none		SOIL 27	C	50	CL,N,M		SOIL 29	C	70	CL,N
SOIL 25	D	0	none		SOIL 27	D	60	CL,N,M		SOIL 29	D	80	CL,N,M
SOIL 25	E	10	N		SOIL 27	E	60	CL,N,M		SOIL 29	E	80	CL,N,M
SOIL 25	F	10	M		SOIL 27	F	60	CL,N,M,CC		SOIL 29	F	80	CL,N,M
SOIL 25	G	10	M		SOIL 27	G	60	CL,N,M		SOIL 29	G	80	CL,N,M
SOIL 25	H	0	none		SOIL 27	H	70	CL,N,M		SOIL 29	H	100	M
SOIL 25	I	10	N,M		SOIL 27	I	60	CL,N,M		SOIL 29	I	90	CL,N,M
SOIL 25	J	0	none		SOIL 27	J	60	CL,N,M		SOIL 29	J	100	M
SOIL 26	A	30	CL,N		SOIL 28	A	10	N		SOIL 30	A	.	NE
SOIL 26	B	30	N,LC,M		SOIL 28	B	0	none		SOIL 30	B	.	NE
SOIL 26	C	30	CL,N,LC,M		SOIL 28	C	10	N		SOIL 30	C	.	NE
SOIL 26	D	10	N,M		SOIL 28	D	10	N		SOIL 30	D	100	M
SOIL 26	E	10	N,M		SOIL 28	E	10	N,CC		SOIL 30	E	.	NE
SOIL 26	F	30	CL,N		SOIL 28	F	10	N		SOIL 30	F	.	NE
SOIL 26	G	20	N		SOIL 28	G	10	N,M		SOIL 30	G	100	M
SOIL 26	H	10	N		SOIL 28	H	10	N		SOIL 30	H	.	NE
SOIL 26	I	10	N,M		SOIL 28	I	10	N		SOIL 30	I	.	NE
SOIL 26	J	10	N,M		SOIL 28	J	0	none		SOIL 30	J	.	NE

M – Mortality; CL – Chlorosis; N – Necrosis; CC – Color Change; NE – None Emerged; LC – Leaf Curl

Appendix 5.3

(continued)

Sideoats Grama (Nursery-Provided) Test Results: Condition

SOIL	REP	Condition Score	Symptom(s) Observed		SOIL	REP	Condition Score	Symptom(s) Observed
SOIL 31	A	30	N,CC		SOIL 35	A	.	NE
SOIL 31	B	30	N,M		SOIL 35	B	.	NE
SOIL 31	C	40	CL,N,M		SOIL 35	C	.	NE
SOIL 31	D	40	CL,N,M		SOIL 35	D	.	NE
SOIL 31	E	60	CL,N,M,CC		SOIL 35	E	.	NE
SOIL 31	F	50	CL,N,M,CC		SOIL 35	F	.	NE
SOIL 31	G	60	CL,N,M		SOIL 35	G	.	NE
SOIL 31	H	40	CL,N,M		SOIL 35	H	.	NE
SOIL 31	I	30	CL,N,CC		SOIL 35	I	.	NE
SOIL 31	J	40	CL,N,M		SOIL 35	J	.	NE
SOIL 32	A	90	N		SOIL 36	A	.	NE
SOIL 32	B	80	CL,N,M		SOIL 36	B	100	M
SOIL 32	C	90	N		SOIL 36	C	.	NE
SOIL 32	D	90	N,M		SOIL 36	D	.	NE
SOIL 32	E	90	N,M		SOIL 36	E	.	NE
SOIL 32	F	100	M		SOIL 36	F	.	NE
SOIL 32	G	90	N,M		SOIL 36	G	.	NE
SOIL 32	H	90	N,M		SOIL 36	H	.	NE
SOIL 32	I	90	N		SOIL 36	I	.	NE
SOIL 32	J	90	N,M		SOIL 36	J	.	NE

M – Mortality; CL – Chlorosis; N – Necrosis; CC – Color Change; NE – None Emerged

Appendix 6.1

Sideoats Grama (Field-Collected) Test Results: pH, Emergence, Survival, Root Length and Dry Weight

SOIL	REP	INIT PH	FIN PH	EM 0	EM 21	SURV	RT LGTH	TOT DWT	MN DWT
		pH	pH	per 12	per 12	per 12	cm	g	g
NC	A	5.9	5.8	8	8	5	16	0.0853	0.0171
NC	B	5.9	5.1	3	5	4	10	0.0162	0.0041
NC	C	5.9	5.7	4	4	4	23	0.0261	0.0065
NC	D	5.9	6.4	8	8	8	19	0.1209	0.0151
NC	E	5.9	6.2	8	9	9	23	0.0915	0.0102
NC	F	5.9	4.8	10	10	6	25	0.0362	0.0060
NC	G	5.9	4	5	5	2	9	0.0062	0.0031
NC	H	5.9	5.6	5	8	7	15	0.0490	0.0070
NC	I	5.9	5.6	12	12	12	25	0.1016	0.0085
NC	J	5.9	5.2	7	8	7	19	0.0625	0.0089
					7.70	6.40	18.4		0.0086
					2.45	2.88	5.83		0.0045
SOIL 1	A	6.0	4	0	0	.	.	.	.
SOIL 1	B	6.0	3.6	0	0	.	.	.	.
SOIL 1	C	6.0	3.6	0	0	.	.	.	.
SOIL 1	D	6.0	3.6	0	0	.	.	.	.
SOIL 1	E	6.0	4.4	0	0	.	.	.	.
SOIL 1	F	6.0	3.6	0	0	.	.	.	.
SOIL 1	G	6.0	5.4	0	0	.	.	.	.
SOIL 1	H	6.0	5.8	0	0	.	.	.	.
SOIL 1	I	6.0	3.5	0	0	.	.	.	.
SOIL 1	J	6.0	5.6	0	0	.	.	.	.
					0.00	.	.		.
					0.00	.	.		.

Appendix 6.1

(continued)

Sideoats Grama (Field-Collected) Test Results: pH, Emergence, Survival, Root Length and Dry Weight

SOIL	REP	INIT PH	FIN PH	EM 0	EM 21	SURV	RT LGTH	TOT DWT	MN DWT
		pH	pH	per 12	per 12	per 12	cm	g	g
SOIL 2	A	6.2	4.5	8	10	10	10	0.0377	0.0038
SOIL 2	B	6.2	4.5	5	12	12	11	0.0303	0.0025
SOIL 2	C	6.2	4.3	3	12	12	12	0.0307	0.0026
SOIL 2	D	6.2	4.2	4	12	11	12	0.0225	0.0020
SOIL 2	E	6.2	4.2	4	9	9	12	0.0242	0.0027
SOIL 2	F	6.2	4.2	5	11	11	11	0.0356	0.0032
SOIL 2	G	6.2	4.8	2	11	11	11	0.0300	0.0027
SOIL 2	H	6.2	3.8	3	9	9	13	0.0233	0.0026
SOIL 2	I	6.2	4.6	2	8	8	11	0.0232	0.0029
SOIL 2	J	6.2	4.6	2	9	9	15	0.0325	0.0036
					10.30	10.20	11.8		0.0029
					1.49	1.40	1.40		0.0005
SOIL 3	A	5.6	3.5	3	4	3	13	0.0136	0.0045
SOIL 3	B	5.6	3	2	4	2	6	0.0048	0.0024
SOIL 3	C	5.6	3.9	3	4	3	8	0.0064	0.0021
SOIL 3	D	5.6	3.9	0	1	1	4	0.0013	0.0013
SOIL 3	E	5.6	3.6	2	3	3	5	0.0053	0.0018
SOIL 3	F	5.6	3.7	3	4	3	14	0.0098	0.0033
SOIL 3	G	5.6	3.6	0	0	.	.	.	.
SOIL 3	H	5.6	3.9	1	4	4	17	0.0104	0.0026
SOIL 3	I	5.6	3.8	1	4	2	12	0.0060	0.0030
SOIL 3	J	5.6	3.6	3	5	5	14	0.0212	0.0042
					3.30	2.89	10.3		0.0028
					1.57	1.17	4.66		0.0011

Appendix 6.1

(continued)

Sideoats Grama (Field-Collected) Test Results: pH, Emergence, Survival, Root Length and Dry Weight

SOIL	REP	INIT PH	FIN PH	EM 0	EM 21	SURV	RT LGTH	TOT DWT	MN DWT
		pH	pH	per 12	per 12	per 12	cm	g	g
SOIL 4	A	5.2	3.2	5	5	5	14	0.0105	0.0021
SOIL 4	B	5.2	3	3	6	5	16	0.0213	0.0043
SOIL 4	C	5.2	4.5	0	5	5	17	0.0198	0.0040
SOIL 4	D	5.2	3.7	2	5	4	7	0.0091	0.0023
SOIL 4	E	5.2	4.6	0	5	5	19	0.0170	0.0034
SOIL 4	F	5.2	3.6	5	7	6	13	0.0301	0.0050
SOIL 4	G	5.2	3.5	3	6	5	14	0.0206	0.0041
SOIL 4	H	5.2	4.6	4	7	3	18	0.0141	0.0047
SOIL 4	I	5.2	4	1	4	4	11	0.0113	0.0028
SOIL 4	J	5.2	3.7	4	8	7	14	0.0354	0.0051
					5.80	4.90	14.3		0.0038
					1.23	1.10	3.53		0.0011
SOIL 5	A	5.8	3.8	1	4	4	9	0.0146	0.0037
SOIL 5	B	5.8	3.6	1	5	5	10	0.0068	0.0014
SOIL 5	C	5.8	4.7	1	7	6	9	0.0202	0.0034
SOIL 5	D	5.8	4.2	1	4	3	14	0.0088	0.0029
SOIL 5	E	5.8	3.9	4	9	9	12	0.0165	0.0018
SOIL 5	F	5.8	3.7	0	5	5	11	0.0082	0.0016
SOIL 5	G	5.8	3.6	3	4	4	7	0.0098	0.0025
SOIL 5	H	5.8	4.4	4	9	9	12	0.0278	0.0031
SOIL 5	I	5.8	4.2	1	5	4	6	0.0118	0.0030
SOIL 5	J	5.8	3.9	0	3	3	6	0.0070	0.0023
					5.50	5.20	9.6		0.0026
					2.12	2.20	2.72		0.0008

Appendix 6.1

(continued)

Sideoats Grama (Field-Collected) Test Results: pH, Emergence, Survival, Root Length and Dry Weight

SOIL	REP	INIT PH	FIN PH	EM 0	EM 21	SURV	RT LGTH	TOT DWT	MN DWT
		pH	pH	per 12	per 12	per 12	cm	g	g
SOIL 6	A	6.6	3.5	0	6	4	0.25	0.0053	0.0013
SOIL 6	B	6.6	3	0	2	2	0.25	0.0013	0.0007
SOIL 6	C	6.6	3.7	1	7	0	.	.	.
SOIL 6	D	6.6	3.4	0	3	2	0.25	0.0012	0.0006
SOIL 6	E	6.6	3.4	0	1	0	.	.	.
SOIL 6	F	6.6	5.2	1	6	3	1	0.0007	0.0002
SOIL 6	G	6.6	5.8	0	4	3	1	0.0025	0.0008
SOIL 6	H	6.6	5.8	0	4	4	2	0.0028	0.0007
SOIL 6	I	6.6	4.2	0	4	4	2	0.0036	0.0009
SOIL 6	J	6.6	4	1	4	3	1	0.0033	0.0011
					4.10	2.50	1.0		0.0008
					1.85	1.51	0.73		0.0003
SOIL 7	A	5.9	3.5	0	0	.	.	.	.
SOIL 7	B	5.9	5.6	0	0	.	.	.	.
SOIL 7	C	5.9	3.6	0	0	.	.	.	.
SOIL 7	D	5.9	4.5	0	0	.	.	.	.
SOIL 7	E	5.9	4.8	0	0	.	.	.	.
SOIL 7	F	5.9	3.4	0	0	.	.	.	.
SOIL 7	G	5.9	3.5	0	0	.	.	.	.
SOIL 7	H	5.9	4.4	0	0	.	.	.	.
SOIL 7	I	5.9	3.5	0	0	.	.	.	.
SOIL 7	J	5.9	3.4	0	0	.	.	.	.
					0.00	.	.		.
					0.00	.	.		.

Appendix 6.1

(continued)

Sideoats Grama (Field-Collected) Test Results: pH, Emergence, Survival, Root Length and Dry Weight

SOIL	REP	INIT PH	FIN PH	EM 0	EM 21	SURV	RT LGTH	TOT DWT	MN DWT
		pH	pH	per 12	per 12	per 12	cm	g	g
SOIL 8	A	6.0	3.2	1	7	5	2	0.0025	0.0005
SOIL 8	B	6.0	3.4	0	3	0	.	.	.
SOIL 8	C	6.0	3.7	0	3	1	0.25	0.0004	0.0004
SOIL 8	D	6.0	3.5	0	1	0	.	.	.
SOIL 8	E	6.0	3.2	2	4	1	0.25	0.0003	0.0003
SOIL 8	F	6.0	3	0	2	2	0.25	0.0006	0.0003
SOIL 8	G	6.0	3	1	1	0	.	.	.
SOIL 8	H	6.0	3.5	1	4	2	0.25	0.0007	0.0004
SOIL 8	I	6.0	3.2	2	4	1	0.25	0.0008	0.0008
SOIL 8	J	6.0	3.2	0	5	0	.	.	.
					3.40	1.20	0.5		0.0004
					1.84	1.55	0.71		0.0002
SOIL 9	A	6.4	3.4	0	0	.	.	.	.
SOIL 9	B	6.4	3	0	0	.	.	.	.
SOIL 9	C	6.4	3.5	0	0	.	.	.	.
SOIL 9	D	6.4	3.4	0	0	.	.	.	.
SOIL 9	E	6.4	3	0	0	.	.	.	.
SOIL 9	F	6.4	3.5	0	0	.	.	.	.
SOIL 9	G	6.4	5.3	0	0	.	.	.	.
SOIL 9	H	6.4	5.1	0	0	.	.	.	.
SOIL 9	I	6.4	3.4	0	0	.	.	.	.
SOIL 9	J	6.4	3.8	0	0	.	.	.	.
					0.00	.	.		.
					0.00	.	.		.

Appendix 6.1
(continued)
Sideoats Grama (Field-Collected) Test Results: pH, Emergence, Survival, Root Length and Dry Weight

SOIL	REP	INIT PH	FIN PH	EM 0	EM 21	SURV	RT LGTH	TOT DWT	MN DWT
		pH	pH	per 12	per 12	per 12	cm	g	g
SOIL 10	A	6.0	3	0	1	0	.	.	.
SOIL 10	B	6.0	3	0	1	0	.	.	.
SOIL 10	C	6.0	3.9	0	1	1	1	0.0007	0.0007
SOIL 10	D	6.0	3.4	0	2	0	.	.	.
SOIL 10	E	6.0	3.5	0	4	2	1	0.0015	0.0008
SOIL 10	F	6.0	3.5	0	0	.	.	.	.
SOIL 10	G	6.0	3.6	0	0	.	.	.	.
SOIL 10	H	6.0	3.9	0	4	2	1	0.0054	0.0027
SOIL 10	I	6.0	3	0	2	0	.	.	.
SOIL 10	J	6.0	3.5	0	2	0	.	.	.
					1.70	0.63	1.0		0.0014
					1.42	0.92	0.00		0.0011
SOIL 11	A	4.4	5	0	0	.	.	.	.
SOIL 11	B	4.4	5.8	1	2	0	.	.	.
SOIL 11	C	4.4	7	1	2	0	.	.	.
SOIL 11	D	4.4	5.6	1	1	0	.	.	.
SOIL 11	E	4.4	5.2	0	1	0	.	.	.
SOIL 11	F	4.4	5	0	0	.	.	.	.
SOIL 11	G	4.4	4.3	0	3	1	0.25	0.0004	0.0004
SOIL 11	H	4.4	5.3	0	1	0	.	.	.
SOIL 11	I	4.4	4	1	1	0	.	.	.
SOIL 11	J	4.4	5.5	0	0	.	.	.	.
					1.10	0.14	0.3		0.0004
					0.99	0.38	.		.

Appendix 6.1
(continued)
Sideoats Grama (Field-Collected) Test Results: pH, Emergence, Survival, Root Length and Dry Weight

SOIL	REP	INIT PH	FIN PH	EM 0	EM 21	SURV	RT LGTH	TOT DWT	MN DWT
		pH	pH	per 12	per 12	per 12	cm	g	g
SOIL 12	A	5.8	4	4	9	8	22	0.0253	0.0032
SOIL 12	B	5.8	4.2	4	8	8	14	0.0260	0.0033
SOIL 12	C	5.8	4	6	11	11	20	0.0282	0.0026
SOIL 12	D	5.8	4.1	9	12	12	20	0.0302	0.0025
SOIL 12	E	5.8	3.8	4	10	10	17	0.0237	0.0024
SOIL 12	F	5.8	4.6	3	12	12	13	0.0272	0.0023
SOIL 12	G	5.8	5	8	12	12	20	0.0293	0.0024
SOIL 12	H	5.8	4.9	8	12	10	18	0.0314	0.0031
SOIL 12	I	5.8	4	7	12	12	19	0.0360	0.0030
SOIL 12	J	5.8	4.7	4	12	10	17	0.0272	0.0027
					11.00	10.50	18.0		0.0027
					1.49	1.58	2.83		0.0004
SOIL 13	A	5.4	3.6	3	3	0	.	.	.
SOIL 13	B	5.4	3.7	2	2	1	1	0.0015	0.0015
SOIL 13	C	5.4	3.5	2	5	3	2	0.0071	0.0024
SOIL 13	D	5.4	3.6	3	4	3	1	0.0015	0.0005
SOIL 13	E	5.4	4	4	4	1	1	0.0032	0.0032
SOIL 13	F	5.4	3.5	1	3	2	3	0.0048	0.0024
SOIL 13	G	5.4	3.5	4	4	3	2	0.0059	0.0020
SOIL 13	H	5.4	3.6	2	7	6	1	0.0087	0.0015
SOIL 13	I	5.4	3.5	3	5	4	2	0.0047	0.0012
SOIL 13	J	5.4	3.9	4	8	6	2	0.0125	0.0021
					4.50	2.90	1.7		0.0018
					1.84	2.02	0.71		0.0008

Appendix 6.1

(continued)

Sideoats Grama (Field-Collected) Test Results: pH, Emergence, Survival, Root Length and Dry Weight

SOIL	REP	INIT PH	FIN PH	EM 0	EM 21	SURV	RT LGTH	TOT DWT	MN DWT
		pH	pH	per 12	per 12	per 12	cm	g	g
SOIL 14	A	5.4	3	0	0	.	.	.	.
SOIL 14	B	5.4	3.2	0	0	.	.	.	.
SOIL 14	C	5.4	3	0	0	.	.	.	.
SOIL 14	D	5.4	3	0	0	.	.	.	.
SOIL 14	E	5.4	3.6	0	0	.	.	.	.
SOIL 14	F	5.4	3	0	0	.	.	.	.
SOIL 14	G	5.4	3	0	0	.	.	.	.
SOIL 14	H	5.4	3	0	0	.	.	.	.
SOIL 14	I	5.4	3	0	0	.	.	.	.
SOIL 14	J	5.4	3	0	0	.	.	.	.
					0.00	.	.		.
					0.00	.	.		.
SOIL 15	A	5.8	3	1	5	4	0.25	0.0017	0.0004
SOIL 15	B	5.8	3.4	1	5	3	0.25	0.0020	0.0007
SOIL 15	C	5.8	3.5	3	9	7	0.25	0.0115	0.0016
SOIL 15	D	5.8	3	2	4	2	0.25	0.0075	0.0038
SOIL 15	E	5.8	3.6	1	6	5	3	0.0052	0.0010
SOIL 15	F	5.8	3.4	1	4	3	1	0.0019	0.0006
SOIL 15	G	5.8	3.4	2	5	2	2	0.0021	0.0011
SOIL 15	H	5.8	3.5	1	7	7	2	0.0092	0.0013
SOIL 15	I	5.8	3.4	1	7	6	2	0.0108	0.0018
SOIL 15	J	5.8	3.6	0	2	0	.	.	.
					5.40	3.90	1.2		0.0014
					1.96	2.33	1.05		0.0010

Appendix 6.1

(continued)

Sideoats Grama (Field-Collected) Test Results: pH, Emergence, Survival, Root Length and Dry Weight

SOIL	REP	INIT PH	FIN PH	EM 0	EM 21	SURV	RT LGTH	TOT DWT	MN DWT
		pH	pH	per 12	per 12	per 12	cm	g	g
SOIL 16	A	5.6	3	1	4	3	1	0.0025	0.0008
SOIL 16	B	5.6	3.2	3	5	1	0.25	0.0008	0.0008
SOIL 16	C	5.6	3	1	6	3	1	0.0022	0.0007
SOIL 16	D	5.6	3.2	0	1	0	.	.	.
SOIL 16	E	5.6	3.5	0	5	4	1	0.0027	0.0007
SOIL 16	F	5.6	3	1	2	2	1	0.0006	0.0003
SOIL 16	G	5.6	3.4	0	5	3	1	0.0029	0.0010
SOIL 16	H	5.6	3.6	1	2	2	1	0.0007	0.0004
SOIL 16	I	5.6	3.4	0	2	1	0.25	0.0005	0.0005
SOIL 16	J	5.6	3.5	1	2	2	0.25	0.0018	0.0009
					3.40	2.10	0.8		0.0007
					1.78	1.20	0.38		0.0002
SOIL 17	A	5.3	3.8	6	8	8	13	0.0242	0.0030
SOIL 17	B	5.3	4	1	11	11	11	0.0235	0.0021
SOIL 17	C	5.3	4.2	3	10	10	14	0.0270	0.0027
SOIL 17	D	5.3	3.8	2	4	4	12	0.0098	0.0025
SOIL 17	E	5.3	3.6	8	10	9	15	0.0209	0.0023
SOIL 17	F	5.3	4	5	11	10	17	0.0247	0.0025
SOIL 17	G	5.3	4	3	8	8	16	0.0136	0.0017
SOIL 17	H	5.3	4	1	8	7	15	0.0132	0.0019
SOIL 17	I	5.3	4	3	10	10	17	0.0279	0.0028
SOIL 17	J	5.3	3.7	7	11	11	15	0.0325	0.0030
					9.10	8.80	14.5		0.0024
					2.18	2.15	2.01		0.0004

Appendix 6.1
(continued)
Sideoats Grama (Field-Collected) Test Results: pH, Emergence, Survival, Root Length and Dry Weight

SOIL	REP	INIT PH	FIN PH	EM 0	EM 21	SURV	RT LGTH	TOT DWT	MN DWT
		pH	pH	per 12	per 12	per 12	cm	g	g
SOIL 19	A	5.6	3.8	1	2	0	.	.	.
SOIL 19	B	5.6	4	0	0	.	.	.	.
SOIL 19	C	5.6	4	0	1	0	.	.	.
SOIL 19	D	5.6	3.6	0	0	.	.	.	.
SOIL 19	E	5.6	5	0	1	0	.	.	.
SOIL 19	F	5.6	3.9	0	0	.	.	.	.
SOIL 19	G	5.6	3.6	0	0	.	.	.	.
SOIL 19	H	5.6	3.8	0	0	.	.	.	.
SOIL 19	I	5.6	3.6	0	0	.	.	.	.
SOIL 19	J	5.6	4.4	0	0	.	.	.	.
					0.40	0.00	.		.
					0.70	0.00	.		.
SOIL 20	A	5.9	6.2	6	10	10	18	0.0327	0.0033
SOIL 20	B	5.9	5.4	5	8	8	10	0.0281	0.0035
SOIL 20	C	5.9	6	4	9	9	8	0.0276	0.0031
SOIL 20	D	5.9	6.2	4	9	9	7	0.0269	0.0030
SOIL 20	E	5.9	4.2	5	8	8	17	0.0300	0.0038
SOIL 20	F	5.9	5.5	7	11	10	13	0.0353	0.0035
SOIL 20	G	5.9	5.8	4	8	7	9	0.0220	0.0031
SOIL 20	H	5.9	5.8	8	12	12	10	0.0228	0.0019
SOIL 20	I	5.9	5.8	6	10	10	14	0.0253	0.0025
SOIL 20	J	5.9	4.8	7	11	11	16	0.0414	0.0038
					9.60	9.40	12.2		0.0031
					1.43	1.51	3.94		0.0006

Appendix 6.1

(continued)

Sideoats Grama (Field-Collected) Test Results: pH, Emergence, Survival, Root Length and Dry Weight

SOIL	REP	INIT PH	FIN PH	EM 0	EM 21	SURV	RT LGTH	TOT DWT	MN DWT
		pH	pH	per 12	per 12	per 12	cm	g	g
SOIL 21	A	6.1	3.7	0	1	0	.	.	.
SOIL 21	B	6.1	3.7	0	3	0	.	.	.
SOIL 21	C	6.1	3.8	0	3	0	.	.	.
SOIL 21	D	6.1	3.7	0	0	.	.	.	.
SOIL 21	E	6.1	3.8	0	0	.	.	.	.
SOIL 21	F	6.1	4	0	1	0	.	.	.
SOIL 21	G	6.1	3.5	0	4	1	0.25	0.0012	0.0012
SOIL 21	H	6.1	3.5	0	1	0	.	.	.
SOIL 21	I	6.1	3.6	0	1	0	.	.	.
SOIL 21	J	6.1	3.8	0	2	0	.	.	.
					1.60	0.13	0.3		0.0012
					1.35	0.35	.		.
SOIL 22	A	5.9	4	0	1	1	0.25	0.0009	0.0009
SOIL 22	B	5.9	3.6	0	1	0	.	.	.
SOIL 22	C	5.9	3.5	0	1	1	0.25	0.0062	0.0062
SOIL 22	D	5.9	3.6	0	1	0	.	.	.
SOIL 22	E	5.9	3.6	0	2	0	.	.	.
SOIL 22	F	5.9	4.6	0	2	0	.	.	.
SOIL 22	G	5.9	3.6	0	2	0	.	.	.
SOIL 22	H	5.9	3.8	0	2	0	.	.	.
SOIL 22	I	5.9	3.8	0	2	0	.	.	.
SOIL 22	J	5.9	3.8	0	1	0	.	.	.
					1.50	0.20	0.3		0.0036
					0.53	0.42	0.00		0.0037

Appendix 6.1

(continued)

Sideoats Grama (Field-Collected) Test Results: pH, Emergence, Survival, Root Length and Dry Weight

SOIL	REP	INIT PH	FIN PH	EM 0	EM 21	SURV	RT LGTH	TOT DWT	MN DWT
		pH	pH	per 12	per 12	per 12	cm	g	g
SOIL 23	A	6.4	5.8	0	2	0	.	.	.
SOIL 23	B	6.4	6.1	0	0	0	.	.	.
SOIL 23	C	6.4	6.7	1	2	1	1	0.0006	0.0006
SOIL 23	D	6.4	4.8	1	1	0	.	.	.
SOIL 23	E	6.4	5	0	1	0	.	.	.
SOIL 23	F	6.4	3.8	1	2	1	0.25	0.0008	0.0008
SOIL 23	G	6.4	4.6	1	1	1	1	0.0014	0.0014
SOIL 23	H	6.4	3.9	0	3	2	0.25	0.0015	0.0008
SOIL 23	I	6.4	4.4	0	1	1	2	0.0009	0.0009
SOIL 23	J	6.4	4	0	1	0	.	.	.
					1.40	0.60	0.9		0.0009
					0.84	0.70	0.72		0.0003
SOIL 24	A	6.0	4	2	8	6	12	0.0348	0.0058
SOIL 24	B	6.0	4.3	3	8	8	20	0.0482	0.0060
SOIL 24	C	6.0	4.2	0	5	5	23	0.0224	0.0045
SOIL 24	D	6.0	4.3	2	7	6	23	0.0317	0.0053
SOIL 24	E	6.0	4.2	3	4	2	14	0.0131	0.0066
SOIL 24	F	6.0	5.4	3	6	6	26	0.0287	0.0048
SOIL 24	G	6.0	5.3	1	5	5	8	0.0335	0.0067
SOIL 24	H	6.0	5.6	2	5	5	6	0.0280	0.0056
SOIL 24	I	6.0	5.1	1	9	9	10	0.0403	0.0045
SOIL 24	J	6.0	5	1	6	6	26	0.0357	0.0060
					6.30	5.80	16.8		0.0056
					1.64	1.87	7.66		0.0008

Appendix 6.1

(continued)

Sideoats Grama (Field-Collected) Test Results: pH, Emergence, Survival, Root Length and Dry Weight

SOIL	REP	INIT PH	FIN PH	EM 0	EM 21	SURV	RT LGTH	TOT DWT	MN DWT
		pH	pH	per 12	per 12	per 12	cm	g	g
SOIL 25	A	5.2	5.6	10	10	10	20	0.0605	0.0061
SOIL 25	B	5.2	5.6	7	8	8	10	0.0390	0.0049
SOIL 25	C	5.2	5.3	7	9	9	11	0.0375	0.0042
SOIL 25	D	5.2	5.7	4	8	8	21	0.0360	0.0045
SOIL 25	E	5.2	5.2	8	11	10	14	0.0403	0.0040
SOIL 25	F	5.2	4.8	9	10	9	21	0.0555	0.0062
SOIL 25	G	5.2	5.2	7	10	10	23	0.0470	0.0047
SOIL 25	H	5.2	5	3	7	7	13	0.0277	0.0040
SOIL 25	I	5.2	5.2	7	9	8	19	0.0358	0.0045
SOIL 25	J	5.2	5.2	7	9	9	24	0.0510	0.0057
					9.10	8.80	17.6		0.0049
					1.20	1.03	5.13		0.0008
SOIL 26	A	6.0	5.3	4	9	8	20	0.0237	0.0030
SOIL 26	B	6.0	5.9	4	7	7	14	0.0162	0.0023
SOIL 26	C	6.0	5.4	4	5	4	21	0.0109	0.0027
SOIL 26	D	6.0	5.9	4	8	7	21	0.0214	0.0031
SOIL 26	E	6.0	5.8	5	8	8	17	0.0284	0.0036
SOIL 26	F	6.0	5.3	6	10	10	16	0.0318	0.0032
SOIL 26	G	6.0	5.2	6	8	8	21	0.0243	0.0030
SOIL 26	H	6.0	5.3	4	5	4	21	0.0136	0.0034
SOIL 26	I	6.0	5.1	6	8	8	22	0.0282	0.0035
SOIL 26	J	6.0	5.1	6	11	8	12	0.0251	0.0031
					7.90	7.20	18.5		0.0031
					1.91	1.87	3.50		0.0004

Appendix 6.1

(continued)

Sideoats Grama (Field-Collected) Test Results: pH, Emergence, Survival, Root Length and Dry Weight

SOIL	REP	INIT PH	FIN PH	EM 0	EM 21	SURV	RT LGTH	TOT DWT	MN DWT
		pH	pH	per 12	per 12	per 12	cm	g	g
SOIL 27	A	6.2	4.4	6	9	5	1	0.0118	0.0024
SOIL 27	B	6.2	3.7	4	12	8	0.25	0.0176	0.0022
SOIL 27	C	6.2	4	5	8	8	1	0.0159	0.0020
SOIL 27	D	6.2	4	3	8	4	0.25	0.0087	0.0022
SOIL 27	E	6.2	4.2	6	11	11	2	0.0303	0.0028
SOIL 27	F	6.2	4.4	2	7	3	2	0.0061	0.0020
SOIL 27	G	6.2	3.6	2	8	5	0.25	0.0102	0.0020
SOIL 27	H	6.2	3.6	4	10	6	1	0.0135	0.0023
SOIL 27	I	6.2	3.5	5	8	6	2	0.0122	0.0020
SOIL 27	J	6.2	3.6	3	9	4	1	0.0051	0.0013
					9.00	6.00	1.1		0.0021
					1.56	2.40	0.72		0.0004
SOIL 28	A	6.7	4.8	5	8	8	16	0.0388	0.0049
SOIL 28	B	6.7	4.2	5	8	8	25	0.0339	0.0042
SOIL 28	C	6.7	4.9	5	10	10	22	0.0594	0.0059
SOIL 28	D	6.7	4.8	4	8	8	26	0.0402	0.0050
SOIL 28	E	6.7	4.2	5	9	8	15	0.0300	0.0038
SOIL 28	F	6.7	4.9	6	11	10	17	0.0423	0.0042
SOIL 28	G	6.7	4.8	6	7	7	20	0.0299	0.0043
SOIL 28	H	6.7	5	9	9	9	28	0.0568	0.0063
SOIL 28	I	6.7	4.9	4	8	8	9	0.0355	0.0044
SOIL 28	J	6.7	5.2	9	10	10	25	0.0486	0.0049
					8.80	8.60	20.3		0.0048
					1.23	1.07	6.00		0.0008

Appendix 6.1

(continued)

Sideoats Grama (Field-Collected) Test Results: pH, Emergence, Survival, Root Length and Dry Weight

SOIL	REP	INIT PH	FIN PH	EM 0	EM 21	SURV	RT LGTH	TOT DWT	MN DWT
		pH	pH	per 12	per 12	per 12	cm	g	g
SOIL 29	A	5.4	4.2	2	3	1	0.25	0.0008	0.0008
SOIL 29	B	5.4	4	2	4	1	1	0.0009	0.0009
SOIL 29	C	5.4	3.8	1	4	2	1	0.0027	0.0014
SOIL 29	D	5.4	4.2	0	1	0	.	.	.
SOIL 29	E	5.4	4.4	1	4	1	0.25	0.0013	0.0013
SOIL 29	F	5.4	5	3	8	3	1	0.0030	0.0010
SOIL 29	G	5.4	5.2	2	5	3	1	0.0018	0.0006
SOIL 29	H	5.4	5.4	0	2	0	.	.	.
SOIL 29	I	5.4	6	1	5	3	1	0.0034	0.0011
SOIL 29	J	5.4	5.6	0	6	1	0.25	0.0007	0.0007
					4.20	1.50	0.7		0.0010
					1.99	1.18	0.39		0.0003
SOIL 30	A	4.0	4.9	0	1	1	0.25	0.0004	0.0004
SOIL 30	B	4.0	4.2	0	0	.	.	.	.
SOIL 30	C	4.0	4.2	0	1	0	.	.	.
SOIL 30	D	4.0	3.8	1	1	1	0.25	0.0004	0.0004
SOIL 30	E	4.0	4.8	0	1	0	.	.	.
SOIL 30	F	4.0	3.8	1	3	0	.	.	.
SOIL 30	G	4.0	3.5	1	1	0	.	.	.
SOIL 30	H	4.0	3.5	0	0	.	.	.	.
SOIL 30	I	4.0	3	0	2	0	.	.	.
SOIL 30	J	4.0	3.6	0	0	.	.	.	.
					1.00	0.29	0.3		0.0004
					0.94	0.49	0.00		0.0000

Appendix 6.1
(continued)
Sideoats Grama (Field-Collected) Test Results: pH, Emergence, Survival, Root Length and Dry Weight

SOIL	REP	INIT PH	FIN PH	EM 0	EM 21	SURV	RT LGTH	TOT DWT	MN DWT
		pH	pH	per 12	per 12	per 12	cm	g	g
SOIL 31	A	6.4	3.6	5	6	5	6	0.0236	0.0047
SOIL 31	B	6.4	3.6	2	7	7	5	0.0436	0.0062
SOIL 31	C	6.4	3.6	4	10	10	7	0.0492	0.0049
SOIL 31	D	6.4	3.6	3	8	8	10	0.0358	0.0045
SOIL 31	E	6.4	3.6	2	7	7	5	0.0241	0.0034
SOIL 31	F	6.4	3.6	8	10	10	4	0.0459	0.0046
SOIL 31	G	6.4	3.5	8	10	8	4	0.0270	0.0034
SOIL 31	H	6.4	3.4	4	8	7	3	0.0254	0.0036
SOIL 31	I	6.4	3.5	5	7	7	3	0.0251	0.0036
SOIL 31	J	6.4	3.4	7	8	8	3	0.0257	0.0032
					8.10	7.70	5.0		0.0042
					1.45	1.49	2.21		0.0009
SOIL 32	A	6.6	3.6	2	6	3	0.25	0.0025	0.0008
SOIL 32	B	6.6	3.5	1	3	1	0.25	0.0019	0.0019
SOIL 32	C	6.6	3.7	2	5	0	.	.	.
SOIL 32	D	6.6	3.7	0	3	0	.	.	.
SOIL 32	E	6.6	3.8	0	6	3	1	0.0050	0.0017
SOIL 32	F	6.6	3.6	1	5	3	0.25	0.0030	0.0010
SOIL 32	G	6.6	3.8	0	3	2	0.25	0.0011	0.0006
SOIL 32	H	6.6	3.5	1	3	3	0.25	0.0015	0.0005
SOIL 32	I	6.6	3.5	0	0	.	.	.	.
SOIL 32	J	6.6	3.6	0	3	1	0.25	0.0012	0.0012
					3.70	1.78	0.4		0.0011
					1.83	1.30	0.28		0.0005

Appendix 6.1

(continued)

Sideoats Grama (Field-Collected) Test Results: pH, Emergence, Survival, Root Length and Dry Weight

SOIL	REP	INIT PH	FIN PH	EM 0	EM 21	SURV	RT LGTH	TOT DWT	MN DWT
		pH	pH	per 12	per 12	per 12	cm	g	g
SOIL 35	A	4.8	3	0	0	.	.	.	.
SOIL 35	B	4.8	3.7	0	0	.	.	.	.
SOIL 35	C	4.8	3.5	0	0	.	.	.	.
SOIL 35	D	4.8	3.5	0	0	.	.	.	.
SOIL 35	E	4.8	4.4	0	0	.	.	.	.
SOIL 35	F	4.8	4.2	0	0	.	.	.	.
SOIL 35	G	4.8	3.6	0	0	.	.	.	.
SOIL 35	H	4.8	3.4	0	0	.	.	.	.
SOIL 35	I	4.8	3	0	0	.	.	.	.
SOIL 35	J	4.8	4.2	0	0	.	.	.	.
					0.00	.	.		.
					0.00	.	.		.
SOIL 36	A	5.0	3.5	0	0	.	.	.	.
SOIL 36	B	5.0	4	0	0	.	.	.	.
SOIL 36	C	5.0	3.4	0	0	.	.	.	.
SOIL 36	D	5.0	3.5	0	0	.	.	.	.
SOIL 36	E	5.0	3	0	0	.	.	.	.
SOIL 36	F	5.0	3.9	0	0	.	.	.	.
SOIL 36	G	5.0	3.4	0	0	.	.	.	.
SOIL 36	H	5.0	3.4	0	0	.	.	.	.
SOIL 36	I	5.0	3	0	0	.	.	.	.
SOIL 36	J	5.0	3	0	0	.	.	.	.
					0.00	.	.		.
					0.00	.	.		.

Appendix 6.2

Sideoats Grama (Nursery Provided) Test Results: Height

SOIL	REP	MN HT	HT1	HT2	HT3	HT4	HT5	HT6	HT7	HT8	HT9	HT10	HT11	HT12
		cm	cm											
NC	A	12.6	20	13	11	13	6	.	.	.	.	.	.	.
NC	B	6.0	6	4	9	5	.	.	.	.	.	.	.	.
NC	C	6.5	4	8	5	9	.	.	.	.	.	.	.	.
NC	D	12.9	13	17	13	15	14	10	13	8	.	.	.	.
NC	E	9.8	13	9	3	14	6	11	10	13	9	.	.	.
NC	F	6.2	12	4	4	5	8	4	.	.	.	.	.	.
NC	G	5.0	5	5	.	.	.	.	.	.	.	.	.	.
NC	H	7.1	12	5	4	15	9	2	3	.	.	.	.	.
NC	I	9.3	12	11	12	14	11	9	10	8	3	7	4	10
NC	J	9.3	10	7	7	17	10	12	2	.	.	.	.	.
		8.5												
		2.76												
SOIL 1	A	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 1	B	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 1	C	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 1	D	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 1	E	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 1	F	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 1	G	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 1	H	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 1	I	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 1	J	.	.	.	.	.	.	.	.	.	.	.	.	.
		.												
		.												

Appendix 6.2

(continued)

Sideoats Grama (Nursery Provided) Test Results: Height

SOIL	REP	MN HT	HT1	HT2	HT3	HT4	HT5	HT6	HT7	HT8	HT9	HT10	HT11	HT12
		cm	cm											
SOIL 2	A	4.7	6	5	3	4	4	6	3	5	7	4	.	.
SOIL 2	B	3.8	5	4	2	4	6	3	6	4	2	1	4	4
SOIL 2	C	3.7	2	6	5	3	6	3	4	2	2	2	6	3
SOIL 2	D	3.6	3	5	3	5	3	2	4	5	2	3	5	.
SOIL 2	E	4.2	4	4	4	6	4	5	4	6	1	.	.	.
SOIL 2	F	4.5	1	6	6	2	8	4	3	6	2	5	7	.
SOIL 2	G	4.1	2	5	2	4	4	2	6	6	4	5	5	.
SOIL 2	H	4.3	3	7	3	4	5	3	4	6	4	.	.	.
SOIL 2	I	4.9	6	2	4	6	6	5	7	3	.	.	.	.
SOIL 2	J	5.0	4	6	6	8	5	5	3	3	5	.	.	.
		4.3												
		0.50												
SOIL 3	A	5.0	6	4	5	.	.	.	.	.	.	.	.	.
SOIL 3	B	3.5	3	4	.	.	.	.	.	.	.	.	.	.
SOIL 3	C	3.7	6	1	4	.	.	.	.	.	.	.	.	.
SOIL 3	D	4.0	4	.	.	.	.	.	.	.	.	.	.	.
SOIL 3	E	3.3	5	4	1	.	.	.	.	.	.	.	.	.
SOIL 3	F	5.0	5	6	4	.	.	.	.	.	.	.	.	.
SOIL 3	G	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 3	H	3.8	1	5	4	5	.	.	.	.	.	.	.	.
SOIL 3	I	4.0	5	3	.	.	.	.	.	.	.	.	.	.
SOIL 3	J	5.2	6	1	7	6	6	.	.	.	.	.	.	.
		4.2												
		0.71												

Appendix 6.2
(continued)
Sideoats Grama (Nursery Provided) Test Results: Height

SOIL	REP	MN HT	HT1	HT2	HT3	HT4	HT5	HT6	HT7	HT8	HT9	HT10	HT11	HT12
		cm	cm											
SOIL 4	A	3.4	4	2	3	3	5	.	.	.	.	.	.	.
SOIL 4	B	5.8	8	3	4	8	6	.	.	.	.	.	.	.
SOIL 4	C	5.4	5	4	4	7	7	.	.	.	.	.	.	.
SOIL 4	D	3.3	4	3	2	4	.	.	.	.	.	.	.	.
SOIL 4	E	4.4	7	1	5	4	5	.	.	.	.	.	.	.
SOIL 4	F	7.7	8	8	12	10	7	1	.	.	.	.	.	.
SOIL 4	G	5.2	3	7	5	8	3	.	.	.	.	.	.	.
SOIL 4	H	7.3	9	4	9	.	.	.	.	.	.	.	.	.
SOIL 4	I	4.0	10	2	3	1	.	.	.	.	.	.	.	.
SOIL 4	J	7.4	4	8	11	9	9	9	2	.	.	.	.	.
		5.4												
		1.66												
SOIL 5	A	4.8	4	6	5	4	.	.	.	.	.	.	.	.
SOIL 5	B	3.6	4	4	3	5	2	.	.	.	.	.	.	.
SOIL 5	C	5.2	4	6	7	3	7	4	.	.	.	.	.	.
SOIL 5	D	5.3	4	6	6	.	.	.	.	.	.	.	.	.
SOIL 5	E	4.3	3	6	4	6	3	4	3	5	5	.	.	.
SOIL 5	F	2.9	3	3	4	4	0.25	.	.	.	.	.	.	.
SOIL 5	G	4.8	4	4	5	6	.	.	.	.	.	.	.	.
SOIL 5	H	5.6	6	4	6	4	5	6	7	6	6	.	.	.
SOIL 5	I	4.0	3	5	4	4	.	.	.	.	.	.	.	.
SOIL 5	J	4.0	3	4	5	.	.	.	.	.	.	.	.	.
		4.4												
		0.84												

Appendix 6.2

(continued)

Sideoats Grama (Nursery Provided) Test Results: Height

SOIL	REP	MN HT	HT1	HT2	HT3	HT4	HT5	HT6	HT7	HT8	HT9	HT10	HT11	HT12
		cm	cm											
SOIL 6	A	0.6	1	1	0.25	0.25	.	.	.	.	.	.	.	.
SOIL 6	B	1.0	1	1	.	.	.	.	.	.	.	.	.	.
SOIL 6	C	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 6	D	0.3	0.25	0.25	.	.	.	.	.	.	.	.	.	.
SOIL 6	E	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 6	F	0.8	1	1	0.25	.	.	.	.	.	.	.	.	.
SOIL 6	G	0.5	1	0.25	0.25	.	.	.	.	.	.	.	.	.
SOIL 6	H	1.6	3	2	1	0.25	.	.	.	.	.	.	.	.
SOIL 6	I	0.9	0.25	0.25	1	2	.	.	.	.	.	.	.	.
SOIL 6	J	1.7	2	1	2	.	.	.	.	.	.	.	.	.
		0.9												
		0.50												
SOIL 7	A	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 7	B	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 7	C	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 7	D	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 7	E	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 7	F	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 7	G	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 7	H	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 7	I	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 7	J	.	.	.	.	.	.	.	.	.	.	.	.	.
		.												
		.												

Appendix 6.2

(continued)

Sideoats Grama (Nursery Provided) Test Results: Height

SOIL	REP	MN HT	HT1	HT2	HT3	HT4	HT5	HT6	HT7	HT8	HT9	HT10	HT11	HT12
		cm	cm											
SOIL 8	A	1.7	2	1	2	3	0.25	.	.	.	.	.	.	.
SOIL 8	B	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 8	C	0.3	0.25	.	.	.	.	.	.	.	.	.	.	.
SOIL 8	D	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 8	E	2.0	2	.	.	.	.	.	.	.	.	.	.	.
SOIL 8	F	0.6	1	0.25	.	.	.	.	.	.	.	.	.	.
SOIL 8	G	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 8	H	1.5	2	1	.	.	.	.	.	.	.	.	.	.
SOIL 8	I	1.0	1	.	.	.	.	.	.	.	.	.	.	.
SOIL 8	J	.	.	.	.	.	.	.	.	.	.	.	.	.
		1.2												
		0.66												
SOIL 9	A	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 9	B	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 9	C	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 9	D	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 9	E	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 9	F	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 9	G	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 9	H	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 9	I	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 9	J	.	.	.	.	.	.	.	.	.	.	.	.	.
		.												
		.												

Appendix 6.2

(continued)

Sideoats Grama (Nursery Provided) Test Results: Height

SOIL	REP	MN HT	HT1	HT2	HT3	HT4	HT5	HT6	HT7	HT8	HT9	HT10	HT11	HT12
		cm	cm											
SOIL 10	A	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 10	B	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 10	C	1.0	1	.	.	.	.	.	.	.	.	.	.	.
SOIL 10	D	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 10	E	0.6	1	0.25	.	.	.	.	.	.	.	.	.	.
SOIL 10	F	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 10	G	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 10	H	0.6	1	0.25	.	.	.	.	.	.	.	.	.	.
SOIL 10	I	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 10	J	.	.	.	.	.	.	.	.	.	.	.	.	.
		0.8												
		0.22												
SOIL 11	A	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 11	B	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 11	C	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 11	D	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 11	E	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 11	F	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 11	G	0.3	0.25	.	.	.	.	.	.	.	.	.	.	.
SOIL 11	H	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 11	I	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 11	J	.	.	.	.	.	.	.	.	.	.	.	.	.
		0.3												
		.												

Appendix 6.2

(continued)

Sideoats Grama (Nursery Provided) Test Results: Height

SOIL	REP	MN HT	HT1	HT2	HT3	HT4	HT5	HT6	HT7	HT8	HT9	HT10	HT11	HT12
		cm	cm											
SOIL 12	A	4.3	4	8	6	4	2	3	3	4	.	.	.	.
SOIL 12	B	5.0	5	7	6	7	5	4	6	0.25	.	.	.	.
SOIL 12	C	4.6	5	6	2	5	6	4	6	4	5	4	4	.
SOIL 12	D	4.7	5	4	6	5	6	5	3	3	4	5	5	5
SOIL 12	E	4.7	5	4	5	5	3	3	3	6	4	9	.	.
SOIL 12	F	4.3	1	2	5	3	6	3	5	7	5	7	6	2
SOIL 12	G	4.7	5	0.25	6	5	5	5	5	8	4	6	5	2
SOIL 12	H	5.2	6	5	3	7	6	7	5	4	5	4	.	.
SOIL 12	I	4.6	6	5	2	6	6	4	5	2	5	4	5	5
SOIL 12	J	4.6	5	4	5	4	6	5	4	4	4	5	.	.
		4.7												
		0.28												
SOIL 13	A	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 13	B	4.0	4	.	.	.	.	.	.	.	.	.	.	.
SOIL 13	C	3.3	6	3	1	.	.	.	.	.	.	.	.	.
SOIL 13	D	3.0	3	.	.	.	.	.	.	.	.	.	.	.
SOIL 13	E	5.0	5	.	.	.	.	.	.	.	.	.	.	.
SOIL 13	F	3.5	1	6	.	.	.	.	.	.	.	.	.	.
SOIL 13	G	2.7	4	1	3	.	.	.	.	.	.	.	.	.
SOIL 13	H	2.5	4	3	1	3	2	2	.	.	.	.	.	.
SOIL 13	I	1.8	1	1	3	2	.	.	.	.	.	.	.	.
SOIL 13	J	2.9	6	1	3	4	3	0.25	.	.	.	.	.	.
		3.2												
		0.94												

Appendix 6.2

(continued)

Sideoats Grama (Nursery Provided) Test Results: Height

SOIL	REP	MN HT	HT1	HT2	HT3	HT4	HT5	HT6	HT7	HT8	HT9	HT10	HT11	HT12
		cm	cm											
SOIL 14	A	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 14	B	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 14	C	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 14	D	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 14	E	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 14	F	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 14	G	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 14	H	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 14	I	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 14	J	.	.	.	.	.	.	.	.	.	.	.	.	.
		.												
		.												
SOIL 15	A	0.8	1	1	1	0.25	.	.	.	.	.	.	.	.
SOIL 15	B	1.0	1	1	1	.	.	.	.	.	.	.	.	.
SOIL 15	C	2.4	3	3	4	2	2	2	1	.	.	.	.	.
SOIL 15	D	2.0	2	2	.	.	.	.	.	.	.	.	.	.
SOIL 15	E	1.1	0.25	1	1	0.25	3	.	.	.	.	.	.	.
SOIL 15	F	1.1	2	1	0.25	.	.	.	.	.	.	.	.	.
SOIL 15	G	1.5	2	1	.	.	.	.	.	.	.	.	.	.
SOIL 15	H	0.9	2	2	1	0.25	0.25	0.25	0.25	.	.	.	.	.
SOIL 15	I	1.2	2	1	1	1	1	1	.	.	.	.	.	.
SOIL 15	J	.	.	.	.	.	.	.	.	.	.	.	.	.
		1.3												
		0.55												

Appendix 6.2
(continued)
Sideoats Grama (Nursery Provided) Test Results: Height

SOIL	REP	MN HT	HT1	HT2	HT3	HT4	HT5	HT6	HT7	HT8	HT9	HT10	HT11	HT12
		cm	cm											
SOIL 16	A	1.1	2	1	0.25	.	.	.	.	.	.	.	.	.
SOIL 16	B	0.3	0.25	.	.	.	.	.	.	.	.	.	.	.
SOIL 16	C	1.0	1	1	1	.	.	.	.	.	.	.	.	.
SOIL 16	D	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 16	E	0.6	0.25	0.25	1	1	.	.	.	.	.	.	.	.
SOIL 16	F	2.0	2	2	.	.	.	.	.	.	.	.	.	.
SOIL 16	G	1.3	2	1	1	.	.	.	.	.	.	.	.	.
SOIL 16	H	0.6	1	0.25	.	.	.	.	.	.	.	.	.	.
SOIL 16	I	1.0	1	.	.	.	.	.	.	.	.	.	.	.
SOIL 16	J	1.1	2	0.25	.	.	.	.	.	.	.	.	.	.
		1.0												
		0.50												
SOIL 17	A	4.9	4	6	4	5	6	4	6	4	.	.	.	.
SOIL 17	B	3.7	6	0.25	4	2	3	2	5	5	4	4	5	.
SOIL 17	C	4.2	4	3	4	4	3	6	5	3	5	5	.	.
SOIL 17	D	4.5	5	5	4	4	.	.	.	.	.	.	.	.
SOIL 17	E	4.0	5	6	3	3	0.25	5	4	5	5	.	.	.
SOIL 17	F	4.9	6	4	6	3	4	4	6	4	6	6	.	.
SOIL 17	G	3.5	5	3	3	2	2	5	5	3	.	.	.	.
SOIL 17	H	4.0	4	4	4	2	5	5	4	.	.	.	.	.
SOIL 17	I	4.4	6	3	4	2	4	5	5	6	4	5	.	.
SOIL 17	J	4.7	3	4	5	3	6	5	7	6	3	5	5	.
		4.3												
		0.49												

Appendix 6.2

(continued)

Sideoats Grama (Nursery Provided) Test Results: Height

SOIL	REP	MN HT	HT1	HT2	HT3	HT4	HT5	HT6	HT7	HT8	HT9	HT10	HT11	HT12
		cm	cm											
SOIL 19	A	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 19	B	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 19	C	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 19	D	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 19	E	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 19	F	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 19	G	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 19	H	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 19	I	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 19	J	.	.	.	.	.	.	.	.	.	.	.	.	.
		.												
		.												
SOIL 20	A	6.2	8	8	5	5	6	6	3	7	9	5	.	.
SOIL 20	B	5.6	6	6	7	4	6	5	6	5	.	.	.	.
SOIL 20	C	6.4	8	4	7	6	8	5	5	8	7	.	.	.
SOIL 20	D	5.9	8	6	5	4	4	4	9	8	5	.	.	.
SOIL 20	E	7.3	7	9	9	5	6	8	7	7	.	.	.	.
SOIL 20	F	6.8	5	5	4	6	10	9	7	5	9	8	.	.
SOIL 20	G	6.3	8	7	9	3	7	6	4	.	.	.	.	.
SOIL 20	H	6.6	9	4	7	6	3	5	8	11	10	6	6	4
SOIL 20	I	5.3	5	5	6	7	3	4	5	7	6	5	.	.
SOIL 20	J	7.0	5	9	5	9	9	7	5	5	6	9	8	.
		6.3												
		0.61												

Appendix 6.2

(continued)

Sideoats Grama (Nursery Provided) Test Results: Height

SOIL	REP	MN HT	HT1	HT2	HT3	HT4	HT5	HT6	HT7	HT8	HT9	HT10	HT11	HT12
		cm	cm											
SOIL 21	A	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 21	B	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 21	C	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 21	D	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 21	E	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 21	F	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 21	G	0.3	0.25	.	.	.	.	.	.	.	.	.	.	.
SOIL 21	H	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 21	I	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 21	J	.	.	.	.	.	.	.	.	.	.	.	.	.
		0.3												
		.												
SOIL 22	A	2.0	2	.	.	.	.	.	.	.	.	.	.	.
SOIL 22	B	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 22	C	1.0	1	.	.	.	.	.	.	.	.	.	.	.
SOIL 22	D	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 22	E	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 22	F	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 22	G	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 22	H	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 22	I	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 22	J	.	.	.	.	.	.	.	.	.	.	.	.	.
		1.5												
		0.71												

Appendix 6.2
(continued)
Sideoats Grama (Nursery Provided) Test Results: Height

SOIL	REP	MN HT	HT1	HT2	HT3	HT4	HT5	HT6	HT7	HT8	HT9	HT10	HT11	HT12
		cm	cm											
SOIL 23	A	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 23	B	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 23	C	1.0	1	.	.	.	.	.	.	.	.	.	.	.
SOIL 23	D	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 23	E	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 23	F	2.0	2	.	.	.	.	.	.	.	.	.	.	.
SOIL 23	G	1.0	1	.	.	.	.	.	.	.	.	.	.	.
SOIL 23	H	1.0	1	1	.	.	.	.	.	.	.	.	.	.
SOIL 23	I	2.0	2	.	.	.	.	.	.	.	.	.	.	.
SOIL 23	J	.	.	.	.	.	.	.	.	.	.	.	.	.
		1.4												
		0.55												
SOIL 24	A	9.3	9	11	10	11	8	7	.	.	.	.	.	.
SOIL 24	B	8.6	12	11	9	9	11	6	1	10	.	.	.	.
SOIL 24	C	6.4	9	7	2	7	7	.	.	.	.	.	.	.
SOIL 24	D	7.7	11	6	9	10	8	2	.	.	.	.	.	.
SOIL 24	E	10.0	9	11	.	.	.	.	.	.	.	.	.	.
SOIL 24	F	7.2	5	11	3	11	5	8	.	.	.	.	.	.
SOIL 24	G	8.4	11	7	5	9	10	.	.	.	.	.	.	.
SOIL 24	H	8.4	6	9	8	10	9	.	.	.	.	.	.	.
SOIL 24	I	6.7	7	5	8	9	9	7	3	7	5	.	.	.
SOIL 24	J	8.5	11	8	10	8	6	8	.	.	.	.	.	.
		8.1												
		1.14												

Appendix 6.2
(continued)
Sideoats Grama (Nursery Provided) Test Results: Height

SOIL	REP	MN HT	HT1	HT2	HT3	HT4	HT5	HT6	HT7	HT8	HT9	HT10	HT11	HT12
		cm	cm											
SOIL 25	A	8.5	11	8	10	7	6	7	8	10	11	7	.	.
SOIL 25	B	7.6	5	8	10	3	8	10	6	11	.	.	.	.
SOIL 25	C	6.9	8	5	7	5	7	7	9	8	6	.	.	.
SOIL 25	D	7.6	7	6	10	9	8	6	7	8	.	.	.	.
SOIL 25	E	5.8	8	3	4	5	4	7	8	7	2	10	.	.
SOIL 25	F	9.3	10	11	12	10	9	8	8	8	8	.	.	.
SOIL 25	G	7.1	5	6	7	10	5	10	7	8	10	3	.	.
SOIL 25	H	6.9	0.25	12	6	7	10	7	6	.	.	.	.	.
SOIL 25	I	7.6	7	8	3	9	6	12	9	7	.	.	.	.
SOIL 25	J	8.3	9	10	9	3	9	10	10	9	6	.	.	.
		7.6												
		0.99												
SOIL 26	A	4.6	5	5	5	5	5	5	5	2	.	.	.	.
SOIL 26	B	3.4	4	5	3	2	5	4	1	.	.	.	.	.
SOIL 26	C	5.3	5	6	5	5	.	.	.	.	.	.	.	.
SOIL 26	D	4.3	5	1	4	4	6	5	5	.	.	.	.	.
SOIL 26	E	4.8	4	5	4	5	5	7	8	0.25	.	.	.	.
SOIL 26	F	5.3	6	6	4	7	4	7	5	4	6	4	.	.
SOIL 26	G	4.6	3	4	5	2	5	8	5	5	.	.	.	.
SOIL 26	H	4.8	3	5	4	7	.	.	.	.	.	.	.	.
SOIL 26	I	4.9	5	7	4	5	5	5	4	4	.	.	.	.
SOIL 26	J	4.4	5	2	4	6	4	6	5	3	.	.	.	.
		4.6												
		0.53												

Appendix 6.2
(continued)
Sideoats Grama (Nursery Provided) Test Results: Height

SOIL	REP	MN HT	HT1	HT2	HT3	HT4	HT5	HT6	HT7	HT8	HT9	HT10	HT11	HT12
		cm	cm											
SOIL 27	A	3.4	3	4	4	2	4	.	.	.	.	.	.	.
SOIL 27	B	2.9	3	3	3	4	3	2	3	2	.	.	.	.
SOIL 27	C	3.1	4	3	4	4	3	4	1	2	.	.	.	.
SOIL 27	D	3.0	4	3	4	1	.	.	.	.	.	.	.	.
SOIL 27	E	4.0	5	6	4	4	6	2	4	5	4	2	2	.
SOIL 27	F	1.7	2	2	1	.	.	.	.	.	.	.	.	.
SOIL 27	G	3.2	4	2	3	3	4	.	.	.	.	.	.	.
SOIL 27	H	3.2	5	4	3	2	2	3	.	.	.	.	.	.
SOIL 27	I	3.2	3	3	4	1	4	4	.	.	.	.	.	.
SOIL 27	J	2.5	2	3	3	2	.	.	.	.	.	.	.	.
		3.0												
		0.61												
SOIL 28	A	6.5	11	9	3	6	3	3	10	7	.	.	.	.
SOIL 28	B	8.3	10	11	2	9	8	7	11	8	.	.	.	.
SOIL 28	C	7.1	10	9	6	7	7	9	8	5	6	4	.	.
SOIL 28	D	7.5	10	4	6	8	6	8	10	8	.	.	.	.
SOIL 28	E	6.6	8	8	1	9	8	8	4	7	.	.	.	.
SOIL 28	F	7.0	8	5	6	8	6	7	6	9	9	6	.	.
SOIL 28	G	6.7	6	9	8	1	11	7	5	.	.	.	.	.
SOIL 28	H	7.2	9	6	8	8	7	3	8	10	6	.	.	.
SOIL 28	I	5.8	7	0.25	7	6	7	5	6	8	.	.	.	.
SOIL 28	J	7.6	8	8	6	9	7	9	8	2	10	9	.	.
		7.0												
		0.68												

Appendix 6.2
(continued)
Sideoats Grama (Nursery Provided) Test Results: Height

SOIL	REP	MN HT	HT1	HT2	HT3	HT4	HT5	HT6	HT7	HT8	HT9	HT10	HT11	HT12
		cm	cm											
SOIL 29	A	2.0	2	.	.	.	.	.	.	.	.	.	.	.
SOIL 29	B	0.3	0.25	.	.	.	.	.	.	.	.	.	.	.
SOIL 29	C	1.6	3	0.25	.	.	.	.	.	.	.	.	.	.
SOIL 29	D	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 29	E	1.0	1	.	.	.	.	.	.	.	.	.	.	.
SOIL 29	F	0.8	1	1	0.25	.	.	.	.	.	.	.	.	.
SOIL 29	G	2.0	1	3	2	.	.	.	.	.	.	.	.	.
SOIL 29	H	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 29	I	1.3	1	2	1	.	.	.	.	.	.	.	.	.
SOIL 29	J	1.0	1	.	.	.	.	.	.	.	.	.	.	.
		1.2												
		0.61												
SOIL 30	A	0.3	0.25	.	.	.	.	.	.	.	.	.	.	.
SOIL 30	B	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 30	C	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 30	D	0.3	0.25	.	.	.	.	.	.	.	.	.	.	.
SOIL 30	E	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 30	F	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 30	G	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 30	H	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 30	I	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 30	J	.	.	.	.	.	.	.	.	.	.	.	.	.
		0.3												
		0.00												

Appendix 6.2
(continued)
Sideoats Grama (Nursery Provided) Test Results: Height

SOIL	REP	MN HT	HT1	HT2	HT3	HT4	HT5	HT6	HT7	HT8	HT9	HT10	HT11	HT12
		cm	cm											
SOIL 31	A	5.2	5	6	4	5	6	.	.	.	.	.	.	.
SOIL 31	B	5.3	6	7	4	5	5	5	5	.	.	.	.	.
SOIL 31	C	5.0	5	6	5	3	6	5	5	6	5	4	.	.
SOIL 31	D	4.5	4	4	3	5	8	3	4	5	.	.	.	.
SOIL 31	E	4.4	5	4	4	4	4	4	6	.	.	.	.	.
SOIL 31	F	4.8	5	5	4	5	5	5	4	4	6	5	.	.
SOIL 31	G	3.7	3	0.25	6	4	0.25	5	5	6	.	.	.	.
SOIL 31	H	4.2	5	7	6	1	4	6	0.25	.	.	.	.	.
SOIL 31	I	4.1	4	3	5	5	5	4	3	.	.	.	.	.
SOIL 31	J	4.1	4	4	4	3	6	3	4	5	.	.	.	.
		4.5												
		0.52												
SOIL 32	A	0.8	0.25	1	1	.	.	.	.	.	.	.	.	.
SOIL 32	B	1.0	1	.	.	.	.	.	.	.	.	.	.	.
SOIL 32	C	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 32	D	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 32	E	1.7	1	2	2	.	.	.	.	.	.	.	.	.
SOIL 32	F	1.3	1	2	1	.	.	.	.	.	.	.	.	.
SOIL 32	G	1.1	2	0.25	.	.	.	.	.	.	.	.	.	.
SOIL 32	H	0.8	1	1	0.25	.	.	.	.	.	.	.	.	.
SOIL 32	I	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 32	J	0.3	0.25	.	.	.	.	.	.	.	.	.	.	.
		1.0												
		0.46												

Appendix 6.2

(continued)

Sideoats Grama (Nursery Provided) Test Results: Height

SOIL	REP	MN HT	HT1	HT2	HT3	HT4	HT5	HT6	HT7	HT8	HT9	HT10	HT11	HT12
		cm	cm											
SOIL 35	A	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 35	B	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 35	C	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 35	D	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 35	E	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 35	F	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 35	G	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 35	H	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 35	I	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 35	J	.	.	.	.	.	.	.	.	.	.	.	.	.
		.												
		.												
SOIL 36	A	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 36	B	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 36	C	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 36	D	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 36	E	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 36	F	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 36	G	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 36	H	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 36	I	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 36	J	.	.	.	.	.	.	.	.	.	.	.	.	.
		.												
		.												

Appendix 6.3

Sideoats Grama (Nursery Provided) Test Results: Condition

SOIL	REP	Condition Score	Symptom(s) Observed		SOIL	REP	Condition Score	Symptom(s) Observed		SOIL	REP	Condition Score	Symptom(s) Observed
NC	A	20	M		SOIL 2	A	0	none		SOIL 4	A	30	N
NC	B	40	N,M		SOIL 2	B	0	none		SOIL 4	B	20	N,M
NC	C	30	CL,N		SOIL 2	C	10	N		SOIL 4	C	10	N
NC	D	0	none		SOIL 2	D	10	M		SOIL 4	D	40	CL,N,M
NC	E	0	none		SOIL 2	E	0	none		SOIL 4	E	20	CL,N
NC	F	30	N,M		SOIL 2	F	0	none		SOIL 4	F	20	N,M
NC	G	40	N,M		SOIL 2	G	0	none		SOIL 4	G	20	N,M
NC	H	10	N,M		SOIL 2	H	10	N		SOIL 4	H	40	N,M
NC	I	10	N		SOIL 2	I	0	none		SOIL 4	I	50	CL,N
NC	J	10	N		SOIL 2	J	0	none		SOIL 4	J	10	N,M
SOIL 1	A	.	NE		SOIL 3	A	40	N,M		SOIL 5	A	20	CL,N,LC,CC
SOIL 1	B	.	NE		SOIL 3	B	60	N,M,CC		SOIL 5	B	40	CL,N,LC
SOIL 1	C	.	NE		SOIL 3	C	20	M		SOIL 5	C	20	CL,N,M
SOIL 1	D	.	NE		SOIL 3	D	0	none		SOIL 5	D	30	CL,M
SOIL 1	E	.	NE		SOIL 3	E	20	N		SOIL 5	E	20	CL,N
SOIL 1	F	.	NE		SOIL 3	F	20	M		SOIL 5	F	40	CL,N,LC
SOIL 1	G	.	NE		SOIL 3	G	.	NE		SOIL 5	G	20	CL,N
SOIL 1	H	.	NE		SOIL 3	H	10	N		SOIL 5	H	20	CL,N
SOIL 1	I	.	NE		SOIL 3	I	60	N,M		SOIL 5	I	30	CL,N,M
SOIL 1	J	.	NE		SOIL 3	J	30	CL,N,CC		SOIL 5	J	20	CL,N,LC

M – Mortality; CL – Chlorosis; N – Necrosis; CC – Color Change; NE – None Emerged; LC – Leaf Curl

Appendix 6.3
(continued)
Sideoats Grama (Nursery Provided) Test Results: Condition

SOIL	REP	Condition Score	Symptom(s) Observed		SOIL	REP	Condition Score	Symptom(s) Observed		SOIL	REP	Condition Score	Symptom(s) Observed
SOIL 6	A	90	CL,N,M		SOIL 8	A	70	CL,N,M		SOIL 10	A	100	M
SOIL 6	B	90	N		SOIL 8	B	100	M		SOIL 10	B	100	M
SOIL 6	C	100	M		SOIL 8	C	90	N,M		SOIL 10	C	90	N
SOIL 6	D	90	N,M		SOIL 8	D	100	M		SOIL 10	D	100	M
SOIL 6	E	100	M		SOIL 8	E	90	CL,N,M		SOIL 10	E	90	CL,N,M
SOIL 6	F	90	CL,N,LC,M		SOIL 8	F	90	N		SOIL 10	F	.	NE
SOIL 6	G	90	CL,N,LC,M		SOIL 8	G	100	M		SOIL 10	G	.	NE
SOIL 6	H	80	CL,N,CC		SOIL 8	H	90	CL,N,M		SOIL 10	H	90	CL,N,M
SOIL 6	I	80	CL,N		SOIL 8	I	90	CL,N,M		SOIL 10	I	100	M
SOIL 6	J	90	CL,N,M		SOIL 8	J	100	M		SOIL 10	J	100	M
SOIL 7	A	.	NE		SOIL 9	A	.	NE		SOIL 11	A	.	NE
SOIL 7	B	.	NE		SOIL 9	B	.	NE		SOIL 11	B	100	M
SOIL 7	C	.	NE		SOIL 9	C	.	NE		SOIL 11	C	100	M
SOIL 7	D	.	NE		SOIL 9	D	.	NE		SOIL 11	D	100	M
SOIL 7	E	.	NE		SOIL 9	E	.	NE		SOIL 11	E	100	M
SOIL 7	F	.	NE		SOIL 9	F	.	NE		SOIL 11	F	.	NE
SOIL 7	G	.	NE		SOIL 9	G	.	NE		SOIL 11	G	90	CL,N,M
SOIL 7	H	.	NE		SOIL 9	H	.	NE		SOIL 11	H	100	M
SOIL 7	I	.	NE		SOIL 9	I	.	NE		SOIL 11	I	100	M
SOIL 7	J	.	NE		SOIL 9	J	.	NE		SOIL 11	J	.	NE

M – Mortality; CL – Chlorosis; N – Necrosis; CC – Color Change; NE – None Emerged

Appendix 6.3
(continued)
Sideoats Grama (Nursery Provided) Test Results: Condition

SOIL	REP	Condition Score	Symptom(s) Observed		SOIL	REP	Condition Score	Symptom(s) Observed		SOIL	REP	Condition Score	Symptom(s) Observed
SOIL 12	A	10	N,M		SOIL 14	A	.	NE		SOIL 16	A	90	CL,N,M
SOIL 12	B	0	none		SOIL 14	B	.	NE		SOIL 16	B	90	N,M
SOIL 12	C	10	N		SOIL 14	C	.	NE		SOIL 16	C	90	CL,N,M,CC
SOIL 12	D	10	N		SOIL 14	D	.	NE		SOIL 16	D	100	M
SOIL 12	E	10	N		SOIL 14	E	.	NE		SOIL 16	E	90	CL,N,M,CC
SOIL 12	F	20	N		SOIL 14	F	.	NE		SOIL 16	F	80	N
SOIL 12	G	0	none		SOIL 14	G	.	NE		SOIL 16	G	90	CL,N,M
SOIL 12	H	30	N,M		SOIL 14	H	.	NE		SOIL 16	H	90	CL,N
SOIL 12	I	10	N		SOIL 14	I	.	NE		SOIL 16	I	90	CL,N,M
SOIL 12	J	10	N,M,CC		SOIL 14	J	.	NE		SOIL 16	J	90	CL,N,CC
SOIL 13	A	100	M		SOIL 15	A	90	CL,N,M		SOIL 17	A	10	CL,N
SOIL 13	B	60	CL,N,M		SOIL 15	B	90	CL,N,M		SOIL 17	B	20	CL,N,LC
SOIL 13	C	60	CL,N,M,CC		SOIL 15	C	70	CL,N,M,CC		SOIL 17	C	20	CL,N,LC
SOIL 13	D	70	CL,M		SOIL 15	D	90	CL,N,M		SOIL 17	D	10	CL,LC
SOIL 13	E	60	CL,N,M		SOIL 15	E	90	CL,N,M		SOIL 17	E	20	CL,LC,M
SOIL 13	F	70	CL,N,M		SOIL 15	F	90	CL,N,M		SOIL 17	F	20	CL,N,LC,M
SOIL 13	G	60	CL,N,M		SOIL 15	G	90	CL,N,M		SOIL 17	G	20	CL,N,LC
SOIL 13	H	60	CL,N,M		SOIL 15	H	80	CL,N		SOIL 17	H	20	CL,LC,M
SOIL 13	I	80	CL,N,M		SOIL 15	I	90	CL,N,M		SOIL 17	I	20	CL,N,LC
SOIL 13	J	60	CL,N,M		SOIL 15	J	100	M		SOIL 17	J	10	CL,LC

M – Mortality; CL – Chlorosis; N – Necrosis; CC – Color Change; NE – None Emerged; LC – Leaf Curl

Appendix 6.3

(continued)

Sideoats Grama (Nursery Provided) Test Results: Condition

SOIL	REP	Condition Score	Symptom(s) Observed		SOIL	REP	Condition Score	Symptom(s) Observed		SOIL	REP	Condition Score	Symptom(s) Observed
SOIL 19	A	100	M		SOIL 21	A	100	M		SOIL 23	A	100	M
SOIL 19	B	.	NE		SOIL 21	B	100	M		SOIL 23	B	.	NE
SOIL 19	C	100	M		SOIL 21	C	100	M		SOIL 23	C	90	CL,N,M
SOIL 19	D	.	NE		SOIL 21	D	.	NE		SOIL 23	D	100	M
SOIL 19	E	100	M		SOIL 21	E	.	NE		SOIL 23	E	100	M
SOIL 19	F	.	NE		SOIL 21	F	100	M		SOIL 23	F	80	N,M
SOIL 19	G	.	NE		SOIL 21	G	90	N,M		SOIL 23	G	90	N
SOIL 19	H	.	NE		SOIL 21	H	100	M		SOIL 23	H	90	CL,N,M,CC
SOIL 19	I	.	NE		SOIL 21	I	100	M		SOIL 23	I	80	CL,N
SOIL 19	J	.	NE		SOIL 21	J	100	M		SOIL 23	J	100	M
SOIL 20	A	0	none		SOIL 22	A	70	CL,N		SOIL 24	A	20	N,M
SOIL 20	B	10	CL,LC		SOIL 22	B	100	M		SOIL 24	B	10	N
SOIL 20	C	10	CL,LC		SOIL 22	C	80	N		SOIL 24	C	10	N
SOIL 20	D	10	CL		SOIL 22	D	100	M		SOIL 24	D	20	N,M
SOIL 20	E	10	CL		SOIL 22	E	100	M		SOIL 24	E	50	M
SOIL 20	F	20	CL,N,LC,CC,M		SOIL 22	F	100	M		SOIL 24	F	10	N
SOIL 20	G	20	CL,N,LC,M		SOIL 22	G	100	M		SOIL 24	G	10	N
SOIL 20	H	10	CL		SOIL 22	H	100	M		SOIL 24	H	0	none
SOIL 20	I	20	CL,LC		SOIL 22	I	100	M		SOIL 24	I	0	none
SOIL 20	J	10	CL		SOIL 22	J	100	M		SOIL 24	J	0	none

M – Mortality; CL – Chlorosis; N – Necrosis; CC – Color Change; NE – None Emerged; LC – Leaf Curl

Appendix 6.3
(continued)
Sideoats Grama (Nursery Provided) Test Results: Condition

SOIL	REP	Condition Score	Symptom(s) Observed		SOIL	REP	Condition Score	Symptom(s) Observed		SOIL	REP	Condition Score	Symptom(s) Observed
SOIL 25	A	0	none		SOIL 27	A	60	CL,N,M		SOIL 29	A	90	CL,N,M
SOIL 25	B	10	CL,N		SOIL 27	B	70	CL,N,M,CC		SOIL 29	B	90	CL,N,M
SOIL 25	C	0	none		SOIL 27	C	60	CL,N		SOIL 29	C	90	CL,N,M
SOIL 25	D	0	none		SOIL 27	D	70	CL,N,M		SOIL 29	D	100	M
SOIL 25	E	20	CL,N,M		SOIL 27	E	60	CL,N,CC		SOIL 29	E	90	CL,N,M
SOIL 25	F	10	N,M		SOIL 27	F	80	CL,N,M		SOIL 29	F	90	CL,N,M
SOIL 25	G	10	CL,LC		SOIL 27	G	60	CL,N,M		SOIL 29	G	80	CL,N,M
SOIL 25	H	10	CL		SOIL 27	H	60	CL,N,M,CC		SOIL 29	H	100	M
SOIL 25	I	10	CL,M		SOIL 27	I	70	CL,N,M,CC		SOIL 29	I	80	CL,N,M
SOIL 25	J	0	none		SOIL 27	J	80	CL,N,M,CC		SOIL 29	J	90	CL,N,M
SOIL 26	A	20	N,LC,M		SOIL 28	A	10	LC		SOIL 30	A	90	N
SOIL 26	B	40	N,LC		SOIL 28	B	0	none		SOIL 30	B	.	NE
SOIL 26	C	40	CL,N,LC,M		SOIL 28	C	0	none		SOIL 30	C	100	M
SOIL 26	D	30	CL,N,LC,M		SOIL 28	D	0	none		SOIL 30	D	90	CL,N
SOIL 26	E	0	none		SOIL 28	E	20	N,M		SOIL 30	E	100	M
SOIL 26	F	20	CL,N,LC		SOIL 28	F	10	N,M		SOIL 30	F	100	M
SOIL 26	G	20	CL,LC		SOIL 28	G	0	none		SOIL 30	G	100	M
SOIL 26	H	20	CL,N,LC,M		SOIL 28	H	0	none		SOIL 30	H	.	NE
SOIL 26	I	20	N,LC		SOIL 28	I	0	none		SOIL 30	I	100	M
SOIL 26	J	30	N,LC,M		SOIL 28	J	10	N		SOIL 30	J	.	NE

M – Mortality; CL – Chlorosis; N – Necrosis; CC – Color Change; NE – None Emerged; LC – Leaf Curl

Appendix 6.3

(continued)

Sideoats Grama (Nursery Provided) Test Results: Condition

SOIL	REP	Condition Score	Symptom(s) Observed		SOIL	REP	Condition Score	Symptom(s) Observed
SOIL 31	A	40	CL,N,M		SOIL 35	A	.	NE
SOIL 31	B	30	CL,N,CC		SOIL 35	B	.	NE
SOIL 31	C	30	CL,N,CC		SOIL 35	C	.	NE
SOIL 31	D	40	CL,N,CC		SOIL 35	D	.	NE
SOIL 31	E	50	CL,N,CC		SOIL 35	E	.	NE
SOIL 31	F	40	CL,N,CC		SOIL 35	F	.	NE
SOIL 31	G	50	CL,N,CC,M		SOIL 35	G	.	NE
SOIL 31	H	40	CL,N,CC,M		SOIL 35	H	.	NE
SOIL 31	I	50	CL,N,CC		SOIL 35	I	.	NE
SOIL 31	J	50	CL,N,CC		SOIL 35	J	.	NE
SOIL 32	A	90	CL,N,M		SOIL 36	A	.	NE
SOIL 32	B	90	N,M		SOIL 36	B	.	NE
SOIL 32	C	100	M		SOIL 36	C	.	NE
SOIL 32	D	100	M		SOIL 36	D	.	NE
SOIL 32	E	80	CL,N,M,CC		SOIL 36	E	.	NE
SOIL 32	F	90	CL,N,M		SOIL 36	F	.	NE
SOIL 32	G	90	CL,N,M		SOIL 36	G	.	NE
SOIL 32	H	90	CL,N		SOIL 36	H	.	NE
SOIL 32	I	.	.		SOIL 36	I	.	NE
SOIL 32	J	90	CL,N,M		SOIL 36	J	.	NE

M – Mortality; CL – Chlorosis; N – Necrosis; CC – Color Change; NE – None Emerged

Appendix 7.1

Tansy Aster (Nursery-Provided) Test Results: pH, Emergence, Survival, Root Length and Dry Weight

SOIL	REP	INIT PH	FIN PH (Soil Probe)	FIN PH (Lab Meter)	EM 0	EM 21	SURV	RT LGTH	TOT DWT	MN DWT
		pH	pH	pH	per 12	per 12	per 12	cm	g	g
NC	A	5.8	5.2	6.1	6	6	2	15	0.358	0.179
NC	B	5.8	5.2	6.4	6	6	2	34	0.549	0.275
NC	C	5.8	6.1	6.7	5	5	2	16	0.539	0.270
NC	D	5.8	5.8	6.7	7	7	4	30	1.032	0.258
NC	E	5.8	6.0	6.7	7	7	2	19	0.579	0.290
NC	F	5.8	4.8	6.8	5	5	1	22	0.581	0.581
NC	G	5.8	4.8	5.6	3	3	0	.	.	.
NC	H	5.8	4.2	7.5	4	4	1	14	0.505	0.505
NC	I	5.8	4.8	6.9	7	7	5	19	1.749	0.350
NC	J	5.8	4.8	6.4	4	4	3	20	0.876	0.292
						5.40	2.20	21.0		0.333
						1.43	1.48	6.80		0.128
SOIL 1	A	4.6	4.9	4.3	0	0	0	.	.	.
SOIL 1	B	4.6	4.5	4.0	0	0	0	.	.	.
SOIL 1	C	4.6	3.6	4.2	0	0	0	.	.	.
SOIL 1	D	4.6	4.2	4.3	0	0	0	.	.	.
SOIL 1	E	4.6	4.8	4.3	0	0	0	.	.	.
SOIL 1	F	4.6	3.8	4.5	0	0	0	.	.	.
SOIL 1	G	4.6	<3.5	4.7	0	0	0	.	.	.
SOIL 1	H	4.6	3.9	4.4	0	0	0	.	.	.
SOIL 1	I	4.6	3.9	4.5	0	0	0	.	.	.
SOIL 1	J	4.6	<3.5	4.3	0	0	0	.	.	.
						0.00	0.00	.		.
						0.00	0.00	.		.

Appendix 7.1
(continued)
Tansy Aster (Nursery-Provided) Test Results: pH, Emergence, Survival, Root Length and Dry Weight

SOIL	REP	INIT PH	FIN PH (Soil Probe)	FIN PH (Lab Meter)	EM 0	EM 21	SURV	RT LGTH	TOT DWT	MN DWT
		pH	pH	pH	per 12	per 12	per 12	cm	g	g
SOIL 2	A	4.6	5.5	7.5	1	1	1	3	0.005	0.005
SOIL 2	B	4.6	6.5	7.5	1	1	1	3	0.011	0.011
SOIL 2	C	4.6	6.8	7.7	2	2	2	4	0.025	0.013
SOIL 2	D	4.6	6.7	7.7	1	1	1	4	0.021	0.021
SOIL 2	E	4.6	6.3	7.5	0	0	0	.	.	.
SOIL 2	F	4.6	7.0	7.8	0	0	0	.	.	.
SOIL 2	G	4.6	7.0	7.9	0	0	0	.	.	.
SOIL 2	H	4.6	5.7	7.6	0	0	0	.	.	.
SOIL 2	I	4.6	5.9	7.6	0	0	0	.	.	.
SOIL 2	J	4.6	7.0	7.8	0	0	0	.	.	.
						0.50	0.50	3.5		0.012
						0.71	0.71	0.58		0.007
SOIL 3	A	5.2	6.8	4.9	1	1	0	.	.	.
SOIL 3	B	5.2	6.9	5.1	0	0	0	.	.	.
SOIL 3	C	5.2	7.0	5.4	2	2	2	5	0.002	0.001
SOIL 3	D	5.2	6.8	5.4	1	1	1	2	0.003	0.003
SOIL 3	E	5.2	6.7	5.0	0	0	0	.	.	.
SOIL 3	F	5.2	6.8	5.5	1	1	1	3	0.003	0.003
SOIL 3	G	5.2	6.0	5.1	1	1	1	1	0.004	0.004
SOIL 3	H	5.2	5.9	5.4	1	1	1	2	0.003	0.003
SOIL 3	I	5.2	6.2	5.2	3	3	3	1	0.005	0.002
SOIL 3	J	5.2	6.9	4.6	0	0	0	.	.	.
						1.00	0.90	2.3		0.003
						0.94	0.99	1.51		0.001

Appendix 7.1

(continued)

Tansy Aster (Nursery-Provided) Test Results: pH, Emergence, Survival, Root Length and Dry Weight

SOIL	REP	INIT PH	FIN PH (Soil Probe)	FIN PH (Lab Meter)	EM 0	EM 21	SURV	RT LGTH	TOT DWT	MN DWT
		pH	pH	pH	per 12	per 12	per 12	cm	g	g
SOIL 4	A	5.8	5.6	5.1	5	5	5	12	0.254	0.051
SOIL 4	B	5.8	5.6	5.3	4	4	3	17	0.191	0.064
SOIL 4	C	5.8	6.3	5.1	4	4	4	22	0.193	0.048
SOIL 4	D	5.8	6.1	5.2	3	3	3	5	0.112	0.037
SOIL 4	E	5.8	6.0	5.2	1	1	1	20	0.038	0.038
SOIL 4	F	5.8	6.0	5.5	2	2	2	13	0.169	0.085
SOIL 4	G	5.8	6.3	5.2	3	3	3	13	0.205	0.068
SOIL 4	H	5.8	5.8	5.5	3	3	3	16	0.108	0.036
SOIL 4	I	5.8	6.1	5.3	2	2	2	5	0.125	0.063
SOIL 4	J	5.8	5.8	5.0	3	3	3	9	0.213	0.071
						3.00	2.90	13.2		0.056
						1.15	1.10	5.77		0.016
SOIL 5	A	5.1	6.0	6.3	1	1	1	1	0.002	0.002
SOIL 5	B	5.1	6.9	6.4	1	1	1	2	0.009	0.009
SOIL 5	C	5.1	7.0	6.5	3	3	2	2	0.025	0.013
SOIL 5	D	5.1	5.8	6.6	4	4	4	2	0.015	0.004
SOIL 5	E	5.1	5.7	5.9	4	4	4	3	0.019	0.005
SOIL 5	F	5.1	5.7	6.1	4	4	4	3	0.019	0.005
SOIL 5	G	5.1	5.5	6.2	4	4	4	3	0.028	0.007
SOIL 5	H	5.1	5.8	6.2	4	5	4	2	0.030	0.008
SOIL 5	I	5.1	5.7	6.4	2	2	2	2	0.005	0.003
SOIL 5	J	5.1	4.8	6.3	1	1	1	1	0.005	0.005
						2.90	2.70	2.1		0.006
						1.52	1.42	0.74		0.003

Appendix 7.1
(continued)
Tansy Aster (Nursery-Provided) Test Results: pH, Emergence, Survival, Root Length and Dry Weight

SOIL	REP	INIT PH	FIN PH (Soil Probe)	FIN PH (Lab Meter)	EM 0	EM 21	SURV	RT LGTH	TOT DWT	MN DWT
		pH	pH	pH	per 12	per 12	per 12	cm	g	g
SOIL 6	A	4.3	6.8	4.0	0	0	0	.	.	.
SOIL 6	B	4.3	6.9	3.4	0	0	0	.	.	.
SOIL 6	C	4.3	7.0	4.0	0	0	0	.	.	.
SOIL 6	D	4.3	7.0	3.6	0	0	0	.	.	.
SOIL 6	E	4.3	6.8	3.8	0	0	0	.	.	.
SOIL 6	F	4.3	6.5	3.5	0	0	0	.	.	.
SOIL 6	G	4.3	6.3	3.5	0	0	0	.	.	.
SOIL 6	H	4.3	6.1	3.5	1	1	1	2	0.003	0.003
SOIL 6	I	4.3	7.0	3.4	0	0	0	.	.	.
SOIL 6	J	4.3	6.2	3.4	0	0	0	.	.	.
						0.10	0.10	2.0		0.003
						0.32	0.32	.		.
SOIL 7	A	4.0	5.3	2.9	0	0	0	.	.	.
SOIL 7	B	4.0	4.6	3.0	0	0	0	.	.	.
SOIL 7	C	4.0	6.2	3.0	0	0	0	.	.	.
SOIL 7	D	4.0	4.5	3.1	0	0	0	.	.	.
SOIL 7	E	4.0	4.3	3.1	0	0	0	.	.	.
SOIL 7	F	4.0	3.7	3.0	0	0	0	.	.	.
SOIL 7	G	4.0	5.6	2.9	0	0	0	.	.	.
SOIL 7	H	4.0	3.7	2.9	0	0	0	.	.	.
SOIL 7	I	4.0	4.1	2.9	0	0	0	.	.	.
SOIL 7	J	4.0	5.3	2.9	0	0	0	.	.	.
						0.00	0.00	.		.
						0.00	0.00	.		.

Appendix 7.1
(continued)
Tansy Aster (Nursery-Provided) Test Results: pH, Emergence, Survival, Root Length and Dry Weight

SOIL	REP	INIT PH	FIN PH (Soil Probe)	FIN PH (Lab Meter)	EM 0	EM 21	SURV	RT LGTH	TOT DWT	MN DWT
		pH	pH	pH	per 12	per 12	per 12	cm	g	g
SOIL 8	A	5.5	6.2	4.8	2	2	2	0.25	0.002	0.001
SOIL 8	B	5.5	6.2	4.7	2	2	2	1	0.003	0.002
SOIL 8	C	5.5	5.8	4.9	2	2	2	1	0.006	0.003
SOIL 8	D	5.5	5.5	5.1	2	2	2	1	0.004	0.002
SOIL 8	E	5.5	6.6	4.7	1	1	1	1	0.001	0.001
SOIL 8	F	5.5	5.9	5.0	1	1	1	0.25	0.001	0.001
SOIL 8	G	5.5	5.9	4.8	2	2	1	0.25	0.006	0.006
SOIL 8	H	5.5	6.3	4.8	2	2	2	0.25	0.001	0.001
SOIL 8	I	5.5	6.8	4.9	2	2	2	1	0.001	0.001
SOIL 8	J	5.5	6.2	4.7	3	3	2	2	0.002	0.001
						1.90	1.70	0.8		0.002
						0.57	0.48	0.56		0.002
SOIL 9	A	6.0	3.7	4.1	0	0	0	.	.	.
SOIL 9	B	6.0	3.7	4.2	0	0	0	.	.	.
SOIL 9	C	6.0	<3.5	3.7	0	0	0	.	.	.
SOIL 9	D	6.0	3.7	3.8	0	0	0	.	.	.
SOIL 9	E	6.0	4.1	3.8	0	0	0	.	.	.
SOIL 9	F	6.0	3.7	3.9	0	0	0	.	.	.
SOIL 9	G	6.0	<3.5	4.4	0	0	0	.	.	.
SOIL 9	H	6.0	<3.5	3.9	0	0	0	.	.	.
SOIL 9	I	6.0	<3.5	4.1	0	0	0	.	.	.
SOIL 9	J	6.0	3.7	3.9	0	0	0	.	.	.
						0.00	0.00	.		.
						0.00	0.00	.		.

Appendix 7.1
(continued)
Tansy Aster (Nursery-Provided) Test Results: pH, Emergence, Survival, Root Length and Dry Weight

SOIL	REP	INIT PH	FIN PH (Soil Probe)	FIN PH (Lab Meter)	EM 0	EM 21	SURV	RT LGTH	TOT DWT	MN DWT
		pH	pH	pH	per 12	per 12	per 12	cm	g	g
SOIL 10	A	4.4	6.4	5.4	1	1	0	.	.	.
SOIL 10	B	4.4	6.9	5.4	0	0	0	.	.	.
SOIL 10	C	4.4	6.8	5.4	0	0	0	.	.	.
SOIL 10	D	4.4	6.5	5.4	0	0	0	.	.	.
SOIL 10	E	4.4	6.4	5.0	1	1	0	.	.	.
SOIL 10	F	4.4	5.3	5.1	0	0	0	.	.	.
SOIL 10	G	4.4	5.1	5.2	0	0	0	.	.	.
SOIL 10	H	4.4	5.8	5.2	0	0	0	.	.	.
SOIL 10	I	4.4	5.5	5.7	1	1	0	.	.	.
SOIL 10	J	4.4	5.2	5.8	0	0	0	.	.	.
						0.30	0.00	.		.
						0.48	0.00	.		.
SOIL 11	A	5.4	6.1	3.7	0	0	0	.	.	.
SOIL 11	B	5.4	5.4	3.9	0	0	0	.	.	.
SOIL 11	C	5.4	3.7	4.0	0	0	0	.	.	.
SOIL 11	D	5.4	6.1	3.7	0	0	0	.	.	.
SOIL 11	E	5.4	6.3	3.6	0	0	0	.	.	.
SOIL 11	F	5.4	6.1	3.7	0	0	0	.	.	.
SOIL 11	G	5.4	3.9	3.9	0	0	0	.	.	.
SOIL 11	H	5.4	4.7	3.9	0	0	0	.	.	.
SOIL 11	I	5.4	3.8	3.9	0	0	0	.	.	.
SOIL 11	J	5.4	4.6	3.5	0	0	0	.	.	.
						0.00	0.00	.		.
						0.00	0.00	.		.

Appendix 7.1
(continued)
Tansy Aster (Nursery-Provided) Test Results: pH, Emergence, Survival, Root Length and Dry Weight

SOIL	REP	INIT PH	FIN PH (Soil Probe)	FIN PH (Lab Meter)	EM 0	EM 21	SURV	RT LGTH	TOT DWT	MN DWT
		pH	pH	pH	per 12	per 12	per 12	cm	g	g
SOIL 12	A	4.2	6.2	6.7	3	3	3	3	0.007	0.002
SOIL 12	B	4.2	6.4	6.8	1	1	1	3	0.003	0.003
SOIL 12	C	4.2	6.6	7.0	1	1	1	4	0.002	0.002
SOIL 12	D	4.2	5.7	7.0	3	3	3	4	0.012	0.004
SOIL 12	E	4.2	6.7	7.0	3	3	2	3	0.005	0.003
SOIL 12	F	4.2	6.2	6.9	2	2	2	5	0.007	0.004
SOIL 12	G	4.2	6.1	6.7	1	1	1	3	0.001	0.001
SOIL 12	H	4.2	7.0	6.7	1	1	1	3	0.002	0.002
SOIL 12	I	4.2	7.1	6.9	1	1	0	.	.	.
SOIL 12	J	4.2	7.0	7.1	2	2	2	4	0.006	0.003
						1.80	1.60	3.6		0.003
						0.92	0.97	0.73		0.001
SOIL 13	A	5.6	6.4	5.3	0	0	0	.	.	.
SOIL 13	B	5.6	6.5	5.6	0	0	0	.	.	.
SOIL 13	C	5.6	6.2	6.0	0	0	0	.	.	.
SOIL 13	D	5.6	6.7	5.6	1	1	0	.	.	.
SOIL 13	E	5.6	6.9	6.0	0	0	0	.	.	.
SOIL 13	F	5.6	6.3	6.4	3	3	3	7	0.113	0.038
SOIL 13	G	5.6	6.0	6.1	3	3	3	20	0.114	0.038
SOIL 13	H	5.6	6.8	6.1	0	0	0	.	.	.
SOIL 13	I	5.6	6.3	6.4	2	2	2	7	0.035	0.018
SOIL 13	J	5.6	7.0	6.3	2	2	2	7	0.061	0.031
						1.10	1.00	10.3		0.031
						1.29	1.33	6.50		0.010

Appendix 7.1
(continued)
Tansy Aster (Nursery-Provided) Test Results: pH, Emergence, Survival, Root Length and Dry Weight

SOIL	REP	INIT PH	FIN PH (Soil Probe)	FIN PH (Lab Meter)	EM 0	EM 21	SURV	RT LGTH	TOT DWT	MN DWT
		pH	pH	pH	per 12	per 12	per 12	cm	g	g
SOIL 14	A	5.0	3.8	3.7	0	0	0	.	.	.
SOIL 14	B	5.0	3.7	3.7	0	0	0	.	.	.
SOIL 14	C	5.0	4.4	3.6	0	0	0	.	.	.
SOIL 14	D	5.0	3.9	3.6	0	0	0	.	.	.
SOIL 14	E	5.0	5.0	3.6	0	0	0	.	.	.
SOIL 14	F	5.0	4.3	3.7	0	0	0	.	.	.
SOIL 14	G	5.0	4.3	3.4	0	0	0	.	.	.
SOIL 14	H	5.0	4.5	3.6	0	0	0	.	.	.
SOIL 14	I	5.0	4.2	3.5	0	0	0	.	.	.
SOIL 14	J	5.0	4.3	3.5	0	0	0	.	.	.
						0.00	0.00	.		.
						0.00	0.00	.		.
SOIL 15	A	5.2	6.9	4.6	1	1	0	.	.	.
SOIL 15	B	5.2	6.8	4.8	2	2	1	2	0.003	0.003
SOIL 15	C	5.2	7.0	4.2	0	0	0	.	.	.
SOIL 15	D	5.2	7.2	4.4	1	1	0	.	.	.
SOIL 15	E	5.2	7.0	4.4	1	2	2	0.25	0.003	0.002
SOIL 15	F	5.2	7.0	4.3	1	1	1	2	0.001	0.001
SOIL 15	G	5.2	7.0	4.5	2	2	2	2	0.005	0.003
SOIL 15	H	5.2	7.0	4.2	3	3	1	0.25	0.015	0.015
SOIL 15	I	5.2	7.1	4.6	0	0	0	.	.	.
SOIL 15	J	5.2	7.1	4.5	1	1	1	2	0.001	0.001
						1.30	0.80	1.4		0.004
						0.95	0.79	0.90		0.005

Appendix 7.1

(continued)

Tansy Aster (Nursery-Provided) Test Results: pH, Emergence, Survival, Root Length and Dry Weight

SOIL	REP	INIT PH	FIN PH (Soil Probe)	FIN PH (Lab Meter)	EM 0	EM 21	SURV	RT LGTH	TOT DWT	MN DWT
		pH	pH	pH	per 12	per 12	per 12	cm	g	g
SOIL 16	A	4.4	5.5	4.9	0	0	0	.	.	.
SOIL 16	B	4.4	5.0	5.0	0	0	0	.	.	.
SOIL 16	C	4.4	4.9	4.8	0	0	0	.	.	.
SOIL 16	D	4.4	5.0	4.9	0	0	0	.	.	.
SOIL 16	E	4.4	5.0	5.0	0	0	0	.	.	.
SOIL 16	F	4.4	6.2	4.8	0	0	0	.	.	.
SOIL 16	G	4.4	4.6	4.7	0	0	0	.	.	.
SOIL 16	H	4.4	5.0	4.8	0	0	0	.	.	.
SOIL 16	I	4.4	4.6	4.5	0	0	0	.	.	.
SOIL 16	J	4.4	4.1	4.6	0	0	0	.	.	.
						0.00	0.00	.		.
						0.00	0.00	.		.
SOIL 17	A	4.6	7.0	7.3	3	3	3	1	0.005	0.002
SOIL 17	B	4.6	6.8	7.0	1	1	1	1	0.003	0.003
SOIL 17	C	4.6	6.4	7.3	3	3	3	5	0.033	0.011
SOIL 17	D	4.6	6.8	7.3	4	4	4	1	0.014	0.004
SOIL 17	E	4.6	6.7	7.2	4	4	3	3	0.023	0.008
SOIL 17	F	4.6	6.4	7.0	2	2	2	3	0.012	0.006
SOIL 17	G	4.6	6.5	7.0	2	3	3	4	0.010	0.003
SOIL 17	H	4.6	6.2	7.3	3	3	3	1	0.009	0.003
SOIL 17	I	4.6	6.8	7.4	3	3	3	2	0.014	0.005
SOIL 17	J	4.6	7.0	7.5	4	4	4	9	0.042	0.011
						3.00	2.90	3.0		0.005
						0.94	0.88	2.54		0.003

Appendix 7.1

(continued)

Tansy Aster (Nursery-Provided) Test Results: pH, Emergence, Survival, Root Length and Dry Weight

SOIL	REP	INIT PH	FIN PH (Soil Probe)	FIN PH (Lab Meter)	EM 0	EM 21	SURV	RT LGTH	TOT DWT	MN DWT
		pH	pH	pH	per 12	per 12	per 12	cm	g	g
SOIL 19	A	5.8	7.0	5.3	0	0	0	.	.	.
SOIL 19	B	5.8	6.0	4.8	0	0	0	.	.	.
SOIL 19	C	5.8	6.4	4.6	0	0	0	.	.	.
SOIL 19	D	5.8	6.0	4.8	0	0	0	.	.	.
SOIL 19	E	5.8	6.9	4.7	0	0	0	.	.	.
SOIL 19	F	5.8	5.5	4.7	0	0	0	.	.	.
SOIL 19	G	5.8	4.9	4.5	0	0	0	.	.	.
SOIL 19	H	5.8	5.2	4.3	0	0	0	.	.	.
SOIL 19	I	5.8	4.6	4.6	0	0	0	.	.	.
SOIL 19	J	5.8	5.9	4.5	0	0	0	.	.	.
						0.00	0.00	.		.
						0.00	0.00	.		.
SOIL 20	A	5.4	6.2	7.2	3	3	3	4	0.015	0.005
SOIL 20	B	5.4	5.6	7.3	2	2	2	4	0.011	0.006
SOIL 20	C	5.4	5.0	7.4	3	3	3	5	0.016	0.005
SOIL 20	D	5.4	5.7	7.0	3	3	3	13	0.041	0.014
SOIL 20	E	5.4	6.1	7.3	5	5	5	4	0.034	0.007
SOIL 20	F	5.4	7.0	7.6	2	2	2	3	0.016	0.008
SOIL 20	G	5.4	6.0	7.5	0	0	0	.	.	.
SOIL 20	H	5.4	6.4	7.4	2	2	2	2	0.030	0.015
SOIL 20	I	5.4	6.9	7.5	3	3	3	3	0.033	0.011
SOIL 20	J	5.4	6.5	7.4	4	4	4	4	0.025	0.006
						2.70	2.70	4.7		0.009
						1.34	1.34	3.24		0.004

Appendix 7.1
(continued)
Tansy Aster (Nursery-Provided) Test Results: pH, Emergence, Survival, Root Length and Dry Weight

SOIL	REP	INIT PH	FIN PH (Soil Probe)	FIN PH (Lab Meter)	EM 0	EM 21	SURV	RT LGTH	TOT DWT	MN DWT
		pH	pH	pH	per 12	per 12	per 12	cm	g	g
SOIL 21	A	5.1	4.2	4.2	2	2	0	.	.	.
SOIL 21	B	5.1	5.6	3.7	0	0	0	.	.	.
SOIL 21	C	5.1	5.2	3.8	1	1	0	.	.	.
SOIL 21	D	5.1	4.8	3.7	1	1	0	.	.	.
SOIL 21	E	5.1	4.7	3.8	1	1	0	.	.	.
SOIL 21	F	5.1	6.8	3.9	0	0	0	.	.	.
SOIL 21	G	5.1	6.5	3.9	0	0	0	.	.	.
SOIL 21	H	5.1	5.2	3.9	0	0	0	.	.	.
SOIL 21	I	5.1	5.1	3.9	0	0	0	.	.	.
SOIL 21	J	5.1	5.8	3.9	1	1	0	.	.	.
						0.60	0.00	.		.
						0.70	0.00	.		.
SOIL 22	A	5.0	6.3	4.6	0	0	0	.	.	.
SOIL 22	B	5.0	6.4	4.3	0	0	0	.	.	.
SOIL 22	C	5.0	6.0	4.6	0	0	0	.	.	.
SOIL 22	D	5.0	6.0	4.4	0	0	0	.	.	.
SOIL 22	E	5.0	6.2	4.4	0	0	0	.	.	.
SOIL 22	F	5.0	6.5	4.5	0	0	0	.	.	.
SOIL 22	G	5.0	7.0	4.1	0	0	0	.	.	.
SOIL 22	H	5.0	6.5	4.4	0	0	0	.	.	.
SOIL 22	I	5.0	6.8	4.3	0	0	0	.	.	.
SOIL 22	J	5.0	6.7	4.2	0	0	0	.	.	.
						0.00	0.00	.		.
						0.00	0.00	.		.

Appendix 7.1

(continued)

Tansy Aster (Nursery-Provided) Test Results: pH, Emergence, Survival, Root Length and Dry Weight

SOIL	REP	INIT PH	FIN PH (Soil Probe)	FIN PH (Lab Meter)	EM 0	EM 21	SURV	RT LGTH	TOT DWT	MN DWT
		pH	pH	pH	per 12	per 12	per 12	cm	g	g
SOIL 23	A	5.4	4.2	4.1	0	0	0	.	.	.
SOIL 23	B	5.4	5.8	4.5	0	0	0	.	.	.
SOIL 23	C	5.4	5.2	4.2	0	0	0	.	.	.
SOIL 23	D	5.4	5.5	4.3	0	0	0	.	.	.
SOIL 23	E	5.4	5.1	4.2	0	0	0	.	.	.
SOIL 23	F	5.4	5.7	4.3	0	0	0	.	.	.
SOIL 23	G	5.4	6.8	4.2	0	0	0	.	.	.
SOIL 23	H	5.4	6.0	4.3	0	0	0	.	.	.
SOIL 23	I	5.4	6.5	4.4	0	0	0	.	.	.
SOIL 23	J	5.4	6.3	4.5	0	0	0	.	.	.
						0.00	0.00	.		.
						0.00	0.00	.		.
SOIL 24	A	5.7	6.5	6.5	1	1	1	6	0.026	0.026
SOIL 24	B	5.7	6.0	7.0	3	3	3	5	0.046	0.015
SOIL 24	C	5.7	5.9	7.3	1	1	1	5	0.024	0.024
SOIL 24	D	5.7	6.8	7.5	2	2	2	7	0.105	0.053
SOIL 24	E	5.7	6.6	7.3	4	4	4	6	0.154	0.039
SOIL 24	F	5.7	6.2	7.3	3	3	3	6	0.225	0.075
SOIL 24	G	5.7	6.5	7.5	2	2	2	7	0.097	0.049
SOIL 24	H	5.7	6.0	7.6	1	1	1	6	0.043	0.043
SOIL 24	I	5.7	6.0	7.5	2	2	2	6	0.121	0.061
SOIL 24	J	5.7	6.5	7.6	3	3	3	7	0.101	0.034
						2.20	2.20	6.1		0.042
						1.03	1.03	0.74		0.018

Appendix 7.1

(continued)

Tansy Aster (Nursery-Provided) Test Results: pH, Emergence, Survival, Root Length and Dry Weight

SOIL	REP	INIT PH	FIN PH (Soil Probe)	FIN PH (Lab Meter)	EM 0	EM 21	SURV	RT LGTH	TOT DWT	MN DWT
		pH	pH	pH	per 12	per 12	per 12	cm	g	g
SOIL 25	A	5.2	5.8	7.5	1	1	1	5	0.028	0.028
SOIL 25	B	5.2	6.2	7.2	1	1	1	4	0.012	0.012
SOIL 25	C	5.2	6.2	7.6	2	2	2	5	0.066	0.033
SOIL 25	D	5.2	6.9	7.0	0	0	0	.	.	.
SOIL 25	E	5.2	6.5	7.9	1	1	1	7	0.058	0.058
SOIL 25	F	5.2	6.6	7.4	1	1	1	6	0.032	0.032
SOIL 25	G	5.2	6.3	7.0	1	1	1	5	0.040	0.040
SOIL 25	H	5.2	6.3	7.6	1	1	1	5	0.023	0.023
SOIL 25	I	5.2	6.8	7.7	1	1	1	5	0.058	0.058
SOIL 25	J	5.2	6.8	7.3	2	2	2	8	0.095	0.048
						1.10	1.10	5.6		0.037
						0.57	0.57	1.24		0.016
SOIL 26	A	5.0	6.7	7.8	3	3	3	6	0.023	0.008
SOIL 26	B	5.0	6.3	7.6	3	3	3	6	0.018	0.006
SOIL 26	C	5.0	6.0	7.9	0	0	0	.	.	.
SOIL 26	D	5.0	6.6	7.8	3	3	3	2	0.011	0.004
SOIL 26	E	5.0	6.7	8.0	3	3	3	8	0.011	0.004
SOIL 26	F	5.0	6.8	7.6	1	1	0	.	.	.
SOIL 26	G	5.0	6.7	7.0	2	2	2	2	0.013	0.007
SOIL 26	H	5.0	6.9	7.6	2	2	2	2	0.010	0.005
SOIL 26	I	5.0	6.9	7.7	1	1	1	5	0.013	0.013
SOIL 26	J	5.0	6.9	7.8	2	2	2	3	0.014	0.007
						2.00	1.90	4.3		0.007
						1.05	1.20	2.31		0.003

Appendix 7.1

(continued)

Tansy Aster (Nursery-Provided) Test Results: pH, Emergence, Survival, Root Length and Dry Weight

SOIL	REP	INIT PH	FIN PH (Soil Probe)	FIN PH (Lab Meter)	EM 0	EM 21	SURV	RT LGTH	TOT DWT	MN DWT
		pH	pH	pH	per 12	per 12	per 12	cm	g	g
SOIL 27	A	5.0	5.9	4.3	3	3	0	.	.	.
SOIL 27	B	5.0	6.9	4.3	1	1	0	.	.	.
SOIL 27	C	5.0	6.2	4.5	0	0	0	.	.	.
SOIL 27	D	5.0	6.2	4.4	2	2	0	.	.	.
SOIL 27	E	5.0	6.2	4.4	1	1	0	.	.	.
SOIL 27	F	5.0	7.0	4.4	1	1	0	.	.	.
SOIL 27	G	5.0	5.5	4.5	2	2	2	1	0.006	0.003
SOIL 27	H	5.0	6.8	4.3	0	0	0	.	.	.
SOIL 27	I	5.0	5.2	4.3	1	1	1	1	0.004	0.004
SOIL 27	J	5.0	5.0	4.3	3	3	3	2	0.011	0.004
						1.40	0.60	1.3		0.004
						1.07	1.07	0.58		0.001
SOIL 28	A	5.3	5.5	6.5	1	1	1	2	0.017	0.017
SOIL 28	B	5.3	6.3	7.4	3	3	3	4	0.019	0.006
SOIL 28	C	5.3	5.7	7.6	1	1	1	1	0.009	0.009
SOIL 28	D	5.3	5.8	8.0	1	1	1	2	0.009	0.009
SOIL 28	E	5.3	7.0	7.3	0	0	0	.	.	.
SOIL 28	F	5.3	6.6	7.5	2	2	2	3	0.013	0.007
SOIL 28	G	5.3	6.5	7.3	1	1	1	2	0.004	0.004
SOIL 28	H	5.3	6.4	7.4	1	1	1	4	0.002	0.002
SOIL 28	I	5.3	6.4	7.5	1	1	1	3	0.031	0.031
SOIL 28	J	5.3	5.9	7.6	1	1	1	1	0.001	0.001
						1.20	1.20	2.4		0.010
						0.79	0.79	1.13		0.009

Appendix 7.1

(continued)

Tansy Aster (Nursery-Provided) Test Results: pH, Emergence, Survival, Root Length and Dry Weight

SOIL	REP	INIT PH	FIN PH (Soil Probe)	FIN PH (Lab Meter)	EM 0	EM 21	SURV	RT LGTH	TOT DWT	MN DWT
		pH	pH	pH	per 12	per 12	per 12	cm	g	g
SOIL 29	A	5.8	6.8	5.3	0	0	0	.	.	.
SOIL 29	B	5.8	6.3	5.3	0	0	0	.	.	.
SOIL 29	C	5.8	6.9	5.3	0	0	0	.	.	.
SOIL 29	D	5.8	5.5	5.2	0	0	0	.	.	.
SOIL 29	E	5.8	5.4	5.2	0	0	0	.	.	.
SOIL 29	F	5.8	5.3	5.0	0	0	0	.	.	.
SOIL 29	G	5.8	6.0	4.9	0	0	0	.	.	.
SOIL 29	H	5.8	6.5	4.9	0	0	0	.	.	.
SOIL 29	I	5.8	6.8	4.7	0	0	0	.	.	.
SOIL 29	J	5.8	6.5	4.8	0	0	0	.	.	.
						0.00	0.00	.		.
						0.00	0.00	.		.
SOIL 30	A	5.4	5.7	3.8	0	0	0	.	.	.
SOIL 30	B	5.4	6.0	3.8	0	0	0	.	.	.
SOIL 30	C	5.4	5.6	3.6	0	0	0	.	.	.
SOIL 30	D	5.4	5.4	3.9	0	0	0	.	.	.
SOIL 30	E	5.4	6.4	4.0	0	0	0	.	.	.
SOIL 30	F	5.4	5.9	3.8	0	0	0	.	.	.
SOIL 30	G	5.4	6.4	3.9	0	0	0	.	.	.
SOIL 30	H	5.4	6.7	3.9	0	0	0	.	.	.
SOIL 30	I	5.4	6.8	4.1	0	0	0	.	.	.
SOIL 30	J	5.4	6.8	4.0	0	0	0	.	.	.
						0.00	0.00	.		.
						0.00	0.00	.		.

Appendix 7.1
(continued)
Tansy Aster (Nursery-Provided) Test Results: pH, Emergence, Survival, Root Length and Dry Weight

SOIL	REP	INIT PH	FIN PH (Soil Probe)	FIN PH (Lab Meter)	EM 0	EM 21	SURV	RT LGTH	TOT DWT	MN DWT
		pH	pH	pH	per 12	per 12	per 12	cm	g	g
SOIL 31	A	5.2	6.5	5.7	2	2	2	1	0.002	0.001
SOIL 31	B	5.2	6.6	5.8	1	1	1	1	0.002	0.002
SOIL 31	C	5.2	6.9	5.9	4	4	3	2	0.007	0.002
SOIL 31	D	5.2	6.8	5.6	1	1	1	1	0.004	0.004
SOIL 31	E	5.2	6.3	5.6	2	2	2	2	0.003	0.002
SOIL 31	F	5.2	5.8	5.4	2	2	2	2	0.001	0.001
SOIL 31	G	5.2	6.5	5.2	0	0	0	.	.	.
SOIL 31	H	5.2	7.0	5.5	0	0	0	.	.	.
SOIL 31	I	5.2	5.5	5.8	2	2	2	2	0.013	0.007
SOIL 31	J	5.2	5.8	5.8	0	0	0	.	.	.
						1.40	1.30	1.6		0.003
						1.26	1.06	0.53		0.002
SOIL 32	A	4.2	5.0	5.3	0	0	0	.	.	.
SOIL 32	B	4.2	6.9	5.1	0	0	0	.	.	.
SOIL 32	C	4.2	5.9	5.0	0	0	0	.	.	.
SOIL 32	D	4.2	5.0	4.8	0	0	0	.	.	.
SOIL 32	E	4.2	5.8	4.8	0	0	0	.	.	.
SOIL 32	F	4.2	6.0	5.3	0	0	0	.	.	.
SOIL 32	G	4.2	6.9	5.2	0	0	0	.	.	.
SOIL 32	H	4.2	6.5	4.8	0	0	0	.	.	.
SOIL 32	I	4.2	5.7	4.8	0	0	0	.	.	.
SOIL 32	J	4.2	6.3	5.2	0	0	0	.	.	.
						0.00	0.00	.		.
						0.00	0.00	.		.

Appendix 7.1
(continued)
Tansy Aster (Nursery-Provided) Test Results: pH, Emergence, Survival, Root Length and Dry Weight

SOIL	REP	INIT PH	FIN PH (Soil Probe)	FIN PH (Lab Meter)	EM 0	EM 21	SURV	RT LGTH	TOT DWT	MN DWT
		pH	pH	pH	per 12	per 12	per 12	cm	g	g
SOIL 35	A	4.7	5.7	4.7	0	0	0	.	.	.
SOIL 35	B	4.7	5.0	4.5	0	0	0	.	.	.
SOIL 35	C	4.7	5.3	4.8	0	0	0	.	.	.
SOIL 35	D	4.7	6.0	4.8	0	0	0	.	.	.
SOIL 35	E	4.7	6.5	4.7	0	0	0	.	.	.
SOIL 35	F	4.7	6.0	4.6	0	0	0	.	.	.
SOIL 35	G	4.7	6.9	4.5	0	0	0	.	.	.
SOIL 35	H	4.7	5.5	4.4	0	0	0	.	.	.
SOIL 35	I	4.7	5.2	4.6	0	0	0	.	.	.
SOIL 35	J	4.7	5.2	4.6	0	0	0	.	.	.
						0.00	0.00	.		.
						0.00	0.00	.		.
SOIL 36	A	5.2	6.0	5.5	0	0	0	.	.	.
SOIL 36	B	5.2	6.9	5.6	0	0	0	.	.	.
SOIL 36	C	5.2	6.8	5.6	0	0	0	.	.	.
SOIL 36	D	5.2	6.1	5.5	0	0	0	.	.	.
SOIL 36	E	5.2	6.7	5.5	0	0	0	.	.	.
SOIL 36	F	5.2	6.4	5.7	0	0	0	.	.	.
SOIL 36	G	5.2	6.0	5.6	0	0	0	.	.	.
SOIL 36	H	5.2	6.6	5.7	0	0	0	.	.	.
SOIL 36	I	5.2	5.8	5.7	0	0	0	.	.	.
SOIL 36	J	5.2	5.3	5.6	0	0	0	.	.	.
						0.00	0.00	.		.
						0.00	0.00	.		.

Appendix 7.2

Tansy Aster (Nursery-Provided) Test Results: Height

SOIL	REP	MN HT	HT1	HT2	HT3	HT4	HT5	HT6	HT7	HT8	HT9	HT10	HT11	HT12
		cm	cm											
NC	A	12.0	17	7	.	.	.	.	.	.	.	.	.	.
NC	B	14.5	17	12	.	.	.	.	.	.	.	.	.	.
NC	C	15.5	18	13	.	.	.	.	.	.	.	.	.	.
NC	D	14.8	17	16	15	11	.	.	.	.	.	.	.	.
NC	E	16.5	16	17	.	.	.	.	.	.	.	.	.	.
NC	F	17.0	17	.	.	.	.	.	.	.	.	.	.	.
NC	G	.	.	.	.	.	.	.	.	.	.	.	.	.
NC	H	15.0	15	.	.	.	.	.	.	.	.	.	.	.
NC	I	13.8	6	14	16	15	18	.	.	.	.	.	.	.
NC	J	11.7	10	21	4	.	.	.	.	.	.	.	.	.
		14.5												
		1.81												
SOIL 1	A	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 1	B	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 1	C	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 1	D	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 1	E	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 1	F	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 1	G	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 1	H	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 1	I	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 1	J	.	.	.	.	.	.	.	.	.	.	.	.	.
		.												
		.												

Appendix 7.2
(continued)
Tansy Aster (Nursery-Provided) Test Results: Height

SOIL	REP	MN HT	HT1	HT2	HT3	HT4	HT5	HT6	HT7	HT8	HT9	HT10	HT11	HT12
		cm	cm											
SOIL 2	A	3.0	3	.	.	.	.	.	.	.	.	.	.	.
SOIL 2	B	3.0	3	.	.	.	.	.	.	.	.	.	.	.
SOIL 2	C	4.0	5	3	.	.	.	.	.	.	.	.	.	.
SOIL 2	D	5.0	5	.	.	.	.	.	.	.	.	.	.	.
SOIL 2	E	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 2	F	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 2	G	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 2	H	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 2	I	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 2	J	.	.	.	.	.	.	.	.	.	.	.	.	.
		3.8												
		0.96												
SOIL 3	A	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 3	B	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 3	C	1.0	1	1	.	.	.	.	.	.	.	.	.	.
SOIL 3	D	1.0	1	.	.	.	.	.	.	.	.	.	.	.
SOIL 3	E	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 3	F	1.0	1	.	.	.	.	.	.	.	.	.	.	.
SOIL 3	G	1.0	1	.	.	.	.	.	.	.	.	.	.	.
SOIL 3	H	1.0	1	.	.	.	.	.	.	.	.	.	.	.
SOIL 3	I	1.0	1	1	1	.	.	.	.	.	.	.	.	.
SOIL 3	J	.	.	.	.	.	.	.	.	.	.	.	.	.
		1.0												
		0.00												

Appendix 7.2
(continued)
Tansy Aster (Nursery-Provided) Test Results: Height

SOIL	REP	MN HT	HT1	HT2	HT3	HT4	HT5	HT6	HT7	HT8	HT9	HT10	HT11	HT12
		cm	cm											
SOIL 4	A	6.2	6	7	5	5	8	.	.	.	.	.	.	.
SOIL 4	B	5.0	7	4	4	.	.	.	.	.	.	.	.	.
SOIL 4	C	6.8	7	8	5	7	.	.	.	.	.	.	.	.
SOIL 4	D	4.7	4	6	4	.	.	.	.	.	.	.	.	.
SOIL 4	E	7.0	7	.	.	.	.	.	.	.	.	.	.	.
SOIL 4	F	7.5	10	5	.	.	.	.	.	.	.	.	.	.
SOIL 4	G	7.0	9	5	7	.	.	.	.	.	.	.	.	.
SOIL 4	H	5.7	8	6	3	.	.	.	.	.	.	.	.	.
SOIL 4	I	7.5	9	6	.	.	.	.	.	.	.	.	.	.
SOIL 4	J	7.7	7	7	9	.	.	.	.	.	.	.	.	.
		6.5												
		1.07												
SOIL 5	A	2.0	2	.	.	.	.	.	.	.	.	.	.	.
SOIL 5	B	3.0	3	.	.	.	.	.	.	.	.	.	.	.
SOIL 5	C	4.0	4	4	.	.	.	.	.	.	.	.	.	.
SOIL 5	D	2.0	2	2	3	1	.	.	.	.	.	.	.	.
SOIL 5	E	2.3	2	2	2	3	.	.	.	.	.	.	.	.
SOIL 5	F	2.3	3	2	2	2	.	.	.	.	.	.	.	.
SOIL 5	G	2.8	4	3	3	1	.	.	.	.	.	.	.	.
SOIL 5	H	2.5	2	4	2	2	.	.	.	.	.	.	.	.
SOIL 5	I	3.0	4	2	.	.	.	.	.	.	.	.	.	.
SOIL 5	J	4.0	4	.	.	.	.	.	.	.	.	.	.	.
		2.8												
		0.74												

Appendix 7.2
(continued)
Tansy Aster (Nursery-Provided) Test Results: Height

SOIL	REP	MN HT	HT1	HT2	HT3	HT4	HT5	HT6	HT7	HT8	HT9	HT10	HT11	HT12
		cm	cm											
SOIL 6	A	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 6	B	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 6	C	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 6	D	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 6	E	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 6	F	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 6	G	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 6	H	1.0	1	.	.	.	.	.	.	.	.	.	.	.
SOIL 6	I	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 6	J	.	.	.	.	.	.	.	.	.	.	.	.	.
		1.0												
		.												
SOIL 7	A	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 7	B	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 7	C	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 7	D	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 7	E	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 7	F	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 7	G	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 7	H	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 7	I	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 7	J	.	.	.	.	.	.	.	.	.	.	.	.	.
		.												
		.												

Appendix 7.2

(continued)

Tansy Aster (Nursery-Provided) Test Results: Height

SOIL	REP	MN HT	HT1	HT2	HT3	HT4	HT5	HT6	HT7	HT8	HT9	HT10	HT11	HT12
		cm	cm											
SOIL 8	A	0.3	0.25	0.25	.	.	.	.	.	.	.	.	.	.
SOIL 8	B	0.6	1	0.25	.	.	.	.	.	.	.	.	.	.
SOIL 8	C	1.1	0.25	2	.	.	.	.	.	.	.	.	.	.
SOIL 8	D	0.6	0.25	1	.	.	.	.	.	.	.	.	.	.
SOIL 8	E	0.3	0.25	.	.	.	.	.	.	.	.	.	.	.
SOIL 8	F	0.3	0.25	.	.	.	.	.	.	.	.	.	.	.
SOIL 8	G	0.3	0.25	.	.	.	.	.	.	.	.	.	.	.
SOIL 8	H	0.3	0.25	0.25	.	.	.	.	.	.	.	.	.	.
SOIL 8	I	0.3	0.25	0.25	.	.	.	.	.	.	.	.	.	.
SOIL 8	J	0.3	0.25	0.25	.	.	.	.	.	.	.	.	.	.
		0.4												
		0.29												
SOIL 9	A	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 9	B	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 9	C	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 9	D	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 9	E	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 9	F	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 9	G	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 9	H	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 9	I	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 9	J	.	.	.	.	.	.	.	.	.	.	.	.	.
		.												
		.												

Appendix 7.2
(continued)
Tansy Aster (Nursery-Provided) Test Results: Height

SOIL	REP	MN HT	HT1	HT2	HT3	HT4	HT5	HT6	HT7	HT8	HT9	HT10	HT11	HT12
		cm	cm											
SOIL 10	A	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 10	B	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 10	C	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 10	D	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 10	E	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 10	F	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 10	G	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 10	H	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 10	I	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 10	J	.	.	.	.	.	.	.	.	.	.	.	.	.
		.												
		.												
SOIL 11	A	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 11	B	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 11	C	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 11	D	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 11	E	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 11	F	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 11	G	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 11	H	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 11	I	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 11	J	.	.	.	.	.	.	.	.	.	.	.	.	.
		.												
		.												

Appendix 7.2
(continued)
Tansy Aster (Nursery-Provided) Test Results: Height

SOIL	REP	MN HT	HT1	HT2	HT3	HT4	HT5	HT6	HT7	HT8	HT9	HT10	HT11	HT12
		cm	cm											
SOIL 12	A	1.3	2	1	1	.	.	.	.	.	.	.	.	.
SOIL 12	B	1.0	1	.	.	.	.	.	.	.	.	.	.	.
SOIL 12	C	3.0	3	.	.	.	.	.	.	.	.	.	.	.
SOIL 12	D	2.0	3	1	2	.	.	.	.	.	.	.	.	.
SOIL 12	E	1.5	2	1	.	.	.	.	.	.	.	.	.	.
SOIL 12	F	1.5	2	1	.	.	.	.	.	.	.	.	.	.
SOIL 12	G	2.0	2	.	.	.	.	.	.	.	.	.	.	.
SOIL 12	H	1.0	1	.	.	.	.	.	.	.	.	.	.	.
SOIL 12	I	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 12	J	2.0	2	2	.	.	.	.	.	.	.	.	.	.
		1.7												
		0.63												
SOIL 13	A	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 13	B	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 13	C	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 13	D	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 13	E	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 13	F	6.3	7	5	7	.	.	.	.	.	.	.	.	.
SOIL 13	G	5.7	10	4	3	.	.	.	.	.	.	.	.	.
SOIL 13	H	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 13	I	3.5	2	5	.	.	.	.	.	.	.	.	.	.
SOIL 13	J	5.0	5	5	.	.	.	.	.	.	.	.	.	.
		5.1												
		1.21												

Appendix 7.2
(continued)
Tansy Aster (Nursery-Provided) Test Results: Height

SOIL	REP	MN HT	HT1	HT2	HT3	HT4	HT5	HT6	HT7	HT8	HT9	HT10	HT11	HT12
		cm	cm											
SOIL 14	A	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 14	B	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 14	C	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 14	D	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 14	E	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 14	F	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 14	G	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 14	H	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 14	I	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 14	J	.	.	.	.	.	.	.	.	.	.	.	.	.
		.												
		.												
SOIL 15	A	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 15	B	2.0	2	.	.	.	.	.	.	.	.	.	.	.
SOIL 15	C	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 15	D	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 15	E	0.3	0.25	0.25	.	.	.	.	.	.	.	.	.	.
SOIL 15	F	0.3	0.25	.	.	.	.	.	.	.	.	.	.	.
SOIL 15	G	1.0	1	1	.	.	.	.	.	.	.	.	.	.
SOIL 15	H	0.3	0.25	.	.	.	.	.	.	.	.	.	.	.
SOIL 15	I	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 15	J	1.0	1	.	.	.	.	.	.	.	.	.	.	.
		0.8												
		0.70												

Appendix 7.2

(continued)

Tansy Aster (Nursery-Provided) Test Results: Height

SOIL	REP	MN HT	HT1	HT2	HT3	HT4	HT5	HT6	HT7	HT8	HT9	HT10	HT11	HT12
		cm	cm											
SOIL 16	A	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 16	B	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 16	C	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 16	D	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 16	E	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 16	F	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 16	G	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 16	H	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 16	I	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 16	J	.	.	.	.	.	.	.	.	.	.	.	.	.
		.												
		.												
SOIL 17	A	1.3	2	1	1	.	.	.	.	.	.	.	.	.
SOIL 17	B	2.0	2	.	.	.	.	.	.	.	.	.	.	.
SOIL 17	C	4.0	3	4	5	.	.	.	.	.	.	.	.	.
SOIL 17	D	1.8	3	2	2	0.25	.	.	.	.	.	.	.	.
SOIL 17	E	2.3	2	3	2	.	.	.	.	.	.	.	.	.
SOIL 17	F	2.0	2	2	.	.	.	.	.	.	.	.	.	.
SOIL 17	G	1.2	0.25	3	0.25	.	.	.	.	.	.	.	.	.
SOIL 17	H	1.3	1	1	2	.	.	.	.	.	.	.	.	.
SOIL 17	I	1.7	2	1	2	.	.	.	.	.	.	.	.	.
SOIL 17	J	2.5	3	3	2	2	.	.	.	.	.	.	.	.
		2.0												
		0.82												

Appendix 7.2

(continued)

Tansy Aster (Nursery-Provided) Test Results: Height

SOIL	REP	MN HT	HT1	HT2	HT3	HT4	HT5	HT6	HT7	HT8	HT9	HT10	HT11	HT12
		cm	cm											
SOIL 19	A	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 19	B	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 19	C	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 19	D	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 19	E	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 19	F	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 19	G	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 19	H	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 19	I	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 19	J	.	.	.	.	.	.	.	.	.	.	.	.	.
		.												
		.												
SOIL 20	A	2.0	2	2	2	.	.	.	.	.	.	.	.	.
SOIL 20	B	2.5	1	4	.	.	.	.	.	.	.	.	.	.
SOIL 20	C	2.7	4	2	2	.	.	.	.	.	.	.	.	.
SOIL 20	D	3.7	4	3	4	.	.	.	.	.	.	.	.	.
SOIL 20	E	2.7	3	5	3	2	0.25	.	.	.	.	.	.	.
SOIL 20	F	2.5	2	3	.	.	.	.	.	.	.	.	.	.
SOIL 20	G	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 20	H	3.5	3	4	.	.	.	.	.	.	.	.	.	.
SOIL 20	I	3.3	4	3	3	.	.	.	.	.	.	.	.	.
SOIL 20	J	2.0	1	1	3	3	.	.	.	.	.	.	.	.
		2.8												
		0.61												

Appendix 7.2
(continued)
Tansy Aster (Nursery-Provided) Test Results: Height

SOIL	REP	MN HT	HT1	HT2	HT3	HT4	HT5	HT6	HT7	HT8	HT9	HT10	HT11	HT12
		cm	cm											
SOIL 21	A	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 21	B	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 21	C	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 21	D	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 21	E	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 21	F	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 21	G	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 21	H	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 21	I	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 21	J	.	.	.	.	.	.	.	.	.	.	.	.	.
		.												
		.												
SOIL 22	A	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 22	B	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 22	C	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 22	D	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 22	E	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 22	F	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 22	G	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 22	H	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 22	I	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 22	J	.	.	.	.	.	.	.	.	.	.	.	.	.
		.												
		.												

Appendix 7.2

(continued)

Tansy Aster (Nursery-Provided) Test Results: Height

SOIL	REP	MN HT	HT1	HT2	HT3	HT4	HT5	HT6	HT7	HT8	HT9	HT10	HT11	HT12
		cm	cm											
SOIL 23	A	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 23	B	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 23	C	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 23	D	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 23	E	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 23	F	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 23	G	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 23	H	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 23	I	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 23	J	.	.	.	.	.	.	.	.	.	.	.	.	.
		.												
		.												
SOIL 24	A	6.0	6	.	.	.	.	.	.	.	.	.	.	.
SOIL 24	B	3.3	3	5	2	.	.	.	.	.	.	.	.	.
SOIL 24	C	5.0	5	.	.	.	.	.	.	.	.	.	.	.
SOIL 24	D	8.0	7	9	.	.	.	.	.	.	.	.	.	.
SOIL 24	E	4.3	9	4	2	2	.	.	.	.	.	.	.	.
SOIL 24	F	6.3	6	5	8	.	.	.	.	.	.	.	.	.
SOIL 24	G	5.5	6	5	.	.	.	.	.	.	.	.	.	.
SOIL 24	H	6.0	6	.	.	.	.	.	.	.	.	.	.	.
SOIL 24	I	6.5	7	6	.	.	.	.	.	.	.	.	.	.
SOIL 24	J	6.0	7	8	3	.	.	.	.	.	.	.	.	.
		5.7												
		1.28												

Appendix 7.2

(continued)

Tansy Aster (Nursery-Provided) Test Results: Height

SOIL	REP	MN HT	HT1	HT2	HT3	HT4	HT5	HT6	HT7	HT8	HT9	HT10	HT11	HT12
		cm	cm											
SOIL 25	A	5.0	5	.	.	.	.	.	.	.	.	.	.	.
SOIL 25	B	3.0	3	.	.	.	.	.	.	.	.	.	.	.
SOIL 25	C	4.5	6	3	.	.	.	.	.	.	.	.	.	.
SOIL 25	D	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 25	E	6.0	6	.	.	.	.	.	.	.	.	.	.	.
SOIL 25	F	5.0	5	.	.	.	.	.	.	.	.	.	.	.
SOIL 25	G	5.0	5	.	.	.	.	.	.	.	.	.	.	.
SOIL 25	H	4.0	4	.	.	.	.	.	.	.	.	.	.	.
SOIL 25	I	7.0	7	.	.	.	.	.	.	.	.	.	.	.
SOIL 25	J	5.0	6	4	.	.	.	.	.	.	.	.	.	.
		4.9												
		1.13												
SOIL 26	A	1.7	1	3	1	.	.	.	.	.	.	.	.	.
SOIL 26	B	1.7	2	2	1	.	.	.	.	.	.	.	.	.
SOIL 26	C	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 26	D	1.7	2	2	1	.	.	.	.	.	.	.	.	.
SOIL 26	E	1.7	2	1	2	.	.	.	.	.	.	.	.	.
SOIL 26	F	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 26	G	2.0	3	1	.	.	.	.	.	.	.	.	.	.
SOIL 26	H	1.5	2	1	.	.	.	.	.	.	.	.	.	.
SOIL 26	I	2.0	2	.	.	.	.	.	.	.	.	.	.	.
SOIL 26	J	1.5	2	1	.	.	.	.	.	.	.	.	.	.
		1.7												
		0.19												

Appendix 7.2

(continued)

Tansy Aster (Nursery-Provided) Test Results: Height

SOIL	REP	MN HT	HT1	HT2	HT3	HT4	HT5	HT6	HT7	HT8	HT9	HT10	HT11	HT12
		cm	cm											
SOIL 27	A	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 27	B	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 27	C	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 27	D	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 27	E	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 27	F	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 27	G	0.6	1	0.25	.	.	.	.	.	.	.	.	.	.
SOIL 27	H	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 27	I	0.3	0.25	.	.	.	.	.	.	.	.	.	.	.
SOIL 27	J	0.8	1	1	0.25	.	.	.	.	.	.	.	.	.
		0.5												
		0.26												
SOIL 28	A	4.0	4	.	.	.	.	.	.	.	.	.	.	.
SOIL 28	B	2.7	4	3	1	.	.	.	.	.	.	.	.	.
SOIL 28	C	3.0	3	.	.	.	.	.	.	.	.	.	.	.
SOIL 28	D	2.0	2	.	.	.	.	.	.	.	.	.	.	.
SOIL 28	E	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 28	F	2.0	2	2	.	.	.	.	.	.	.	.	.	.
SOIL 28	G	1.0	1	.	.	.	.	.	.	.	.	.	.	.
SOIL 28	H	1.0	1	.	.	.	.	.	.	.	.	.	.	.
SOIL 28	I	6.0	6	.	.	.	.	.	.	.	.	.	.	.
SOIL 28	J	0.3	0.25	.	.	.	.	.	.	.	.	.	.	.
		2.4												
		1.76												

Appendix 7.2
(continued)
Tansy Aster (Nursery-Provided) Test Results: Height

SOIL	REP	MN HT	HT1	HT2	HT3	HT4	HT5	HT6	HT7	HT8	HT9	HT10	HT11	HT12
		cm	cm											
SOIL 29	A	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 29	B	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 29	C	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 29	D	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 29	E	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 29	F	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 29	G	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 29	H	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 29	I	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 29	J	.	.	.	.	.	.	.	.	.	.	.	.	.
		.												
		.												
SOIL 30	A	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 30	B	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 30	C	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 30	D	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 30	E	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 30	F	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 30	G	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 30	H	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 30	I	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 30	J	.	.	.	.	.	.	.	.	.	.	.	.	.
		.												
		.												

Appendix 7.2

(continued)

Tansy Aster (Nursery-Provided) Test Results: Height

SOIL	REP	MN HT	HT1	HT2	HT3	HT4	HT5	HT6	HT7	HT8	HT9	HT10	HT11	HT12
		cm	cm											
SOIL 31	A	0.3	0.25	0.25	.	.	.	.	.	.	.	.	.	.
SOIL 31	B	1.0	1	.	.	.	.	.	.	.	.	.	.	.
SOIL 31	C	0.8	1	1	0.25	.	.	.	.	.	.	.	.	.
SOIL 31	D	0.3	0.25	.	.	.	.	.	.	.	.	.	.	.
SOIL 31	E	1.0	1	1	.	.	.	.	.	.	.	.	.	.
SOIL 31	F	0.6	1	0.25	.	.	.	.	.	.	.	.	.	.
SOIL 31	G	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 31	H	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 31	I	0.6	0.25	1	.	.	.	.	.	.	.	.	.	.
SOIL 31	J	.	.	.	.	.	.	.	.	.	.	.	.	.
		0.6												
		0.31												
SOIL 32	A	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 32	B	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 32	C	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 32	D	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 32	E	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 32	F	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 32	G	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 32	H	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 32	I	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 32	J	.	.	.	.	.	.	.	.	.	.	.	.	.
		.												
		.												

Appendix 7.2
(continued)
Tansy Aster (Nursery-Provided) Test Results: Height

SOIL	REP	MN HT	HT1	HT2	HT3	HT4	HT5	HT6	HT7	HT8	HT9	HT10	HT11	HT12
		cm	cm											
SOIL 35	A	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 35	B	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 35	C	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 35	D	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 35	E	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 35	F	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 35	G	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 35	H	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 35	I	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 35	J	.	.	.	.	.	.	.	.	.	.	.	.	.
		.												
		.												
SOIL 36	A	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 36	B	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 36	C	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 36	D	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 36	E	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 36	F	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 36	G	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 36	H	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 36	I	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 36	J	.	.	.	.	.	.	.	.	.	.	.	.	.
		.												
		.												

Appendix 7.3

Tansy Aster (Nursery-Provided) Test Results: Condition

SOIL	REP	Condition Score	Symptom(s) Observed		SOIL	REP	Condition Score	Symptom(s) Observed		SOIL	REP	Condition Score	Symptom(s) Observed
NC	A	60	M		SOIL 2	A	0	none		SOIL 4	A	0	none
NC	B	60	M		SOIL 2	B	0	none		SOIL 4	B	20	M
NC	C	50	M		SOIL 2	C	0	none		SOIL 4	C	0	none
NC	D	40	M		SOIL 2	D	0	none		SOIL 4	D	0	none
NC	E	70	M		SOIL 2	E	.	NE		SOIL 4	E	0	none
NC	F	90	M		SOIL 2	F	.	NE		SOIL 4	F	0	none
NC	G	100	M		SOIL 2	G	.	NE		SOIL 4	G	0	none
NC	H	80	M		SOIL 2	H	.	NE		SOIL 4	H	0	none
NC	I	30	M		SOIL 2	I	.	NE		SOIL 4	I	0	none
NC	J	30	M		SOIL 2	J	.	NE		SOIL 4	J	0	none
SOIL 1	A	.	NE		SOIL 3	A	100	M		SOIL 5	A	0	none
SOIL 1	B	.	NE		SOIL 3	B	.	NE		SOIL 5	B	0	none
SOIL 1	C	.	NE		SOIL 3	C	50	N		SOIL 5	C	30	M
SOIL 1	D	.	NE		SOIL 3	D	20	N		SOIL 5	D	20	CL,CC
SOIL 1	E	.	NE		SOIL 3	E	.	NE		SOIL 5	E	10	N
SOIL 1	F	.	NE		SOIL 3	F	10	CL,N		SOIL 5	F	10	CL,CC
SOIL 1	G	.	NE		SOIL 3	G	20	CL,N		SOIL 5	G	10	CC
SOIL 1	H	.	NE		SOIL 3	H	20	CL,N		SOIL 5	H	30	N,M,CC
SOIL 1	I	.	NE		SOIL 3	I	30	CL,N		SOIL 5	I	20	CL,N
SOIL 1	J	.	NE		SOIL 3	J	.	NE		SOIL 5	J	10	N

M – Mortality; CL – Chlorosis; N – Necrosis; CC – Color Change; NE – None Emerged

Appendix 7.3
(continued)
Tansy Aster (Nursery-Provided) Test Results: Condition

SOIL	REP	Condition Score	Symptom(s) Observed		SOIL	REP	Condition Score	Symptom(s) Observed		SOIL	REP	Condition Score	Symptom(s) Observed
SOIL 6	A	.	NE		SOIL 8	A	60	CL,N		SOIL 10	A	100	M
SOIL 6	B	.	NE		SOIL 8	B	60	CL,N		SOIL 10	B	.	NE
SOIL 6	C	.	NE		SOIL 8	C	60	CL,N		SOIL 10	C	.	NE
SOIL 6	D	.	NE		SOIL 8	D	60	CL,N		SOIL 10	D	.	NE
SOIL 6	E	.	NE		SOIL 8	E	80	CL,N,CC		SOIL 10	E	100	M
SOIL 6	F	.	NE		SOIL 8	F	80	CL,N		SOIL 10	F	.	NE
SOIL 6	G	.	NE		SOIL 8	G	90	CL,N,M		SOIL 10	G	.	NE
SOIL 6	H	20	N		SOIL 8	H	80	CL,N,CC		SOIL 10	H	.	NE
SOIL 6	I	.	NE		SOIL 8	I	80	CL,N,CC		SOIL 10	I	100	M
SOIL 6	J	.	NE		SOIL 8	J	90	CL,N,CC,M		SOIL 10	J	.	NE
SOIL 7	A	.	NE		SOIL 9	A	.	NE		SOIL 11	A	.	NE
SOIL 7	B	.	NE		SOIL 9	B	.	NE		SOIL 11	B	.	NE
SOIL 7	C	.	NE		SOIL 9	C	.	NE		SOIL 11	C	.	NE
SOIL 7	D	.	NE		SOIL 9	D	.	NE		SOIL 11	D	.	NE
SOIL 7	E	.	NE		SOIL 9	E	.	NE		SOIL 11	E	.	NE
SOIL 7	F	.	NE		SOIL 9	F	.	NE		SOIL 11	F	.	NE
SOIL 7	G	.	NE		SOIL 9	G	.	NE		SOIL 11	G	.	NE
SOIL 7	H	.	NE		SOIL 9	H	.	NE		SOIL 11	H	.	NE
SOIL 7	I	.	NE		SOIL 9	I	.	NE		SOIL 11	I	.	NE
SOIL 7	J	.	NE		SOIL 9	J	.	NE		SOIL 11	J	.	NE

M – Mortality; CL – Chlorosis; N – Necrosis; CC – Color Change; NE – None Emerged

Appendix 7.3

(continued)

Tansy Aster (Nursery-Provided) Test Results: Condition

SOIL	REP	Condition Score	Symptom(s) Observed		SOIL	REP	Condition Score	Symptom(s) Observed		SOIL	REP	Condition Score	Symptom(s) Observed
SOIL 12	A	50	N		SOIL 14	A	.	NE		SOIL 16	A	.	NE
SOIL 12	B	20	N,LC		SOIL 14	B	.	NE		SOIL 16	B	.	NE
SOIL 12	C	10	N		SOIL 14	C	.	NE		SOIL 16	C	.	NE
SOIL 12	D	20	CL,N		SOIL 14	D	.	NE		SOIL 16	D	.	NE
SOIL 12	E	40	N,LC,M		SOIL 14	E	.	NE		SOIL 16	E	.	NE
SOIL 12	F	30	N,LC		SOIL 14	F	.	NE		SOIL 16	F	.	NE
SOIL 12	G	30	N		SOIL 14	G	.	NE		SOIL 16	G	.	NE
SOIL 12	H	20	LC		SOIL 14	H	.	NE		SOIL 16	H	.	NE
SOIL 12	I	100	M		SOIL 14	I	.	NE		SOIL 16	I	.	NE
SOIL 12	J	30	N,LC		SOIL 14	J	.	NE		SOIL 16	J	.	NE
SOIL 13	A	.	NE		SOIL 15	A	100	M		SOIL 17	A	50	CL,N,CC
SOIL 13	B	.	NE		SOIL 15	B	60	CL,M		SOIL 17	B	0	none
SOIL 13	C	.	NE		SOIL 15	C	.	NE		SOIL 17	C	10	CL,N
SOIL 13	D	100	M		SOIL 15	D	100	M		SOIL 17	D	10	CC
SOIL 13	E	.	NE		SOIL 15	E	80	N,LC		SOIL 17	E	20	CL,M
SOIL 13	F	0	none		SOIL 15	F	60	N		SOIL 17	F	0	none
SOIL 13	G	0	none		SOIL 15	G	60	CL,N		SOIL 17	G	10	CL
SOIL 13	H	.	NE		SOIL 15	H	90	CL,N,M		SOIL 17	H	0	none
SOIL 13	I	0	none		SOIL 15	I	.	NE		SOIL 17	I	0	none
SOIL 13	J	0	none		SOIL 15	J	50	CL,LC		SOIL 17	J	0	none

M – Mortality; CL – Chlorosis; N – Necrosis; CC – Color Change; NE – None Emerged; LC – Leaf Curl

Appendix 7.3

(continued)

Tansy Aster (Nursery-Provided) Test Results: Condition

SOIL	REP	Condition Score	Symptom(s) Observed		SOIL	REP	Condition Score	Symptom(s) Observed		SOIL	REP	Condition Score	Symptom(s) Observed
SOIL 19	A	.	NE		SOIL 21	A	100	M		SOIL 23	A	.	NE
SOIL 19	B	.	NE		SOIL 21	B	.	NE		SOIL 23	B	.	NE
SOIL 19	C	.	NE		SOIL 21	C	100	M		SOIL 23	C	.	NE
SOIL 19	D	.	NE		SOIL 21	D	100	M		SOIL 23	D	.	NE
SOIL 19	E	.	NE		SOIL 21	E	100	M		SOIL 23	E	.	NE
SOIL 19	F	.	NE		SOIL 21	F	.	NE		SOIL 23	F	.	NE
SOIL 19	G	.	NE		SOIL 21	G	.	NE		SOIL 23	G	.	NE
SOIL 19	H	.	NE		SOIL 21	H	.	NE		SOIL 23	H	.	NE
SOIL 19	I	.	NE		SOIL 21	I	.	NE		SOIL 23	I	.	NE
SOIL 19	J	.	NE		SOIL 21	J	100	M		SOIL 23	J	.	NE
SOIL 20	A	0	none		SOIL 22	A	.	NE		SOIL 24	A	0	none
SOIL 20	B	0	none		SOIL 22	B	.	NE		SOIL 24	B	0	none
SOIL 20	C	0	none		SOIL 22	C	.	NE		SOIL 24	C	0	none
SOIL 20	D	0	none		SOIL 22	D	.	NE		SOIL 24	D	0	none
SOIL 20	E	10	N		SOIL 22	E	.	NE		SOIL 24	E	0	none
SOIL 20	F	0	none		SOIL 22	F	.	NE		SOIL 24	F	0	none
SOIL 20	G	.	NE		SOIL 22	G	.	NE		SOIL 24	G	0	none
SOIL 20	H	0	none		SOIL 22	H	.	NE		SOIL 24	H	0	none
SOIL 20	I	0	none		SOIL 22	I	.	NE		SOIL 24	I	0	none
SOIL 20	J	0	none		SOIL 22	J	.	NE		SOIL 24	J	0	none

M – Mortality; N – Necrosis; NE – None Emerged

Appendix 7.3
(continued)
Tansy Aster (Nursery-Provided) Test Results: Condition

SOIL	REP	Condition Score	Symptom(s) Observed		SOIL	REP	Condition Score	Symptom(s) Observed		SOIL	REP	Condition Score	Symptom(s) Observed
SOIL 25	A	0	none		SOIL 27	A	100	M		SOIL 29	A	.	NE
SOIL 25	B	10	CL		SOIL 27	B	100	M		SOIL 29	B	.	NE
SOIL 25	C	0	none		SOIL 27	C	.	NE		SOIL 29	C	.	NE
SOIL 25	D	.	NE		SOIL 27	D	100	M		SOIL 29	D	.	NE
SOIL 25	E	0	none		SOIL 27	E	100	M		SOIL 29	E	.	NE
SOIL 25	F	0	none		SOIL 27	F	100	M		SOIL 29	F	.	NE
SOIL 25	G	0	none		SOIL 27	G	70	CL,N		SOIL 29	G	.	NE
SOIL 25	H	0	none		SOIL 27	H	.	NE		SOIL 29	H	.	NE
SOIL 25	I	0	none		SOIL 27	I	60	CL,N		SOIL 29	I	.	NE
SOIL 25	J	0	none		SOIL 27	J	50	N		SOIL 29	J	.	NE
SOIL 26	A	0	none		SOIL 28	A	0	none		SOIL 30	A	.	NE
SOIL 26	B	20	CL		SOIL 28	B	30	N		SOIL 30	B	.	NE
SOIL 26	C	.	NE		SOIL 28	C	0	none		SOIL 30	C	.	NE
SOIL 26	D	20	CL		SOIL 28	D	0	none		SOIL 30	D	.	NE
SOIL 26	E	20	N		SOIL 28	E	.	NE		SOIL 30	E	.	NE
SOIL 26	F	100	M		SOIL 28	F	20	N,LC		SOIL 30	F	.	NE
SOIL 26	G	40	N		SOIL 28	G	20	CC		SOIL 30	G	.	NE
SOIL 26	H	0	none		SOIL 28	H	20	N,LC,CC		SOIL 30	H	.	NE
SOIL 26	I	0	none		SOIL 28	I	0	none		SOIL 30	I	.	NE
SOIL 26	J	0	none		SOIL 28	J	50	N,LC		SOIL 30	J	.	NE

M – Mortality; CL – Chlorosis; N – Necrosis; CC – Color Change; NE – None Emerged; LC – Leaf Curl

Appendix 7.3

(continued)

Tansy Aster (Nursery-Provided) Test Results: Condition

SOIL	REP	Condition Score	Symptom(s) Observed		SOIL	REP	Condition Score	Symptom(s) Observed
SOIL 31	A	90	N		SOIL 35	A	.	NE
SOIL 31	B	50	CL,N		SOIL 35	B	.	NE
SOIL 31	C	70	CL,N,M		SOIL 35	C	.	NE
SOIL 31	D	90	N		SOIL 35	D	.	NE
SOIL 31	E	60	CL,N,LC		SOIL 35	E	.	NE
SOIL 31	F	70	N,LC		SOIL 35	F	.	NE
SOIL 31	G	.	NE		SOIL 35	G	.	NE
SOIL 31	H	.	NE		SOIL 35	H	.	NE
SOIL 31	I	60	N,LC		SOIL 35	I	.	NE
SOIL 31	J	.	NE		SOIL 35	J	.	NE
SOIL 32	A	.	NE		SOIL 36	A	.	NE
SOIL 32	B	.	NE		SOIL 36	B	.	NE
SOIL 32	C	.	NE		SOIL 36	C	.	NE
SOIL 32	D	.	NE		SOIL 36	D	.	NE
SOIL 32	E	.	NE		SOIL 36	E	.	NE
SOIL 32	F	.	NE		SOIL 36	F	.	NE
SOIL 32	G	.	NE		SOIL 36	G	.	NE
SOIL 32	H	.	NE		SOIL 36	H	.	NE
SOIL 32	I	.	NE		SOIL 36	I	.	NE
SOIL 32	J	.	NE		SOIL 36	J	.	NE

M – Mortality; CL – Chlorosis; N – Necrosis; LC – Leaf Curl; NE – None Emerged

Appendix 8.1

Tansy Aster (Field-Collected) Test Results: pH, Emergence, Survival, Root Length and Dry Weight

SOIL	REP	INIT PH	FIN PH (Soil Probe)	FIN PH (Lab Meter)	EM 0	EM 21	SURV	RT LGTH	TOT DWT	MN DWT
		pH	pH	pH	per 12	per 12	per 12	cm	g	g
NC	A	5.8	4.3	5.7	4	4	0	.	.	.
NC	B	5.8	4.8	6.0	4	4	0	.	.	.
NC	C	5.8	5.1	5.8	4	4	0	.	.	.
NC	D	5.8	4.3	6.3	3	3	1	50	0.212	0.212
NC	E	5.8	4.3	3.1	3	3	2	40	0.389	0.195
NC	F	5.8	4.3	5.7	3	3	0	.	.	.
NC	G	5.8	4.4	6.1	4	4	1	19	0.083	0.083
NC	H	5.8	4.8	6.0	2	2	1	11	0.014	0.014
NC	I	5.8	5.3	6.0	4	4	1	17	0.413	0.413
NC	J	5.8	4.6	6.0	2	2	2	20	0.824	0.412
						3.30	0.80	26.2		0.221
						0.82	0.79	15.25		0.165
SOIL 1	A	4.5	4.9	4.8	0	0	0	.	.	.
SOIL 1	B	4.5	6.0	4.7	0	0	0	.	.	.
SOIL 1	C	4.5	4.8	4.6	0	0	0	.	.	.
SOIL 1	D	4.5	5.2	4.2	0	0	0	.	.	.
SOIL 1	E	4.5	4.4	4.6	0	0	0	.	.	.
SOIL 1	F	4.5	4.8	4.5	0	0	0	.	.	.
SOIL 1	G	4.5	4.0	4.6	0	0	0	.	.	.
SOIL 1	H	4.5	4.4	4.5	0	0	0	.	.	.
SOIL 1	I	4.5	3.9	4.7	0	0	0	.	.	.
SOIL 1	J	4.5	3.6	4.6	0	0	0	.	.	.
						0.00	0.00	.		.
						0.00	0.00	.		.

Appendix 8.1
(continued)
Tansy Aster (Field-Collected) Test Results: pH, Emergence, Survival, Root Length and Dry Weight

SOIL	REP	INIT PH	FIN PH (Soil Probe)	FIN PH (Lab Meter)	EM 0	EM 21	SURV	RT LGTH	TOT DWT	MN DWT
		pH	pH	pH	per 12	per 12	per 12	cm	g	g
SOIL 2	A	4.8	5.9	7.4	0	0	0	.	.	.
SOIL 2	B	4.8	4.6	7.4	0	0	0	.	.	.
SOIL 2	C	4.8	4.2	7.4	0	0	0	.	.	.
SOIL 2	D	4.8	4.4	7.4	0	0	0	.	.	.
SOIL 2	E	4.8	5.0	7.5	1	1	0	.	.	.
SOIL 2	F	4.8	7.0	7.6	0	0	0	.	.	.
SOIL 2	G	4.8	5.9	7.4	0	1	1	9	0.009	0.009
SOIL 2	H	4.8	5.8	7.6	0	0	0	.	.	.
SOIL 2	I	4.8	5.3	7.5	0	0	0	.	.	.
SOIL 2	J	4.8	5.8	7.7	0	0	0	.	.	.
						0.20	0.10	9.0		0.009
						0.42	0.32	.		.
SOIL 3	A	5.0	5.9	5.7	2	2	1	1	0.003	0.003
SOIL 3	B	5.0	7.0	5.6	0	0	0	.	.	.
SOIL 3	C	5.0	7.0	5.2	0	0	0	.	.	.
SOIL 3	D	5.0	7.0	5.2	0	0	0	.	.	.
SOIL 3	E	5.0	6.3	4.8	0	0	0	.	.	.
SOIL 3	F	5.0	6.3	5.8	1	1	1	1	0.001	0.001
SOIL 3	G	5.0	6.0	4.8	1	1	0	.	.	.
SOIL 3	H	5.0	7.0	4.6	0	0	0	.	.	.
SOIL 3	I	5.0	7.1	5.0	0	0	0	.	.	.
SOIL 3	J	5.0	6.6	5.0	1	1	1	1	0.002	0.002
						0.50	0.30	1.0		0.002
						0.71	0.48	0.00		0.001

Appendix 8.1
(continued)
Tansy Aster (Field-Collected) Test Results: pH, Emergence, Survival, Root Length and Dry Weight

SOIL	REP	INIT PH	FIN PH (Soil Probe)	FIN PH (Lab Meter)	EM 0	EM 21	SURV	RT LGTH	TOT DWT	MN DWT
		pH	pH	pH	per 12	per 12	per 12	cm	g	g
SOIL 4	A	5.4	4.9	5.6	2	2	1	1	0.006	0.006
SOIL 4	B	5.4	5.0	5.7	1	1	1	9	0.027	0.027
SOIL 4	C	5.4	6.1	5.4	0	0	0	.	.	.
SOIL 4	D	5.4	6.9	5.8	0	0	0	.	.	.
SOIL 4	E	5.4	5.3	6.0	0	0	0	.	.	.
SOIL 4	F	5.4	5.1	6.0	1	1	1	3	0.001	0.001
SOIL 4	G	5.4	4.6	5.6	1	1	1	2	0.004	0.004
SOIL 4	H	5.4	4.3	5.6	1	1	1	2	0.005	0.005
SOIL 4	I	5.4	4.1	5.8	1	1	1	1	0.003	0.003
SOIL 4	J	5.4	4.4	5.6	1	1	1	7	0.003	0.003
						0.80	0.70	3.6		0.007
						0.63	0.48	3.15		0.009
SOIL 5	A	5.0	5.2	6.5	1	1	1	3	0.003	0.003
SOIL 5	B	5.0	5.0	6.1	0	0	0	.	.	.
SOIL 5	C	5.0	5.6	6.0	2	2	2	9	0.007	0.004
SOIL 5	D	5.0	4.8	6.1	0	0	0	.	.	.
SOIL 5	E	5.0	5.2	6.3	2	2	2	3	0.007	0.004
SOIL 5	F	5.0	4.9	6.2	0	0	0	.	.	.
SOIL 5	G	5.0	5.1	5.9	0	0	0	.	.	.
SOIL 5	H	5.0	5.2	6.0	0	0	0	.	.	.
SOIL 5	I	5.0	4.8	6.1	0	0	0	.	.	.
SOIL 5	J	5.0	4.3	6.3	0	0	0	.	.	.
						0.50	0.50	5.0		0.003
						0.85	0.85	3.46		0.000

Appendix 8.1

(continued)

Tansy Aster (Field-Collected) Test Results: pH, Emergence, Survival, Root Length and Dry Weight

SOIL	REP	INIT PH	FIN PH (Soil Probe)	FIN PH (Lab Meter)	EM 0	EM 21	SURV	RT LGTH	TOT DWT	MN DWT
		pH	pH	pH	per 12	per 12	per 12	cm	g	g
SOIL 6	A	4.1	6.4	4.0	0	0	0	.	.	.
SOIL 6	B	4.1	5.8	4.2	0	0	0	.	.	.
SOIL 6	C	4.1	5.6	4.2	0	0	0	.	.	.
SOIL 6	D	4.1	4.4	4.5	0	0	0	.	.	.
SOIL 6	E	4.1	4.8	3.9	0	0	0	.	.	.
SOIL 6	F	4.1	4.3	4.4	0	0	0	.	.	.
SOIL 6	G	4.1	3.9	4.3	0	0	0	.	.	.
SOIL 6	H	4.1	3.9	4.2	0	0	0	.	.	.
SOIL 6	I	4.1	4.0	4.1	0	0	0	.	.	.
SOIL 6	J	4.1	3.8	4.2	0	0	0	.	.	.
						0.00	0.00	.		.
						0.00	0.00	.		.
SOIL 7	A	4.0	3.8	3.4	0	0	0	.	.	.
SOIL 7	B	4.0	3.9	3.5	0	0	0	.	.	.
SOIL 7	C	4.0	3.5	3.5	0	0	0	.	.	.
SOIL 7	D	4.0	3.6	3.6	0	0	0	.	.	.
SOIL 7	E	4.0	3.6	3.7	0	0	0	.	.	.
SOIL 7	F	4.0	3.6	3.4	0	0	0	.	.	.
SOIL 7	G	4.0	<3.5	3.5	0	0	0	.	.	.
SOIL 7	H	4.0	<3.5	3.3	0	0	0	.	.	.
SOIL 7	I	4.0	<3.5	3.5	0	0	0	.	.	.
SOIL 7	J	4.0	3.8	3.3	0	0	0	.	.	.
						0.00	0.00	.		.
						0.00	0.00	.		.

Appendix 8.1
(continued)
Tansy Aster (Field-Collected) Test Results: pH, Emergence, Survival, Root Length and Dry Weight

SOIL	REP	INIT PH	FIN PH (Soil Probe)	FIN PH (Lab Meter)	EM 0	EM 21	SURV	RT LGTH	TOT DWT	MN DWT
		pH	pH	pH	per 12	per 12	per 12	cm	g	g
SOIL 8	A	5.4	4.0	4.8	0	0	0	.	.	.
SOIL 8	B	5.4	3.8	4.8	0	0	0	.	.	.
SOIL 8	C	5.4	3.9	4.7	0	0	0	.	.	.
SOIL 8	D	5.4	4.1	4.9	1	1	0	.	.	.
SOIL 8	E	5.4	4.6	4.8	0	0	0	.	.	.
SOIL 8	F	5.4	5.4	4.7	0	0	0	.	.	.
SOIL 8	G	5.4	4.6	4.8	0	0	0	.	.	.
SOIL 8	H	5.4	4.1	5.0	0	0	0	.	.	.
SOIL 8	I	5.4	3.9	4.7	0	0	0	.	.	.
SOIL 8	J	5.4	4.8	5.0	0	0	0	.	.	.
						0.10	0.00	.		.
						0.32	0.00	.		.
SOIL 9	A	5.5	4.3	4.4	0	0	0	.	.	.
SOIL 9	B	5.5	4.0	4.5	0	0	0	.	.	.
SOIL 9	C	5.5	5.0	4.2	0	0	0	.	.	.
SOIL 9	D	5.5	4.2	4.2	0	0	0	.	.	.
SOIL 9	E	5.5	4.3	4.3	0	0	0	.	.	.
SOIL 9	F	5.5	3.9	4.5	0	0	0	.	.	.
SOIL 9	G	5.5	3.8	4.2	0	0	0	.	.	.
SOIL 9	H	5.5	5.0	4.2	0	0	0	.	.	.
SOIL 9	I	5.5	4.3	4.4	0	0	0	.	.	.
SOIL 9	J	5.5	3.5	4.3	0	0	0	.	.	.
						0.00	0.00	.		.
						0.00	0.00	.		.

Appendix 8.1

(continued)

Tansy Aster (Field-Collected) Test Results: pH, Emergence, Survival, Root Length and Dry Weight

SOIL	REP	INIT PH	FIN PH (Soil Probe)	FIN PH (Lab Meter)	EM 0	EM 21	SURV	RT LGTH	TOT DWT	MN DWT
		pH	pH	pH	per 12	per 12	per 12	cm	g	g
SOIL 10	A	4.5	5.0	5.2	0	0	0	.	.	.
SOIL 10	B	4.5	5.1	5.3	0	0	0	.	.	.
SOIL 10	C	4.5	5.3	5.5	0	0	0	.	.	.
SOIL 10	D	4.5	5.1	5.4	0	0	0	.	.	.
SOIL 10	E	4.5	5.1	5.2	0	0	0	.	.	.
SOIL 10	F	4.5	5.0	5.1	0	0	0	.	.	.
SOIL 10	G	4.5	5.2	5.1	0	0	0	.	.	.
SOIL 10	H	4.5	5.6	5.4	0	0	0	.	.	.
SOIL 10	I	4.5	5.2	5.6	0	0	0	.	.	.
SOIL 10	J	4.5	5.0	5.3	0	0	0	.	.	.
						0.00	0.00	.		.
						0.00	0.00	.		.
SOIL 11	A	5.2	4.3	3.9	0	0	0	.	.	.
SOIL 11	B	5.2	4.2	3.8	0	0	0	.	.	.
SOIL 11	C	5.2	5.3	3.9	0	0	0	.	.	.
SOIL 11	D	5.2	5.5	4.0	0	0	0	.	.	.
SOIL 11	E	5.2	5.3	4.0	0	0	0	.	.	.
SOIL 11	F	5.2	6.0	4.0	0	0	0	.	.	.
SOIL 11	G	5.2	5.2	4.1	0	0	0	.	.	.
SOIL 11	H	5.2	6.0	4.1	0	0	0	.	.	.
SOIL 11	I	5.2	5.9	4.2	0	0	0	.	.	.
SOIL 11	J	5.2	5.9	4.0	0	0	0	.	.	.
						0.00	0.00	.		.
						0.00	0.00	.		.

Appendix 8.1

(continued)

Tansy Aster (Field-Collected) Test Results: pH, Emergence, Survival, Root Length and Dry Weight

SOIL	REP	INIT PH	FIN PH (Soil Probe)	FIN PH (Lab Meter)	EM 0	EM 21	SURV	RT LGTH	TOT DWT	MN DWT
		pH	pH	pH	per 12	per 12	per 12	cm	g	g
SOIL 12	A	5.2	6.1	6.5	0	0	0	.	.	.
SOIL 12	B	5.2	6.1	6.8	0	0	0	.	.	.
SOIL 12	C	5.2	6.3	6.8	0	0	0	.	.	.
SOIL 12	D	5.2	5.4	6.9	1	1	1	2	0.003	0.003
SOIL 12	E	5.2	6.2	7.0	0	0	0	.	.	.
SOIL 12	F	5.2	6.8	7.3	0	0	0	.	.	.
SOIL 12	G	5.2	6.4	7.3	0	0	0	.	.	.
SOIL 12	H	5.2	6.7	7.4	0	0	0	.	.	.
SOIL 12	I	5.2	6.5	7.2	0	0	0	.	.	.
SOIL 12	J	5.2	4.9	7.0	1	1	1	4	0.003	0.003
						0.20	0.20	3.0		0.003
						0.42	0.42	1.41		0.000
SOIL 13	A	5.4	5.5	5.9	1	1	1	2	0.002	0.002
SOIL 13	B	5.4	5.8	5.6	1	1	1	2	0.003	0.003
SOIL 13	C	5.4	5.3	5.4	0	0	0	.	.	.
SOIL 13	D	5.4	5.3	5.7	0	0	0	.	.	.
SOIL 13	E	5.4	5.5	5.4	0	0	0	.	.	.
SOIL 13	F	5.4	5.1	5.5	1	1	1	3	0.004	0.004
SOIL 13	G	5.4	5.7	5.8	0	0	0	.	.	.
SOIL 13	H	5.4	5.2	5.5	0	0	0	.	.	.
SOIL 13	I	5.4	5.5	5.3	0	0	0	.	.	.
SOIL 13	J	5.4	5.0	5.7	0	0	0	.	.	.
						0.30	0.30	2.3		0.003
						0.48	0.48	0.58		0.001

Appendix 8.1
(continued)
Tansy Aster (Field-Collected) Test Results: pH, Emergence, Survival, Root Length and Dry Weight

SOIL	REP	INIT PH	FIN PH (Soil Probe)	FIN PH (Lab Meter)	EM 0	EM 21	SURV	RT LGTH	TOT DWT	MN DWT
		pH	pH	pH	per 12	per 12	per 12	cm	g	g
SOIL 14	A	5.3	6.0	4.2	0	0	0	.	.	.
SOIL 14	B	5.3	5.7	3.9	0	0	0	.	.	.
SOIL 14	C	5.3	5.6	4.0	1	1	0	.	.	.
SOIL 14	D	5.3	5.3	3.8	0	0	0	.	.	.
SOIL 14	E	5.3	6.9	3.7	0	0	0	.	.	.
SOIL 14	F	5.3	4.2	4.0	0	0	0	.	.	.
SOIL 14	G	5.3	5.6	3.9	0	0	0	.	.	.
SOIL 14	H	5.3	4.6	3.9	0	0	0	.	.	.
SOIL 14	I	5.3	5.2	3.9	0	0	0	.	.	.
SOIL 14	J	5.3	4.4	3.9	0	0	0	.	.	.
						0.10	0.00	.		.
						0.32	0.00	.		.
SOIL 15	A	5.6	6.2	4.4	1	1	0	.	.	.
SOIL 15	B	5.6	7.0	4.5	0	0	0	.	.	.
SOIL 15	C	5.6	7.0	4.9	0	0	0	.	.	.
SOIL 15	D	5.6	5.2	4.9	0	0	0	.	.	.
SOIL 15	E	5.6	5.5	5.1	0	0	0	.	.	.
SOIL 15	F	5.6	6.2	4.5	0	0	0	.	.	.
SOIL 15	G	5.6	7.0	4.6	0	0	0	.	.	.
SOIL 15	H	5.6	6.9	5.0	0	0	0	.	.	.
SOIL 15	I	5.6	6.0	4.7	0	0	0	.	.	.
SOIL 15	J	5.6	5.2	4.7	0	0	0	.	.	.
						0.10	0.00	.		.
						0.32	0.00	.		.

Appendix 8.1

(continued)

Tansy Aster (Field-Collected) Test Results: pH, Emergence, Survival, Root Length and Dry Weight

SOIL	REP	INIT PH	FIN PH (Soil Probe)	FIN PH (Lab Meter)	EM 0	EM 21	SURV	RT LGTH	TOT DWT	MN DWT
		pH	pH	pH	per 12	per 12	per 12	cm	g	g
SOIL 16	A	4.8	5.3	5.2	0	0	0	.	.	.
SOIL 16	B	4.8	3.9	4.8	0	0	0	.	.	.
SOIL 16	C	4.8	4.2	4.7	0	0	0	.	.	.
SOIL 16	D	4.8	5.9	4.8	0	0	0	.	.	.
SOIL 16	E	4.8	5.5	4.7	0	0	0	.	.	.
SOIL 16	F	4.8	5.5	4.7	0	0	0	.	.	.
SOIL 16	G	4.8	4.9	4.8	0	0	0	.	.	.
SOIL 16	H	4.8	4.2	4.8	0	0	0	.	.	.
SOIL 16	I	4.8	5.7	4.7	1	1	0	.	.	.
SOIL 16	J	4.8	5.7	4.7	1	1	0	.	.	.
						0.20	0.00	.		.
						0.42	0.00	.		.
SOIL 17	A	4.8	5.7	7.1	0	0	0	.	.	.
SOIL 17	B	4.8	5.9	7.1	0	0	0	.	.	.
SOIL 17	C	4.8	5.2	7.4	2	2	2	2	0.003	0.002
SOIL 17	D	4.8	5.2	7.3	1	1	1	2	0.005	0.005
SOIL 17	E	4.8	4.8	7.4	1	1	1	3	0.003	0.003
SOIL 17	F	4.8	5.3	7.2	1	1	1	4	0.015	0.015
SOIL 17	G	4.8	5.9	7.3	1	1	1	1	0.008	0.008
SOIL 17	H	4.8	5.5	7.3	0	0	0	.	.	.
SOIL 17	I	4.8	4.8	7.3	1	1	1	8	0.02	0.020
SOIL 17	J	4.8	5.4	7.2	0	0	0	.	.	.
						0.70	0.70	3.3		0.009
						0.67	0.67	2.50		0.007

Appendix 8.1

(continued)

Tansy Aster (Field-Collected) Test Results: pH, Emergence, Survival, Root Length and Dry Weight

SOIL	REP	INIT PH	FIN PH (Soil Probe)	FIN PH (Lab Meter)	EM 0	EM 21	SURV	RT LGTH	TOT DWT	MN DWT
		pH	pH	pH	per 12	per 12	per 12	cm	g	g
SOIL 19	A	6.0	6.1	4.9	0	0	0	.	.	.
SOIL 19	B	6.0	5.9	4.9	0	0	0	.	.	.
SOIL 19	C	6.0	5.2	4.6	0	0	0	.	.	.
SOIL 19	D	6.0	5.4	4.7	0	0	0	.	.	.
SOIL 19	E	6.0	5.4	4.7	0	0	0	.	.	.
SOIL 19	F	6.0	4.8	4.7	0	0	0	.	.	.
SOIL 19	G	6.0	5.3	4.7	0	0	0	.	.	.
SOIL 19	H	6.0	5.0	4.7	0	0	0	.	.	.
SOIL 19	I	6.0	5.8	4.8	0	0	0	.	.	.
SOIL 19	J	6.0	5.4	4.7	0	0	0	.	.	.
						0.00	0.00	.		.
						0.00	0.00	.		.
SOIL 20	A	5.2	5.5	7.6	1	1	1	11	0.005	0.005
SOIL 20	B	5.2	4.9	7.4	1	1	0	.	.	.
SOIL 20	C	5.2	4.9	7.3	0	0	0	.	.	.
SOIL 20	D	5.2	5.1	7.5	0	0	0	.	.	.
SOIL 20	E	5.2	5.0	7.3	1	1	1	3	0.001	0.001
SOIL 20	F	5.2	5.7	7.6	1	1	0	.	.	.
SOIL 20	G	5.2	5.2	7.2	0	0	0	.	.	.
SOIL 20	H	5.2	5.0	7.7	1	1	1	6	0.004	0.004
SOIL 20	I	5.2	5.5	7.5	1	1	1	8	0.003	0.003
SOIL 20	J	5.2	5.5	7.5	2	2	2	9	0.012	0.006
						0.80	0.60	7.4		0.004
						0.63	0.70	3.05		0.002

Appendix 8.1

(continued)

Tansy Aster (Field-Collected) Test Results: pH, Emergence, Survival, Root Length and Dry Weight

SOIL	REP	INIT PH	FIN PH (Soil Probe)	FIN PH (Lab Meter)	EM 0	EM 21	SURV	RT LGTH	TOT DWT	MN DWT
		pH	pH	pH	per 12	per 12	per 12	cm	g	g
SOIL 21	A	5.6	5.1	4.4	0	0	0	.	.	.
SOIL 21	B	5.6	6.8	4.6	0	0	0	.	.	.
SOIL 21	C	5.6	5.9	4.2	0	0	0	.	.	.
SOIL 21	D	5.6	5.9	4.5	0	0	0	.	.	.
SOIL 21	E	5.6	5.8	4.3	0	0	0	.	.	.
SOIL 21	F	5.6	5.3	4.4	0	0	0	.	.	.
SOIL 21	G	5.6	5.0	4.4	0	0	0	.	.	.
SOIL 21	H	5.6	5.3	4.4	0	0	0	.	.	.
SOIL 21	I	5.6	4.5	4.3	0	0	0	.	.	.
SOIL 21	J	5.6	5.6	4.4	0	0	0	.	.	.
						0.00	0.00	.		.
						0.00	0.00	.		.
SOIL 22	A	4.8	5.1	4.7	0	0	0	.	.	.
SOIL 22	B	4.8	6.1	4.7	0	0	0	.	.	.
SOIL 22	C	4.8	5.8	4.7	0	0	0	.	.	.
SOIL 22	D	4.8	5.8	4.7	0	0	0	.	.	.
SOIL 22	E	4.8	6.4	4.7	0	0	0	.	.	.
SOIL 22	F	4.8	4.3	4.5	0	0	0	.	.	.
SOIL 22	G	4.8	4.2	4.5	0	0	0	.	.	.
SOIL 22	H	4.8	4.5	4.7	0	0	0	.	.	.
SOIL 22	I	4.8	4.0	4.5	0	0	0	.	.	.
SOIL 22	J	4.8	4.5	4.6	0	0	0	.	.	.
						0.00	0.00	.		.
						0.00	0.00	.		.

Appendix 8.1
(continued)
Tansy Aster (Field-Collected) Test Results: pH, Emergence, Survival, Root Length and Dry Weight

SOIL	REP	INIT PH	FIN PH (Soil Probe)	FIN PH (Lab Meter)	EM 0	EM 21	SURV	RT LGTH	TOT DWT	MN DWT
		pH	pH	pH	per 12	per 12	per 12	cm	g	g
SOIL 23	A	5.8	5.6	4.4	0	0	0	.	.	.
SOIL 23	B	5.8	4.7	4.6	0	0	0	.	.	.
SOIL 23	C	5.8	4.4	4.6	0	0	0	.	.	.
SOIL 23	D	5.8	4.3	4.4	0	0	0	.	.	.
SOIL 23	E	5.8	5.4	4.4	0	0	0	.	.	.
SOIL 23	F	5.8	4.3	4.4	0	0	0	.	.	.
SOIL 23	G	5.8	3.8	4.5	0	0	0	.	.	.
SOIL 23	H	5.8	3.9	4.6	0	0	0	.	.	.
SOIL 23	I	5.8	4.8	4.4	0	0	0	.	.	.
SOIL 23	J	5.8	4.2	4.4	0	0	0	.	.	.
						0.00	0.00	.		.
						0.00	0.00	.		.
SOIL 24	A	5.9	5.0	7.3	3	3	2	5	0.047	0.024
SOIL 24	B	5.9	4.9	7.3	1	1	0	.	.	.
SOIL 24	C	5.9	5.2	7.5	1	1	1	5	0.074	0.074
SOIL 24	D	5.9	5.5	7.3	1	1	1	5	0.028	0.028
SOIL 24	E	5.9	4.2	7.6	0	0	0	.	.	.
SOIL 24	F	5.9	5.1	7.6	4	4	3	7	0.135	0.045
SOIL 24	G	5.9	4.8	7.3	0	0	0	.	.	.
SOIL 24	H	5.9	4.5	7.3	0	0	0	.	.	.
SOIL 24	I	5.9	4.7	7.6	1	1	1	6	0.052	0.052
SOIL 24	J	5.9	5.5	7.4	0	0	0	.	.	.
						1.10	0.80	5.6		0.045
						1.37	1.03	0.89		0.020

Appendix 8.1

(continued)

Tansy Aster (Field-Collected) Test Results: pH, Emergence, Survival, Root Length and Dry Weight

SOIL	REP	INIT PH	FIN PH (Soil Probe)	FIN PH (Lab Meter)	EM 0	EM 21	SURV	RT LGTH	TOT DWT	MN DWT
		pH	pH	pH	per 12	per 12	per 12	cm	g	g
SOIL 25	A	5.5	4.8	7.6	0	0	0	.	.	.
SOIL 25	B	5.5	5.2	7.5	0	0	0	.	.	.
SOIL 25	C	5.5	5.2	7.7	1	1	1	9	0.037	0.037
SOIL 25	D	5.5	4.7	7.6	0	0	0	.	.	.
SOIL 25	E	5.5	4.9	7.6	1	1	1	31	0.092	0.092
SOIL 25	F	5.5	5.2	7.5	2	2	2	12	0.111	0.056
SOIL 25	G	5.5	5.8	7.7	1	1	1	11	0.084	0.084
SOIL 25	H	5.5	5.7	7.7	1	1	1	19	0.043	0.043
SOIL 25	I	5.5	5.5	7.7	1	1	0	.	.	.
SOIL 25	J	5.5	5.2	7.6	1	1	1	7	0.047	0.047
						0.80	0.70	14.8		0.060
						0.63	0.67	8.91		0.023
SOIL 26	A	5.0	5.4	7.8	1	1	1	1	0.001	0.001
SOIL 26	B	5.0	5.2	7.9	0	0	0	.	.	.
SOIL 26	C	5.0	5.2	7.8	1	1	1	2	0.011	0.011
SOIL 26	D	5.0	5.7	7.5	0	0	0	.	.	.
SOIL 26	E	5.0	5.5	7.7	0	0	0	.	.	.
SOIL 26	F	5.0	5.1	7.6	0	0	0	.	.	.
SOIL 26	G	5.0	5.7	7.7	0	0	0	.	.	.
SOIL 26	H	5.0	5.0	7.5	0	0	0	.	.	.
SOIL 26	I	5.0	5.3	7.8	0	0	0	.	.	.
SOIL 26	J	5.0	5.3	7.6	0	0	0	.	.	.
						0.20	0.20	1.5		0.006
						0.42	0.42	0.71		0.007

Appendix 8.1

(continued)

Tansy Aster (Field-Collected) Test Results: pH, Emergence, Survival, Root Length and Dry Weight

SOIL	REP	INIT PH	FIN PH (Soil Probe)	FIN PH (Lab Meter)	EM 0	EM 21	SURV	RT LGTH	TOT DWT	MN DWT
		pH	pH	pH	per 12	per 12	per 12	cm	g	g
SOIL 27	A	5.0	5.1	5.5	0	0	0	.	.	.
SOIL 27	B	5.0	7.0	5.0	0	0	0	.	.	.
SOIL 27	C	5.0	6.7	5.2	0	0	0	.	.	.
SOIL 27	D	5.0	6.0	4.9	1	1	0	.	.	.
SOIL 27	E	5.0	5.9	4.9	0	0	0	.	.	.
SOIL 27	F	5.0	4.7	5.0	1	1	0	.	.	.
SOIL 27	G	5.0	4.2	4.9	0	0	0	.	.	.
SOIL 27	H	5.0	4.7	4.8	0	0	0	.	.	.
SOIL 27	I	5.0	4.2	4.8	0	0	0	.	.	.
SOIL 27	J	5.0	4.4	4.8	0	0	0	.	.	.
						0.20	0.00	.		.
						0.42	0.00	.		.
SOIL 28	A	5.4	4.9	8.3	1	1	1	4	0.007	0.007
SOIL 28	B	5.4	4.2	7.5	0	0	0	.	.	.
SOIL 28	C	5.4	5.2	7.7	1	1	1	3	0.013	0.013
SOIL 28	D	5.4	5.0	7.8	1	1	1	5	0.009	0.009
SOIL 28	E	5.4	4.5	7.7	0	0	0	.	.	.
SOIL 28	F	5.4	4.4	7.7	0	0	0	.	.	.
SOIL 28	G	5.4	4.4	7.6	0	0	0	.	.	.
SOIL 28	H	5.4	5.3	8.2	1	1	1	14	0.012	0.012
SOIL 28	I	5.4	5.1	7.6	0	0	0	.	.	.
SOIL 28	J	5.4	5.2	7.8	0	0	0	.	.	.
						0.40	0.40	6.5		0.010
						0.52	0.52	5.07		0.003

Appendix 8.1
(continued)
Tansy Aster (Field-Collected) Test Results: pH, Emergence, Survival, Root Length and Dry Weight

SOIL	REP	INIT PH	FIN PH (Soil Probe)	FIN PH (Lab Meter)	EM 0	EM 21	SURV	RT LGTH	TOT DWT	MN DWT
		pH	pH	pH	per 12	per 12	per 12	cm	g	g
SOIL 29	A	5.8	4.9	5.3	0	0	0	.	.	.
SOIL 29	B	5.8	4.9	5.1	0	0	0	.	.	.
SOIL 29	C	5.8	5.6	4.9	0	0	0	.	.	.
SOIL 29	D	5.8	5.4	4.9	0	0	0	.	.	.
SOIL 29	E	5.8	5.3	4.8	0	0	0	.	.	.
SOIL 29	F	5.8	5.0	5.0	0	0	0	.	.	.
SOIL 29	G	5.8	5.3	5.0	0	0	0	.	.	.
SOIL 29	H	5.8	5.9	5.3	0	0	0	.	.	.
SOIL 29	I	5.8	5.7	5.1	0	0	0	.	.	.
SOIL 29	J	5.8	5.1	5.4	0	0	0	.	.	.
						0.00	0.00	.		.
						0.00	0.00	.		.
SOIL 30	A	5.4	5.1	3.9	0	0	0	.	.	.
SOIL 30	B	5.4	4.9	3.9	0	0	0	.	.	.
SOIL 30	C	5.4	5.0	3.8	0	0	0	.	.	.
SOIL 30	D	5.4	5.4	3.9	0	0	0	.	.	.
SOIL 30	E	5.4	4.1	3.9	0	0	0	.	.	.
SOIL 30	F	5.4	5.2	3.9	0	0	0	.	.	.
SOIL 30	G	5.4	4.7	3.8	0	0	0	.	.	.
SOIL 30	H	5.4	5.2	3.9	0	0	0	.	.	.
SOIL 30	I	5.4	4.9	3.8	0	0	0	.	.	.
SOIL 30	J	5.4	4.9	4.0	0	0	0	.	.	.
						0.00	0.00	.		.
						0.00	0.00	.		.

Appendix 8.1

(continued)

Tansy Aster (Field-Collected) Test Results: pH, Emergence, Survival, Root Length and Dry Weight

SOIL	REP	INIT PH	FIN PH (Soil Probe)	FIN PH (Lab Meter)	EM 0	EM 21	SURV	RT LGTH	TOT DWT	MN DWT
		pH	pH	pH	per 12	per 12	per 12	cm	g	g
SOIL 31	A	5.3	4.8	5.9	1	1	1	1	0.001	0.001
SOIL 31	B	5.3	5.5	5.4	0	0	0	.	.	.
SOIL 31	C	5.3	5.0	5.3	0	0	0	.	.	.
SOIL 31	D	5.3	5.4	5.5	0	0	0	.	.	.
SOIL 31	E	5.3	5.9	5.6	0	0	0	.	.	.
SOIL 31	F	5.3	4.7	5.4	0	0	0	.	.	.
SOIL 31	G	5.3	5.2	5.5	0	0	0	.	.	.
SOIL 31	H	5.3	4.9	5.5	0	0	0	.	.	.
SOIL 31	I	5.3	4.8	5.4	0	0	0	.	.	.
SOIL 31	J	5.3	5.2	5.3	1	1	1	3	0.002	0.002
						0.20	0.20	2.0		0.002
						0.42	0.42	1.41		0.001
SOIL 32	A	4.5	5.3	5.1	0	0	0	.	.	.
SOIL 32	B	4.5	5.4	5.1	0	0	0	.	.	.
SOIL 32	C	4.5	5.5	5.1	0	0	0	.	.	.
SOIL 32	D	4.5	5.2	5.0	0	0	0	.	.	.
SOIL 32	E	4.5	5.3	5.2	0	0	0	.	.	.
SOIL 32	F	4.5	5.3	5.1	0	0	0	.	.	.
SOIL 32	G	4.5	4.9	5.2	0	0	0	.	.	.
SOIL 32	H	4.5	5.1	5.2	0	0	0	.	.	.
SOIL 32	I	4.5	5.3	5.3	0	0	0	.	.	.
SOIL 32	J	4.5	5.0	5.3	0	0	0	.	.	.
						0.00	0.00	.		.
						0.00	0.00	.		.

Appendix 8.1

(continued)

Tansy Aster (Field-Collected) Test Results: pH, Emergence, Survival, Root Length and Dry Weight

SOIL	REP	INIT PH	FIN PH (Soil Probe)	FIN PH (Lab Meter)	EM 0	EM 21	SURV	RT LGTH	TOT DWT	MN DWT
		pH	pH	pH	per 12	per 12	per 12	cm	g	g
SOIL 35	A	4.9	3.7	4.8	0	0	0	.	.	.
SOIL 35	B	4.9	3.8	4.7	0	0	0	.	.	.
SOIL 35	C	4.9	4.1	4.7	0	0	0	.	.	.
SOIL 35	D	4.9	4.6	4.8	0	0	0	.	.	.
SOIL 35	E	4.9	4.2	4.6	0	0	0	.	.	.
SOIL 35	F	4.9	3.8	4.7	0	0	0	.	.	.
SOIL 35	G	4.9	3.7	4.8	0	0	0	.	.	.
SOIL 35	H	4.9	3.7	4.7	0	0	0	.	.	.
SOIL 35	I	4.9	4.0	4.8	0	0	0	.	.	.
SOIL 35	J	4.9	4.9	4.6	0	0	0	.	.	.
						0.00	0.00	.		.
						0.00	0.00	.		.
SOIL 36	A	5.2	6.2	5.4	0	0	0	.	.	.
SOIL 36	B	5.2	5.5	5.5	0	0	0	.	.	.
SOIL 36	C	5.2	5.8	5.5	0	0	0	.	.	.
SOIL 36	D	5.2	5.3	5.7	0	0	0	.	.	.
SOIL 36	E	5.2	3.8	5.9	0	0	0	.	.	.
SOIL 36	F	5.2	4.2	5.8	0	0	0	.	.	.
SOIL 36	G	5.2	3.6	5.7	0	0	0	.	.	.
SOIL 36	H	5.2	3.9	6.0	0	0	0	.	.	.
SOIL 36	I	5.2	4.2	6.1	0	0	0	.	.	.
SOIL 36	J	5.2	3.9	6.0	0	0	0	.	.	.
						0.00	0.00	.		.
						0.00	0.00	.		.

Appendix 8.2

Tansy Aster (Field-Collected) Test Results: Height

SOIL	REP	MN HT	HT1	HT2	HT3	HT4	HT5	HT6	HT7	HT8	HT9	HT10	HT11	HT12
		cm	cm											
NC	A	.	.	.	.	.	.	.	.	.	.	.	.	.
NC	B	.	.	.	.	.	.	.	.	.	.	.	.	.
NC	C	.	.	.	.	.	.	.	.	.	.	.	.	.
NC	D	8.0	8	.	.	.	.	.	.	.	.	.	.	.
NC	E	8.5	10	7	.	.	.	.	.	.	.	.	.	.
NC	F	.	.	.	.	.	.	.	.	.	.	.	.	.
NC	G	7.0	7	.	.	.	.	.	.	.	.	.	.	.
NC	H	3.0	3	.	.	.	.	.	.	.	.	.	.	.
NC	I	15.0	15	.	.	.	.	.	.	.	.	.	.	.
NC	J	14.5	14	15	.	.	.	.	.	.	.	.	.	.
		9.3												
		4.62												
SOIL 1	A	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 1	B	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 1	C	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 1	D	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 1	E	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 1	F	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 1	G	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 1	H	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 1	I	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 1	J	.	.	.	.	.	.	.	.	.	.	.	.	.
		.												
		.												

Appendix 8.2
(continued)
Tansy Aster (Field-Collected) Test Results: Height

SOIL	REP	MN HT	HT1	HT2	HT3	HT4	HT5	HT6	HT7	HT8	HT9	HT10	HT11	HT12
		cm	cm											
SOIL 2	A	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 2	B	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 2	C	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 2	D	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 2	E	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 2	F	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 2	G	1.0	1	.	.	.	.	.	.	.	.	.	.	.
SOIL 2	H	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 2	I	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 2	J	.	.	.	.	.	.	.	.	.	.	.	.	.
		1.0												
		.												
SOIL 3	A	0.3	0.25	.	.	.	.	.	.	.	.	.	.	.
SOIL 3	B	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 3	C	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 3	D	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 3	E	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 3	F	0.3	0.25	.	.	.	.	.	.	.	.	.	.	.
SOIL 3	G	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 3	H	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 3	I	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 3	J	0.3	0.25	.	.	.	.	.	.	.	.	.	.	.
		0.3												
		0.00												

Appendix 8.2
(continued)
Tansy Aster (Field-Collected) Test Results: Height

SOIL	REP	MN HT	HT1	HT2	HT3	HT4	HT5	HT6	HT7	HT8	HT9	HT10	HT11	HT12
		cm	cm											
SOIL 4	A	3.0	3	.	.	.	.	.	.	.	.	.	.	.
SOIL 4	B	6.0	6	.	.	.	.	.	.	.	.	.	.	.
SOIL 4	C	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 4	D	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 4	E	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 4	F	0.3	0.25	.	.	.	.	.	.	.	.	.	.	.
SOIL 4	G	1.0	1	.	.	.	.	.	.	.	.	.	.	.
SOIL 4	H	0.3	0.25	.	.	.	.	.	.	.	.	.	.	.
SOIL 4	I	0.3	0.25	.	.	.	.	.	.	.	.	.	.	.
SOIL 4	J	0.3	0.25	.	.	.	.	.	.	.	.	.	.	.
		1.6												
		2.20												
SOIL 5	A	1.0	1	.	.	.	.	.	.	.	.	.	.	.
SOIL 5	B	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 5	C	1.5	2	1	.	.	.	.	.	.	.	.	.	.
SOIL 5	D	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 5	E	1.1	2	0.25	.	.	.	.	.	.	.	.	.	.
SOIL 5	F	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 5	G	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 5	H	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 5	I	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 5	J	.	.	.	.	.	.	.	.	.	.	.	.	.
		1.2												
		0.26												

Appendix 8.2

(continued)

Tansy Aster (Field-Collected) Test Results: Height

SOIL	REP	MN HT	HT1	HT2	HT3	HT4	HT5	HT6	HT7	HT8	HT9	HT10	HT11	HT12
		cm	cm											
SOIL 6	A	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 6	B	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 6	C	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 6	D	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 6	E	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 6	F	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 6	G	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 6	H	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 6	I	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 6	J	.	.	.	.	.	.	.	.	.	.	.	.	.
		.												
		.												
SOIL 7	A	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 7	B	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 7	C	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 7	D	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 7	E	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 7	F	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 7	G	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 7	H	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 7	I	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 7	J	.	.	.	.	.	.	.	.	.	.	.	.	.
		.												
		.												

Appendix 8.2
(continued)
Tansy Aster (Field-Collected) Test Results: Height

SOIL	REP	MN HT	HT1	HT2	HT3	HT4	HT5	HT6	HT7	HT8	HT9	HT10	HT11	HT12
		cm	cm											
SOIL 8	A	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 8	B	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 8	C	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 8	D	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 8	E	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 8	F	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 8	G	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 8	H	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 8	I	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 8	J	.	.	.	.	.	.	.	.	.	.	.	.	.
		.												
		.												
SOIL 9	A	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 9	B	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 9	C	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 9	D	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 9	E	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 9	F	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 9	G	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 9	H	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 9	I	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 9	J	.	.	.	.	.	.	.	.	.	.	.	.	.
		.												
		.												

Appendix 8.2

(continued)

Tansy Aster (Field-Collected) Test Results: Height

SOIL	REP	MN HT	HT1	HT2	HT3	HT4	HT5	HT6	HT7	HT8	HT9	HT10	HT11	HT12
		cm	cm											
SOIL 10	A	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 10	B	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 10	C	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 10	D	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 10	E	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 10	F	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 10	G	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 10	H	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 10	I	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 10	J	.	.	.	.	.	.	.	.	.	.	.	.	.
		.												
		.												
SOIL 11	A	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 11	B	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 11	C	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 11	D	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 11	E	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 11	F	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 11	G	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 11	H	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 11	I	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 11	J	.	.	.	.	.	.	.	.	.	.	.	.	.
		.												
		.												

Appendix 8.2
(continued)
Tansy Aster (Field-Collected) Test Results: Height

SOIL	REP	MN HT	HT1	HT2	HT3	HT4	HT5	HT6	HT7	HT8	HT9	HT10	HT11	HT12
		cm	cm											
SOIL 12	A	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 12	B	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 12	C	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 12	D	1.0	1	.	.	.	.	.	.	.	.	.	.	.
SOIL 12	E	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 12	F	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 12	G	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 12	H	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 12	I	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 12	J	2.0	2	.	.	.	.	.	.	.	.	.	.	.
		1.5												
		0.71												
SOIL 13	A	1.0	1	.	.	.	.	.	.	.	.	.	.	.
SOIL 13	B	1.0	1	.	.	.	.	.	.	.	.	.	.	.
SOIL 13	C	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 13	D	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 13	E	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 13	F	2.0	2	.	.	.	.	.	.	.	.	.	.	.
SOIL 13	G	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 13	H	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 13	I	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 13	J	.	.	.	.	.	.	.	.	.	.	.	.	.
		1.3												
		0.58												

Appendix 8.2

(continued)

Tansy Aster (Field-Collected) Test Results: Height

SOIL	REP	MN HT	HT1	HT2	HT3	HT4	HT5	HT6	HT7	HT8	HT9	HT10	HT11	HT12
		cm	cm											
SOIL 14	A	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 14	B	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 14	C	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 14	D	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 14	E	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 14	F	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 14	G	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 14	H	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 14	I	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 14	J	.	.	.	.	.	.	.	.	.	.	.	.	.
		.												
		.												
SOIL 15	A	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 15	B	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 15	C	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 15	D	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 15	E	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 15	F	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 15	G	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 15	H	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 15	I	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 15	J	.	.	.	.	.	.	.	.	.	.	.	.	.
		.												
		.												

Appendix 8.2
(continued)
Tansy Aster (Field-Collected) Test Results: Height

SOIL	REP	MN HT	HT1	HT2	HT3	HT4	HT5	HT6	HT7	HT8	HT9	HT10	HT11	HT12
		cm	cm											
SOIL 16	A	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 16	B	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 16	C	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 16	D	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 16	E	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 16	F	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 16	G	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 16	H	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 16	I	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 16	J	.	.	.	.	.	.	.	.	.	.	.	.	.
		.												
		.												
SOIL 17	A	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 17	B	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 17	C	0.6	1	0.25	.	.	.	.	.	.	.	.	.	.
SOIL 17	D	2.0	2	.	.	.	.	.	.	.	.	.	.	.
SOIL 17	E	2.0	2	.	.	.	.	.	.	.	.	.	.	.
SOIL 17	F	2.0	2	.	.	.	.	.	.	.	.	.	.	.
SOIL 17	G	1.0	1	.	.	.	.	.	.	.	.	.	.	.
SOIL 17	H	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 17	I	3.0	3	.	.	.	.	.	.	.	.	.	.	.
SOIL 17	J	.	.	.	.	.	.	.	.	.	.	.	.	.
		1.8												
		0.85												

Appendix 8.2
(continued)
Tansy Aster (Field-Collected) Test Results: Height

SOIL	REP	MN HT	HT1	HT2	HT3	HT4	HT5	HT6	HT7	HT8	HT9	HT10	HT11	HT12
		cm	cm											
SOIL 19	A	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 19	B	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 19	C	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 19	D	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 19	E	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 19	F	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 19	G	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 19	H	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 19	I	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 19	J	.	.	.	.	.	.	.	.	.	.	.	.	.
		.												
		.												
SOIL 20	A	1.0	1	.	.	.	.	.	.	.	.	.	.	.
SOIL 20	B	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 20	C	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 20	D	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 20	E	0.3	0.25	.	.	.	.	.	.	.	.	.	.	.
SOIL 20	F	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 20	G	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 20	H	3.0	3	.	.	.	.	.	.	.	.	.	.	.
SOIL 20	I	1.0	1	.	.	.	.	.	.	.	.	.	.	.
SOIL 20	J	2.0	1	3	.	.	.	.	.	.	.	.	.	.
		1.5												
		1.07												

Appendix 8.2

(continued)

Tansy Aster (Field-Collected) Test Results: Height

SOIL	REP	MN HT	HT1	HT2	HT3	HT4	HT5	HT6	HT7	HT8	HT9	HT10	HT11	HT12
		cm	cm											
SOIL 21	A	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 21	B	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 21	C	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 21	D	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 21	E	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 21	F	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 21	G	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 21	H	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 21	I	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 21	J	.	.	.	.	.	.	.	.	.	.	.	.	.
		.												
		.												
SOIL 22	A	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 22	B	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 22	C	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 22	D	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 22	E	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 22	F	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 22	G	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 22	H	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 22	I	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 22	J	.	.	.	.	.	.	.	.	.	.	.	.	.
		.												
		.												

Appendix 8.2

(continued)

Tansy Aster (Field-Collected) Test Results: Height

SOIL	REP	MN HT	HT1	HT2	HT3	HT4	HT5	HT6	HT7	HT8	HT9	HT10	HT11	HT12
		cm	cm											
SOIL 23	A	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 23	B	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 23	C	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 23	D	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 23	E	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 23	F	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 23	G	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 23	H	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 23	I	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 23	J	.	.	.	.	.	.	.	.	.	.	.	.	.
		.												
		.												
SOIL 24	A	4.0	6	2	.	.	.	.	.	.	.	.	.	.
SOIL 24	B	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 24	C	5.0	5	.	.	.	.	.	.	.	.	.	.	.
SOIL 24	D	5.0	5	.	.	.	.	.	.	.	.	.	.	.
SOIL 24	E	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 24	F	5.0	5	6	4	.	.	.	.	.	.	.	.	.
SOIL 24	G	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 24	H	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 24	I	7.0	7	.	.	.	.	.	.	.	.	.	.	.
SOIL 24	J	.	.	.	.	.	.	.	.	.	.	.	.	.
		5.2												
		1.10												

Appendix 8.2
(continued)
Tansy Aster (Field-Collected) Test Results: Height

SOIL	REP	MN HT	HT1	HT2	HT3	HT4	HT5	HT6	HT7	HT8	HT9	HT10	HT11	HT12
		cm	cm											
SOIL 25	A	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 25	B	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 25	C	4.0	4	.	.	.	.	.	.	.	.	.	.	.
SOIL 25	D	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 25	E	6.0	6	.	.	.	.	.	.	.	.	.	.	.
SOIL 25	F	4.5	5	4	.	.	.	.	.	.	.	.	.	.
SOIL 25	G	5.0	5	.	.	.	.	.	.	.	.	.	.	.
SOIL 25	H	4.0	4	.	.	.	.	.	.	.	.	.	.	.
SOIL 25	I	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 25	J	4.0	4	.	.	.	.	.	.	.	.	.	.	.
		4.6												
		0.80												
SOIL 26	A	0.3	0.25	.	.	.	.	.	.	.	.	.	.	.
SOIL 26	B	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 26	C	3.0	3	.	.	.	.	.	.	.	.	.	.	.
SOIL 26	D	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 26	E	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 26	F	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 26	G	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 26	H	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 26	I	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 26	J	.	.	.	.	.	.	.	.	.	.	.	.	.
		1.6												
		1.94												

Appendix 8.2
(continued)
Tansy Aster (Field-Collected) Test Results: Height

SOIL	REP	MN HT	HT1	HT2	HT3	HT4	HT5	HT6	HT7	HT8	HT9	HT10	HT11	HT12
		cm	cm											
SOIL 27	A	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 27	B	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 27	C	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 27	D	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 27	E	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 27	F	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 27	G	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 27	H	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 27	I	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 27	J	.	.	.	.	.	.	.	.	.	.	.	.	.
		.												
		.												
SOIL 28	A	2.0	2	.	.	.	.	.	.	.	.	.	.	.
SOIL 28	B	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 28	C	2.0	2	.	.	.	.	.	.	.	.	.	.	.
SOIL 28	D	2.0	2	.	.	.	.	.	.	.	.	.	.	.
SOIL 28	E	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 28	F	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 28	G	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 28	H	4.0	4	.	.	.	.	.	.	.	.	.	.	.
SOIL 28	I	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 28	J	.	.	.	.	.	.	.	.	.	.	.	.	.
		2.5												
		1.00												

Appendix 8.2
(continued)
Tansy Aster (Field-Collected) Test Results: Height

SOIL	REP	MN HT	HT1	HT2	HT3	HT4	HT5	HT6	HT7	HT8	HT9	HT10	HT11	HT12
		cm	cm											
SOIL 29	A	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 29	B	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 29	C	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 29	D	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 29	E	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 29	F	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 29	G	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 29	H	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 29	I	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 29	J	.	.	.	.	.	.	.	.	.	.	.	.	.
		.												
		.												
SOIL 30	A	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 30	B	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 30	C	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 30	D	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 30	E	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 30	F	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 30	G	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 30	H	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 30	I	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 30	J	.	.	.	.	.	.	.	.	.	.	.	.	.
		.												
		.												

Appendix 8.2
(continued)
Tansy Aster (Field-Collected) Test Results: Height

SOIL	REP	MN HT	HT1	HT2	HT3	HT4	HT5	HT6	HT7	HT8	HT9	HT10	HT11	HT12
		cm	cm											
SOIL 31	A	0.3	0.25	.	.	.	.	.	.	.	.	.	.	.
SOIL 31	B	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 31	C	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 31	D	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 31	E	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 31	F	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 31	G	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 31	H	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 31	I	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 31	J	0.3	0.25	.	.	.	.	.	.	.	.	.	.	.
		0.3												
		0.00												
SOIL 32	A	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 32	B	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 32	C	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 32	D	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 32	E	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 32	F	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 32	G	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 32	H	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 32	I	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 32	J	.	.	.	.	.	.	.	.	.	.	.	.	.
		.												
		.												

Appendix 8.2

(continued)

Tansy Aster (Field-Collected) Test Results: Height

SOIL	REP	MN HT	HT1	HT2	HT3	HT4	HT5	HT6	HT7	HT8	HT9	HT10	HT11	HT12
		cm	cm											
SOIL 35	A	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 35	B	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 35	C	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 35	D	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 35	E	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 35	F	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 35	G	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 35	H	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 35	I	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 35	J	.	.	.	.	.	.	.	.	.	.	.	.	.
		.												
		.												
SOIL 36	A	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 36	B	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 36	C	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 36	D	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 36	E	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 36	F	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 36	G	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 36	H	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 36	I	.	.	.	.	.	.	.	.	.	.	.	.	.
SOIL 36	J	.	.	.	.	.	.	.	.	.	.	.	.	.
		.												
		.												

Appendix 8.3

Tansy Aster (Field-Collected) Test Results: Condition

SOIL	REP	Condition Score	Symptom(s) Observed		SOIL	REP	Condition Score	Symptom(s) Observed		SOIL	REP	Condition Score	Symptom(s) Observed
NC	A	100	M		SOIL 2	A	.	NE		SOIL 4	A	70	CL,N,M
NC	B	100	M		SOIL 2	B	.	NE		SOIL 4	B	0	none
NC	C	100	M		SOIL 2	C	.	NE		SOIL 4	C	.	NE
NC	D	20	M		SOIL 2	D	.	NE		SOIL 4	D	.	NE
NC	E	10	M		SOIL 2	E	100	M		SOIL 4	E	.	NE
NC	F	100	M		SOIL 2	F	.	NE		SOIL 4	F	90	CL,N
NC	G	70	M		SOIL 2	G	90	CL,N		SOIL 4	G	80	CL,N
NC	H	60	N,M		SOIL 2	H	.	NE		SOIL 4	H	90	CL,N
NC	I	60	M		SOIL 2	I	.	NE		SOIL 4	I	90	CL,N
NC	J	0	none		SOIL 2	J	.	NE		SOIL 4	J	90	CL,N
SOIL 1	A	.	NE		SOIL 3	A	90	CL,N,M		SOIL 5	A	80	CL,N
SOIL 1	B	.	NE		SOIL 3	B	.	NE		SOIL 5	B	.	NE
SOIL 1	C	.	NE		SOIL 3	C	.	NE		SOIL 5	C	80	CL,N
SOIL 1	D	.	NE		SOIL 3	D	.	NE		SOIL 5	D	.	NE
SOIL 1	E	.	NE		SOIL 3	E	.	NE		SOIL 5	E	80	CL,N
SOIL 1	F	.	NE		SOIL 3	F	90	CL,N		SOIL 5	F	.	NE
SOIL 1	G	.	NE		SOIL 3	G	100	M		SOIL 5	G	.	NE
SOIL 1	H	.	NE		SOIL 3	H	.	NE		SOIL 5	H	.	NE
SOIL 1	I	.	NE		SOIL 3	I	.	NE		SOIL 5	I	.	NE
SOIL 1	J	.	NE		SOIL 3	J	90	CL,N		SOIL 5	J	.	NE

M – Mortality; CL – Chlorosis; N – Necrosis; NE – None Emerged

Appendix 8.3

(continued)

Tansy Aster (Field-Collected) Test Results: Condition

SOIL	REP	Condition Score	Symptom(s) Observed		SOIL	REP	Condition Score	Symptom(s) Observed		SOIL	REP	Condition Score	Symptom(s) Observed
SOIL 6	A	.	NE		SOIL 8	A	.	NE		SOIL 10	A	.	NE
SOIL 6	B	.	NE		SOIL 8	B	.	NE		SOIL 10	B	.	NE
SOIL 6	C	.	NE		SOIL 8	C	.	NE		SOIL 10	C	.	NE
SOIL 6	D	.	NE		SOIL 8	D	100	M		SOIL 10	D	.	NE
SOIL 6	E	.	NE		SOIL 8	E	.	NE		SOIL 10	E	.	NE
SOIL 6	F	.	NE		SOIL 8	F	.	NE		SOIL 10	F	.	NE
SOIL 6	G	.	NE		SOIL 8	G	.	NE		SOIL 10	G	.	NE
SOIL 6	H	.	NE		SOIL 8	H	.	NE		SOIL 10	H	.	NE
SOIL 6	I	.	NE		SOIL 8	I	.	NE		SOIL 10	I	.	NE
SOIL 6	J	.	NE		SOIL 8	J	.	NE		SOIL 10	J	.	NE
SOIL 7	A	.	NE		SOIL 9	A	.	NE		SOIL 11	A	.	NE
SOIL 7	B	.	NE		SOIL 9	B	.	NE		SOIL 11	B	.	NE
SOIL 7	C	.	NE		SOIL 9	C	.	NE		SOIL 11	C	.	NE
SOIL 7	D	.	NE		SOIL 9	D	.	NE		SOIL 11	D	.	NE
SOIL 7	E	.	NE		SOIL 9	E	.	NE		SOIL 11	E	.	NE
SOIL 7	F	.	NE		SOIL 9	F	.	NE		SOIL 11	F	.	NE
SOIL 7	G	.	NE		SOIL 9	G	.	NE		SOIL 11	G	.	NE
SOIL 7	H	.	NE		SOIL 9	H	.	NE		SOIL 11	H	.	NE
SOIL 7	I	.	NE		SOIL 9	I	.	NE		SOIL 11	I	.	NE
SOIL 7	J	.	NE		SOIL 9	J	.	NE		SOIL 11	J	.	NE

M – Mortality; NE – None Emerged

Appendix 8.3

(continued)

Tansy Aster (Field-Collected) Test Results: Condition

SOIL	REP	Condition Score	Symptom(s) Observed		SOIL	REP	Condition Score	Symptom(s) Observed		SOIL	REP	Condition Score	Symptom(s) Observed
SOIL 12	A	.	NE		SOIL 14	A	.	NE		SOIL 16	A	.	NE
SOIL 12	B	.	NE		SOIL 14	B	.	NE		SOIL 16	B	.	NE
SOIL 12	C	.	NE		SOIL 14	C	100	M		SOIL 16	C	.	NE
SOIL 12	D	90	N		SOIL 14	D	.	NE		SOIL 16	D	.	NE
SOIL 12	E	.	NE		SOIL 14	E	.	NE		SOIL 16	E	.	NE
SOIL 12	F	.	NE		SOIL 14	F	.	NE		SOIL 16	F	.	NE
SOIL 12	G	.	NE		SOIL 14	G	.	NE		SOIL 16	G	.	NE
SOIL 12	H	.	NE		SOIL 14	H	.	NE		SOIL 16	H	.	NE
SOIL 12	I	.	NE		SOIL 14	I	.	NE		SOIL 16	I	100	M
SOIL 12	J	30	CL,N		SOIL 14	J	.	NE		SOIL 16	J	100	M
SOIL 13	A	90	CL,N		SOIL 15	A	100	M		SOIL 17	A	.	NE
SOIL 13	B	90	CL,N		SOIL 15	B	.	NE		SOIL 17	B	.	NE
SOIL 13	C	.	NE		SOIL 15	C	.	NE		SOIL 17	C	90	CL,N
SOIL 13	D	.	NE		SOIL 15	D	.	NE		SOIL 17	D	80	CL,N
SOIL 13	E	.	NE		SOIL 15	E	.	NE		SOIL 17	E	80	CL,N
SOIL 13	F	70	CL,N		SOIL 15	F	.	NE		SOIL 17	F	80	CL,N
SOIL 13	G	.	NE		SOIL 15	G	.	NE		SOIL 17	G	90	CL,N
SOIL 13	H	.	NE		SOIL 15	H	.	NE		SOIL 17	H	.	NE
SOIL 13	I	.	NE		SOIL 15	I	.	NE		SOIL 17	I	40	CL,N
SOIL 13	J	.	NE		SOIL 15	J	.	NE		SOIL 17	J	.	NE

M – Mortality; CL – Chlorosis; N – Necrosis; NE – None Emerged

Appendix 8.3

(continued)

Tansy Aster (Field-Collected) Test Results: Condition

SOIL	REP	Condition Score	Symptom(s) Observed		SOIL	REP	Condition Score	Symptom(s) Observed		SOIL	REP	Condition Score	Symptom(s) Observed
SOIL 19	A	.	NE		SOIL 21	A	.	NE		SOIL 23	A	.	NE
SOIL 19	B	.	NE		SOIL 21	B	.	NE		SOIL 23	B	.	NE
SOIL 19	C	.	NE		SOIL 21	C	.	NE		SOIL 23	C	.	NE
SOIL 19	D	.	NE		SOIL 21	D	.	NE		SOIL 23	D	.	NE
SOIL 19	E	.	NE		SOIL 21	E	.	NE		SOIL 23	E	.	NE
SOIL 19	F	.	NE		SOIL 21	F	.	NE		SOIL 23	F	.	NE
SOIL 19	G	.	NE		SOIL 21	G	.	NE		SOIL 23	G	.	NE
SOIL 19	H	.	NE		SOIL 21	H	.	NE		SOIL 23	H	.	NE
SOIL 19	I	.	NE		SOIL 21	I	.	NE		SOIL 23	I	.	NE
SOIL 19	J	.	NE		SOIL 21	J	.	NE		SOIL 23	J	.	NE
SOIL 20	A	70	N		SOIL 22	A	.	NE		SOIL 24	A	70	N
SOIL 20	B	100	M		SOIL 22	B	.	NE		SOIL 24	B	100	M
SOIL 20	C	.	NE		SOIL 22	C	.	NE		SOIL 24	C	10	CL,LC
SOIL 20	D	.	NE		SOIL 22	D	.	NE		SOIL 24	D	10	CL,LC
SOIL 20	E	90	N		SOIL 22	E	.	NE		SOIL 24	E	.	NE
SOIL 20	F	100	M		SOIL 22	F	.	NE		SOIL 24	F	30	CL,LC,M
SOIL 20	G	.	NE		SOIL 22	G	.	NE		SOIL 24	G	.	NE
SOIL 20	H	60	CL,N		SOIL 22	H	.	NE		SOIL 24	H	.	NE
SOIL 20	I	80	CL,N		SOIL 22	I	.	NE		SOIL 24	I	20	CL,LC
SOIL 20	J	70	CL,N		SOIL 22	J	.	NE		SOIL 24	J	.	NE

M – Mortality; CL – Chlorosis; N – Necrosis; LC – Leaf Curl; NE – None Emerged

Appendix 8.3

(continued)

Tansy Aster (Field-Collected) Test Results: Condition

SOIL	REP	Condition Score	Symptom(s) Observed		SOIL	REP	Condition Score	Symptom(s) Observed		SOIL	REP	Condition Score	Symptom(s) Observed
SOIL 25	A	.	NE		SOIL 27	A	.	NE		SOIL 29	A	.	NE
SOIL 25	B	.	NE		SOIL 27	B	.	NE		SOIL 29	B	.	NE
SOIL 25	C	40	CL,N		SOIL 27	C	.	NE		SOIL 29	C	.	NE
SOIL 25	D	.	NE		SOIL 27	D	100	M		SOIL 29	D	.	NE
SOIL 25	E	30	CL,LC		SOIL 27	E	.	NE		SOIL 29	E	.	NE
SOIL 25	F	30	CL,N		SOIL 27	F	100	M		SOIL 29	F	.	NE
SOIL 25	G	30	CL		SOIL 27	G	.	NE		SOIL 29	G	.	NE
SOIL 25	H	30	CL		SOIL 27	H	.	NE		SOIL 29	H	.	NE
SOIL 25	I	100	M		SOIL 27	I	.	NE		SOIL 29	I	.	NE
SOIL 25	J	30	CL,LC		SOIL 27	J	.	NE		SOIL 29	J	.	NE
SOIL 26	A	90	CL,N		SOIL 28	A	80	CL,N,LC		SOIL 30	A	.	NE
SOIL 26	B	.	NE		SOIL 28	B	.	NE		SOIL 30	B	.	NE
SOIL 26	C	50	CL,N,LC		SOIL 28	C	40	CL,N,LC		SOIL 30	C	.	NE
SOIL 26	D	.	NE		SOIL 28	D	50	CL,N,LC		SOIL 30	D	.	NE
SOIL 26	E	.	NE		SOIL 28	E	.	NE		SOIL 30	E	.	NE
SOIL 26	F	.	NE		SOIL 28	F	.	NE		SOIL 30	F	.	NE
SOIL 26	G	.	NE		SOIL 28	G	.	NE		SOIL 30	G	.	NE
SOIL 26	H	.	NE		SOIL 28	H	40	CL,N,LC		SOIL 30	H	.	NE
SOIL 26	I	.	NE		SOIL 28	I	.	NE		SOIL 30	I	.	NE
SOIL 26	J	.	NE		SOIL 28	J	.	NE		SOIL 30	J	.	NE

M – Mortality; CL – Chlorosis; N – Necrosis; NE – None Emerged; LC – Leaf Curl

Appendix 8.3
(continued)
Tansy Aster (Field-Collected) Test Results: Condition

SOIL	REP	Condition Score	Symptom(s) Observed		SOIL	REP	Condition Score	Symptom(s) Observed
SOIL 31	A	90	CL,N		SOIL 35	A	.	NE
SOIL 31	B	.	NE		SOIL 35	B	.	NE
SOIL 31	C	.	NE		SOIL 35	C	.	NE
SOIL 31	D	.	NE		SOIL 35	D	.	NE
SOIL 31	E	.	NE		SOIL 35	E	.	NE
SOIL 31	F	.	NE		SOIL 35	F	.	NE
SOIL 31	G	.	NE		SOIL 35	G	.	NE
SOIL 31	H	.	NE		SOIL 35	H	.	NE
SOIL 31	I	.	NE		SOIL 35	I	.	NE
SOIL 31	J	90	CL,N		SOIL 35	J	.	NE
SOIL 32	A	.	NE		SOIL 36	A	.	NE
SOIL 32	B	.	NE		SOIL 36	B	.	NE
SOIL 32	C	.	NE		SOIL 36	C	.	NE
SOIL 32	D	.	NE		SOIL 36	D	.	NE
SOIL 32	E	.	NE		SOIL 36	E	.	NE
SOIL 32	F	.	NE		SOIL 36	F	.	NE
SOIL 32	G	.	NE		SOIL 36	G	.	NE
SOIL 32	H	.	NE		SOIL 36	H	.	NE
SOIL 32	I	.	NE		SOIL 36	I	.	NE
SOIL 32	J	.	NE		SOIL 36	J	.	NE

CL – Chlorosis; N – Necrosis; NE – None Emerged

WATER CHEMISTRY LOG

WELL WATER

Date	pH	Meter ID#	D.O. (ppm)	Meter ID#	Conductivity (µS/cm)	Meter ID#	Temp. (°C)	Meter ID#	Initials	Comments
4-2-13	7.9	pH chem #1	8.0	DOAQ #1	367	con #1	17.2	DOAQ #1	RW	—
4-9-13	8.0	pH chem #1	8.2	DOAQ #1	370	con #1	17.8	DOAQ #1	RW	—
4-16-13	8.0	pH chim #1	7.6	DOAQ #1	364	con #1	17.7	DOAQ #1	RW	—
4-25-13	8.1	pH chem #1	7.9	DOAQ #1	342	con #1	17.4	DOAQ #1	RW	—
4-30-13	8.0	pH chem #1	8.0	DOAQ #1	363	con #1	17.5	DOAQ #1	RW	—
5-7-13	8.1	pH chem #1	7.9	DOAQ #1	284	Con #1	17.2	DOAQ #1	MS	—
5-16-13	8.1	pH chem #1	8.0	DOAQ #1	365	Con #1	18.0	DOAQ #1	MS	—
5-21-13	8.0	pH chem #1	8.0	DOAQ #1	357	con #1	18.0	DOAQ #1	RW	—
5-28-13	8.0	pH chem #1	7.5	DOAQ #1	373	con #1	17.8	DOAQ #1	RW	—
6-6-13	8.0	pH chem #1	7.8	DOAQ #1	342	con #1	17.7	DOAQ #1	RW	—
6-11-13	8.1	pH chem #1	8.0	DOAQ #1	323	con #1	18.2	DOAQ #1	RW	—
6-18-13	8.0	pH chem #1	7.5	DOAQ #1	377	con #1	18.3	DOAQ #1	RW	—
6-25-13	8.0	pH chem #1	7.6	DOAQ #1	361	con #1	18.1	DOAQ #1	RW	—
7-2-13	8.0	pH chem #1	7.9	DOAQ #1	372	con #1	18.2	DOAQ #1	RW	—
7-11-13	8.1	pH chem #1	8.0	DOAQ #1	347	con #1	19.5	DOAQ #1	RW	—

WATER CHEMISTRY LOG

WELL WATER

Date	Alkalinity Volume Titrant (mL)	Alkalinity Value (mg/L as $CaCO_3$)	Hardness Volume Titrant (mL)	Hardness Value (mg/L as $CaCO_3$)	Initials	Comments
4-2-13	8.9	178	3.4	136	RW	—
4-9-13	8.9	178	3.4	136	RW	—
4-16-13	9.0	180	3.5	140	RW	—
4-25-13	8.7	174	3.3	132	RW	—
4-30-13	8.9	178	3.5	140	RW	—
5-7-13	9.0	180	3.6	144	MS	—
5-16-13	9.0	180	3.6	144	MS	—
5-21-13	8.8	176	3.5	140	RW	—
5-28-13	8.9	178	3.5	140	RW	—
6-6-13	8.8	176	3.4	136	RW	—
6-11-13	8.8	176	3.3	132	RW	—
6-18-13	8.8	176	3.3	132	RW	—
6-25-13	8.9	178	3.3	132	RW	—
7-2-13	8.8	176	3.5	140	RW	—
7-11-13	8.8	176	3.4	136	RW	—

ANALYTICAL SUMMARY REPORT

August 28, 2015

Chino Mine Company
PO Box 10
Bayard, NM 88023

Work Order: H15080326

Project Name: WI Water Analysis

Energy Laboratories Inc Helena MT received the following 2 samples for Chino Mine Company on 8/18/2015 for analysis.

Lab ID	Client Sample ID	Collect Date	Receive Date	Matrix	Test
H15080326-001	1st Flush	08/17/15 8:00	08/18/15	Aqueous	Metals by ICP/ICPMS, Dissolved Alkalinity Conductivity Hardness as CaCO3 pH Preparation, Dissolved Filtration
H15080326-002	Cleared Lines	08/17/15 8:00	08/18/15	Aqueous	Same As Above

The analyses presented in this report were performed by Energy Laboratories, Inc., 3161 E. Lyndale Ave., Helena, MT 59604, unless otherwise noted. Any exceptions or problems with the analyses are noted in the Laboratory Analytical Report, the QA/QC Summary Report, or the Case Narrative.

The results as reported relate only to the item(s) submitted for testing.

If you have any questions regarding these test results, please call.

Report Approved By:

LABORATORY ANALYTICAL REPORT

Prepared by Helena, MT Branch

Client:	Chino Mine Company	**Report Date:**	08/28/15
Project:	WI Water Analysis	**Collection Date:**	08/17/15 08:00
Lab ID:	H15080326-001	**DateReceived:**	08/18/15
Client Sample ID:	1st Flush	**Matrix:**	Aqueous

Analyses	Result	Units	Qualifiers	RL	MCL/ QCL	Method	Analysis Date / By
PHYSICAL PROPERTIES							
pH	8.0	s.u.	H	0.1		A4500-H B	08/19/15 13:14 / SRW
Conductivity @ 25 C	385	umhos/cm		1		A2510 B	08/19/15 13:14 / SRW
INORGANICS							
Alkalinity, Total as CaCO3	200	mg/L		4		A2320 B	08/19/15 19:32 / SRW
Hardness as CaCO3	140	mg/L		1		A2340 B	08/27/15 14:11 / sld
METALS, DISSOLVED							
Cadmium	ND	mg/L		0.00003		E200.8	08/26/15 20:26 / dck
Calcium	35	mg/L		1		E200.8	08/26/15 20:26 / dck
Copper	0.028	mg/L		0.001		E200.8	08/26/15 20:26 / dck
Lead	0.0010	mg/L		0.0003		E200.8	08/26/15 20:26 / dck
Magnesium	13	mg/L		1		E200.8	08/26/15 20:26 / dck
Nickel	0.012	mg/L		0.005		E200.8	08/26/15 20:26 / dck
Zinc	0.04	mg/L		0.01		E200.8	08/26/15 20:26 / dck

Report Definitions:

RL - Analyte reporting limit.
QCL - Quality control limit.
H - Analysis performed past recommended holding time.
MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.

LABORATORY ANALYTICAL REPORT

Prepared by Helena, MT Branch

Client:	Chino Mine Company	**Report Date:**	08/28/15
Project:	WI Water Analysis	**Collection Date:**	08/17/15 08:00
Lab ID:	H15080326-002	**DateReceived:**	08/18/15
Client Sample ID:	Cleared Lines	**Matrix:**	Aqueous

Analyses	Result	Units	Qualifiers	RL	MCL/ QCL	Method	Analysis Date / By
PHYSICAL PROPERTIES							
pH	8.2	s.u.	H	0.1		A4500-H B	08/19/15 13:17 / SRW
Conductivity @ 25 C	394	umhos/cm		1		A2510 B	08/19/15 13:17 / SRW
INORGANICS							
Alkalinity, Total as CaCO3	200	mg/L		4		A2320 B	08/19/15 19:38 / SRW
Hardness as CaCO3	141	mg/L		1		A2340 B	08/27/15 14:11 / sld
METALS, DISSOLVED							
Cadmium	ND	mg/L		0.00003		E200.8	08/26/15 20:30 / dck
Calcium	35	mg/L		1		E200.8	08/26/15 20:30 / dck
Copper	0.001	mg/L		0.001		E200.8	08/26/15 20:30 / dck
Lead	ND	mg/L		0.0003		E200.8	08/26/15 20:30 / dck
Magnesium	13	mg/L		1		E200.8	08/26/15 20:30 / dck
Nickel	ND	mg/L		0.005		E200.8	08/26/15 20:30 / dck
Zinc	ND	mg/L		0.01		E200.8	08/26/15 20:30 / dck

Report Definitions:	RL - Analyte reporting limit.	MCL - Maximum contaminant level.
	QCL - Quality control limit.	ND - Not detected at the reporting limit.
	H - Analysis performed past recommended holding time.	

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: Chino Mine Company
Project: WI Water Analysis

Report Date: 08/28/15
Work Order: H15080326

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: A2320 B										Batch: R108634
Lab ID: MB		Method Blank				Run: PHSC_101-H_150819A				08/19/15 18:02
Alkalinity, Total as CaCO3		2	mg/L	0.7						
Lab ID: LCS		Laboratory Control Sample				Run: PHSC_101-H_150819A				08/19/15 18:08
Alkalinity, Total as CaCO3		610	mg/L	4.0	101	90	110			
Lab ID: H15080332-001ADUP		Sample Duplicate				Run: PHSC_101-H_150819A				08/19/15 19:23
Alkalinity, Total as CaCO3		450	mg/L	4.0				1.0	10	

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: Chino Mine Company
Project: WI Water Analysis

Report Date: 08/28/15
Work Order: H15080326

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: **A2510 B**										Analytical Run: PHSC_101-H_150819A
Lab ID: **CCV - SC 1413**		Continuing Calibration Verification Standard								08/19/15 10:35
Conductivity @ 25 C		1400	umhos/cm	1.0	99	90	110			
Method: **A2510 B**										Batch: R108634
Lab ID: **SC 150**		Initial Calibration Verification Standard				Run: PHSC_101-H_150819A				08/19/15 08:24
Conductivity @ 25 C		149	umhos/cm	1.0	99	90	110			
Lab ID: **SC 5000**		Initial Calibration Verification Standard				Run: PHSC_101-H_150819A				08/19/15 08:26
Conductivity @ 25 C		4990	umhos/cm	1.0	100	90	110			
Lab ID: **SC 20000**		Initial Calibration Verification Standard				Run: PHSC_101-H_150819A				08/19/15 08:29
Conductivity @ 25 C		19600	umhos/cm	1.0	98	90	110			
Lab ID: **SC 2ND 1000**		Laboratory Control Sample				Run: PHSC_101-H_150819A				08/19/15 08:31
Conductivity @ 25 C		1000	umhos/cm	1.0	100	90	110			
Lab ID: **H15080331-001ADUP**		Sample Duplicate				Run: PHSC_101-H_150819A				08/19/15 13:22
Conductivity @ 25 C		38800	umhos/cm	1.0				0.2	10	

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: Chino Mine Company
Project: WI Water Analysis

Report Date: 08/28/15
Work Order: H15080326

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: A4500-H B						Analytical Run: PHSC_101-H_150819A				
Lab ID: pH 7		Initial Calibration Verification Standard								08/19/15 08:21
pH		7.0	s.u.	0.1	100	98	102			
Lab ID: CCV - pH 7		Continuing Calibration Verification Standard								08/19/15 10:32
pH		7.0	s.u.	0.1	100	98	102			
Lab ID: CCV - pH 7		Continuing Calibration Verification Standard								08/19/15 13:30
pH		7.0	s.u.	0.1	100	98	102			
Method: A4500-H B										Batch: R108634
Lab ID: H15080331-001ADUP		Sample Duplicate				Run: PHSC_101-H_150819A				08/19/15 13:22
pH		7.7	s.u.	0.1				0.0	3	

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: Chino Mine Company **Report Date:** 08/28/15
Project: WI Water Analysis **Work Order:** H15080326

Method: **E200.8** Analytical Run: ICPMS204-B_150826B

Lab ID: **ICV STD** 7 Initial Calibration Verification Standard 08/26/15 14:10

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Cadmium		0.0313	mg/L	0.0010	104	90	110			
Calcium		3.08	mg/L	0.50	103	90	110			
Copper		0.0626	mg/L	0.010	104	90	110			
Lead		0.0594	mg/L	0.010	99	90	110			
Magnesium		3.11	mg/L	0.50	104	90	110			
Nickel		0.0613	mg/L	0.010	102	90	110			
Zinc		0.0626	mg/L	0.010	104	90	110			

Lab ID: **ICSA** 7 Interference Check Sample A 08/26/15 14:13

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Cadmium		0.000341	mg/L	0.0010						
Calcium		119	mg/L	0.50	99	70	130			
Copper		0.000777	mg/L	0.010						
Lead		0.000254	mg/L	0.010						
Magnesium		40.6	mg/L	0.50	102	70	130			
Nickel		0.000646	mg/L	0.010						
Zinc		0.00102	mg/L	0.010						

Lab ID: **ICSAB** 7 Interference Check Sample AB 08/26/15 14:16

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Cadmium		0.0102	mg/L	0.0010	102	70	130			
Calcium		120	mg/L	0.50	100	70	130			
Copper		0.0215	mg/L	0.010	107	70	130			
Lead		0.000259	mg/L	0.010		0	0			
Magnesium		40.0	mg/L	0.50	100	70	130			
Nickel		0.0211	mg/L	0.010	106	70	130			
Zinc		0.0110	mg/L	0.010	110	70	130			

Method: **E200.8** Batch: R108876

Lab ID: **ICB** 7 Method Blank Run: ICPMS204-B_150826B 08/26/15 14:43

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Cadmium		ND	mg/L	2E-05						
Calcium		ND	mg/L	0.010						
Copper		ND	mg/L	6E-05						
Lead		ND	mg/L	3E-05						
Magnesium		ND	mg/L	0.0003						
Nickel		0.0001	mg/L	3E-05						
Zinc		0.0008	mg/L	0.0001						

Lab ID: **LFB** 7 Laboratory Fortified Blank Run: ICPMS204-B_150826B 08/26/15 14:46

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Cadmium		0.0519	mg/L	0.0010	104	85	115			
Calcium		1.07	mg/L	0.50	107	85	115			
Copper		0.0529	mg/L	0.010	106	85	115			
Lead		0.0508	mg/L	0.010	102	85	115			
Magnesium		1.04	mg/L	0.50	104	85	115			
Nickel		0.0528	mg/L	0.010	105	85	115			
Zinc		0.0534	mg/L	0.010	105	85	115			

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: Chino Mine Company **Report Date:** 08/28/15
Project: WI Water Analysis **Work Order:** H15080326

Method: **E200.8** Batch: R108876

Lab ID: **H15080261-031FMS** 7 Sample Matrix Spike Run: ICPMS204-B_150826B 08/26/15 19:45

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Cadmium		0.0479	mg/L	0.0010	96	70	130			
Calcium		135	mg/L	1.0		70	130			A
Copper		0.0495	mg/L	0.0050	98	70	130			
Lead		0.0491	mg/L	0.0010	98	70	130			
Magnesium		78.4	mg/L	1.0		70	130			A
Nickel		0.0503	mg/L	0.0050	98	70	130			
Zinc		0.0486	mg/L	0.010	94	70	130			

Lab ID: **H15080261-031FMSD** 7 Sample Matrix Spike Duplicate Run: ICPMS204-B_150826B 08/26/15 19:48

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Cadmium		0.0488	mg/L	0.0010	98	70	130	2.0	20	
Calcium		137	mg/L	1.0		70	130	1.6	20	A
Copper		0.0506	mg/L	0.0050	100	70	130	2.0	20	
Lead		0.0505	mg/L	0.0010	101	70	130	2.9	20	
Magnesium		79.5	mg/L	1.0		70	130	1.5	20	A
Nickel		0.0514	mg/L	0.0050	100	70	130	2.1	20	
Zinc		0.0506	mg/L	0.010	98	70	130	4.0	20	

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

A - The analyte level was greater than four times the spike level. In accordance with the method % recovery is not calculated.

Work Order Receipt Checklist

Chino Mine Company

H15080326

Login completed by:	Skyler T. Pester	Date Received:	8/18/2015
Reviewed by:	BL2000\sdull	Received by:	stp
Reviewed Date:	8/27/2015	Carrier name:	FedEx Express

Shipping container/cooler in good condition?	Yes ☑	No ☐	Not Present ☐
Custody seals intact on all shipping container(s)/cooler(s)?	Yes ☐	No ☐	Not Present ☑
Custody seals intact on all sample bottles?	Yes ☐	No ☐	Not Present ☑
Chain of custody present?	Yes ☐	No ☑	
Chain of custody signed when relinquished and received?	Yes ☐	No ☑	
Chain of custody agrees with sample labels?	Yes ☐	No ☑	
Samples in proper container/bottle?	Yes ☑	No ☐	
Sample containers intact?	Yes ☑	No ☐	
Sufficient sample volume for indicated test?	Yes ☐	No ☑	
All samples received within holding time? (Exclude analyses that are considered field parameters such as pH, DO, Res Cl, Sulfite, Ferrous Iron, etc.)	Yes ☑	No ☐	
Temp Blank received in all shipping container(s)/cooler(s)?	Yes ☐	No ☑	Not Applicable ☐
Container/Temp Blank temperature:	10.5°C No Ice		
Water - VOA vials have zero headspace?	Yes ☐	No ☐	No VOA vials submitted ☑
Water - pH acceptable upon receipt?	Yes ☐	No ☑	Not Applicable ☐

Standard Reporting Procedures:

Lab measurement of analytes considered field parameters that require analysis within 15 minutes of sampling such as pH, Dissolved Oxygen and Residual Chlorine, are qualified as being analyzed outside of recommended holding time.

Solid/soil samples are reported on a wet weight basis (as received) unless specifically indicated. If moisture corrected, data units are typically noted as –dry. For agricultural and mining soil parameters/characteristics, all samples are dried and ground prior to sample analysis.

Contact and Corrective Action Comments:

Client sample container leaked into ziplock bag during shipping, transfered to proper sealed containers upon arrival. Very low sample volume, prioritize metals, and ph/ec. then ALK, hardness, and DOC. Insufficient sample to analyze DOC. Analysis taken from emails from J. Meyer and M. Barkley. No collection times listed on sample containers - collection times estimated in laboratory.
Samples for Dissolved Metals/Hardness were subsampled, filtered, and preserved to pH <2 with 2 mL of Nitric acid per 250 mL in the laboratory. According to 40CFR136, samples for Dissolved Metals should be filtered and preserved within 15 minutes of collection. 8/19/2015 STP.

Energy Laboratories Inc
3161 East Lyndale Avenue
Helena, MT 59601
(406) 442-0711

CHAIN-OF-CUSTODY RECORD

Page 1 of 1

WorkOrder: H15080326

Client:
Chino Mine Company
PO Box 10
Bayard, NM 88023

TEL:
FAX:
ProjectNo: WI Water Analys
PO:

19-Aug-15

Sample ID	ClientSampID	Matrix	Collection Date	Bottle	Requested Tests					
					200_7_8-W-D	ALK-W	OND-PROBE-	DNESS-CALC	PH-W	WC REVIEW
H15080326-001	1st Flush	Aqueous	8/17/2015 8:00:00 AM		A	B	B	A	B	A
H15080326-002	Cleared Lines	Aqueous	8/17/2015 8:00:00 AM		A	B	B	A	B	

Fedex express overnight
10.5°C
No Ice

Comments: Samples Submitted from WI, under directive of Matthew B. to be analyzed for suspected contamination. See Email in place of COC. 8/19/2015 STP. Very low sample volume, prioritize metals, and ph/ec. then ALK, hardness, and DOC.

	Date/Time		Date/Time
Relinquished by:		**Received by:**	
Relinquished by:		**Received by:**	
Relinquished by:		**Received by:**	8-18-15 9:36 AM

NOTE: Samples are discarded 60 days after results are reported unless other arrangements are made. Hazardous samples will be returned to client or disposed of at client expense.

Bottle Type: L-Liter V-Voa S-Soil Jar O-Orbo T-Tedlar B-Brass P-Plastic OT-Other

H15080326

Skyler T Pester
Soil Dept. Supervisor
Analytical Chemist
Toll free: 877.472.0711
Office: 406.442.0711
Fax: 406.442.0712
spester@energylab.com

From: Barkley, Matthew [mailto:Matthew.Barkley@arcadis.com]
Sent: Tuesday, August 18, 2015 4:43 PM
To: 'spester@energylab.com'
Cc: Meyer, Joseph (Lakewood, CO)
Subject: Dissolved Copper

Skyler-
Please run the Wildlife water for dissolved copper and pH.

Joe – anything else you would like analyzed?

Thanks

Matthew Barkley | Senior Economist - Project Manager | matthew.barkley@arcadis-us.com

ARCADIS U.S., Inc. | 1687 Cole Blvd, 2nd Floor | Lakewood, CO 80401
T. 303-231-9115 ext 157 | M. 805-450-4435 | F. 303-231-9571
www.arcadis-us.com

ARCADIS, Imagine the result
Please consider the environment before printing this email.

H15080326

Skyler Pester

From: Barkley, Matthew <Matthew.Barkley@arcadis.com>
Sent: Tuesday, August 18, 2015 4:43 PM
To: 'spester@energylab.com'
Cc: Meyer, Joseph (Lakewood, CO)
Subject: Dissolved Copper

Skyler-
Please run the Wildlife water for dissolved copper and pH.

Joe – anything else you would like analyzed?

Thanks

Matthew Barkley | Senior Economist - Project Manager | matthew.barkley@arcadis-us.com

ARCADIS U.S., Inc. | 1687 Cole Blvd, 2nd Floor | Lakewood, CO 80401
T. 303-231-9115 ext 157 | M. 805-450-4435 | F. 303-231-9571
www.arcadis-us.com

ARCADIS, Imagine the result

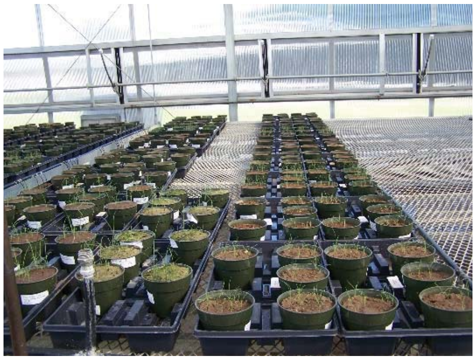
Communication with Arcadis from Wildlife International, clarifying greenhouse experiment methodology.

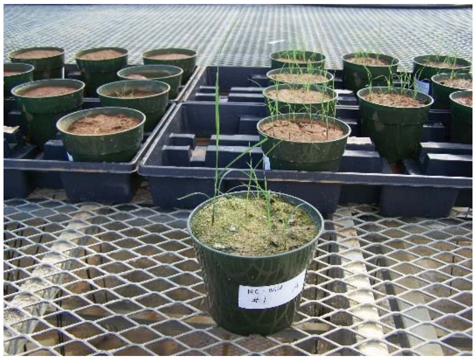
Photoperiod: Photoperiod throughout the study was maintained at least 16 hours. The lights were controlled by a combination of a timer and light meter. Each day, the lights came on at 5 AM and remained on until the ambient light level outdoors reached a setpoint and then turned off. During the day, when the sunlight fell below the setpoint the lights came on to supplement natural light. Each evening, as the light fell below the setpoint, the lights came on again and remained on until 9:00 PM.

Scarlet globemallow: The report provides germination rates for the first 21 days but the test was run for 35 days and only 2 seeds germinated in the negative control pots of 120 field-collected seeds by day 35; none germinated in the nursery seed experiment.

Photographs: Photographic documentation was requested in the Reporting section of the protocol of Attachment C of the Work Plan. However, the Test Procedure, which is typically the portion of the study protocols that specifies what tasks are to be completed, did not include specific instruction to take photographs and laboratory technicians were not instructed to take photographs. As a result, photographic documentation of the greenhouse portion of the phytotoxicity study is limited and only available for sideoats grama.

Photographs of sideoats grama experiment provided by Wildlife International are shown below.





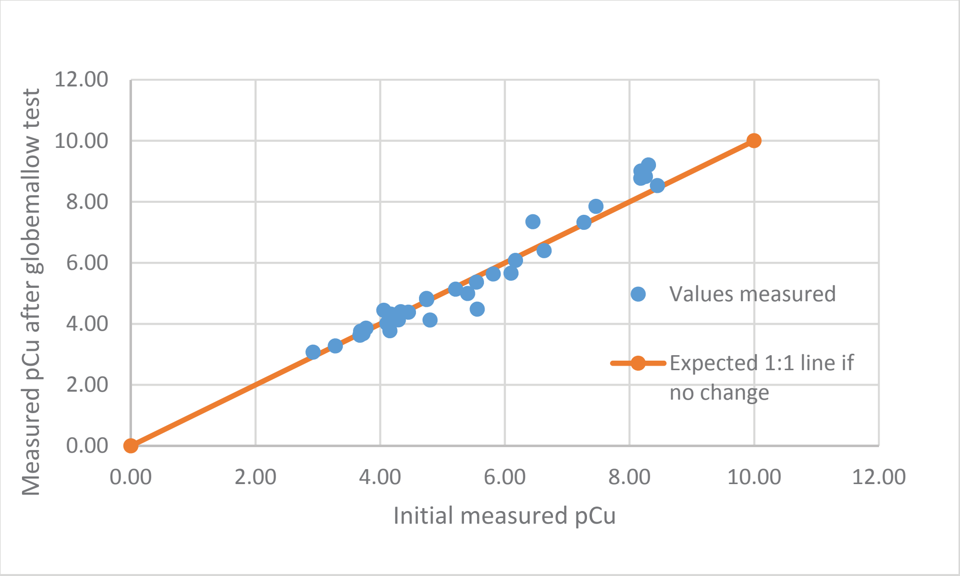
The laboratory also stated the following in their report:

Integrity of the Data

The data and observations that were made are accurately reported. However, the following circumstances may have affected the quality of the data:

> (1) The probes used to measure soil pH in test pots were not validated. However, they were used according to directions.
> (2) It is not known whether the use of reclaimed soils for tansyaster affected results.
> (3) It is not known whether copper in the irrigation lines had an adverse effect on the test.
> (4) It is not known if the species that were used in the test (with the exception of alfalfa) are suitable to be raised in a greenhouse under the conditions of the study.

1. With regard to number 1, the Kelway probe placed in the soil was found to be highly variable when compared to Ross probe paste pH results on the same soil and is not reliable (evaluated by Energy Laboratories for Chino).
2. With regard to number 2, re-using soils did not change the pCu or pH substantially as shown by the graphs below (Figure C-1) showing pCu before the soil was used for the globemallow test and just before the same soil was used for the tansyaster test were similar.



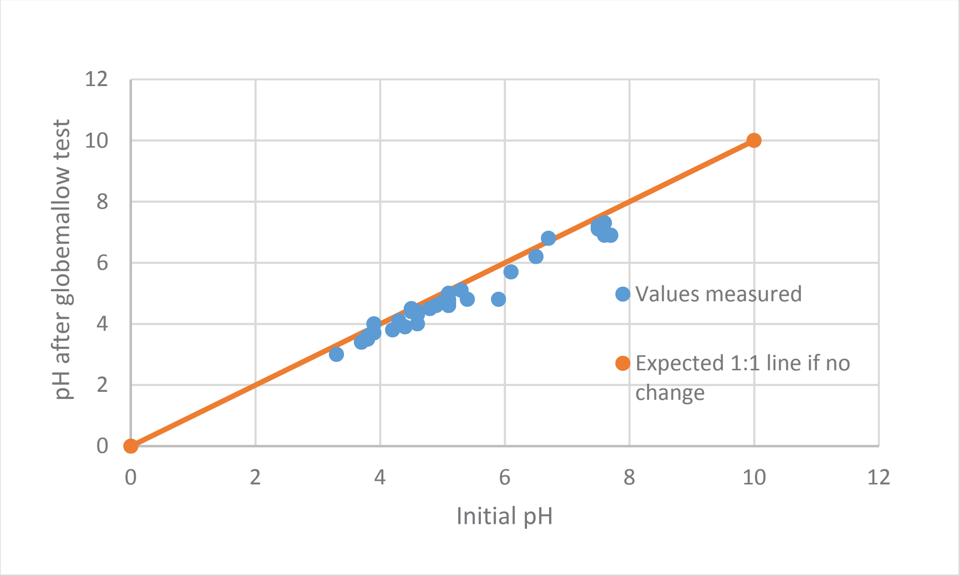


Figure C-1. Measured pCu before any experiments were conducted on the soil in 2013 compared to measured pCu after globemallow test completed on the same soils.

3. With regard to number 3, copper concentration in the Wildlife International water after first flush (tested at Energy laboratories) was low (0.001 mg/L) in the 55-gallon barrel filled with water from their faucet (well water then adjusted to pH of 6), and not of concern (see attached well water chemistry).
4. With regard to number 4, the tansyaster results often had wide confidence intervals around effect levels, much higher than for alfalfa and sideoats grama. Alfalfa had the most precise results, followed by sideoats grama. The tansyaster results are not very reliable.

APPENDIX D

Greenhouse Plant Endpoint Data

Table D-1. Summary of Alfalfa Greenhouse Results

Freeport-McMoran Chino Mines Company
Vanadium, New Mexico
Smelter/Tailing Soils IU Phytotoxicity and Vegetation Community Study

Soil	Average Emergence (%)	Average Survival (%)	Average Root Length (cm)	Average Shoot Weight (g dw)	Average Shoot Height (cm)	Initial pH[a] (s.u.)	Average Final pH[a] (s.u.)
Negative Control	80	96.5	23.1	0.0509	8.71	5.9	5.4
Soil 1[b]	52.5	87.1	1.3	0.00329	0.587	4.5	5
Soil 2	68.3	100	6.5	0.0135	4.19	5.8	5.37
Soil 3	25	88.8	2.03	0.00707	2.1	5.2	4.29
Soil 4	40	95.7	5.7	0.0111	3.58	4.5	3.72
Soil 5	76.7	97	10.7	0.0136	4.2	5.4	5.1
Soil 6	78.3	94.3	3.4	0.00582	1.72	4.8	4.26
Soil 7	45	72.1	1.13	0.00243	0.602	5	3.57
Soil 8	81.7	100	2.4	0.00822	2.1	4.6	3.75
Soil 9	5.83	0	-	-	-	5.7	5.37
Soil 10	57.5	96.1	1.5	0.00311	0.918	5.2	5.35
Soil 11	43.3	78.2	1.7	0.0062	1.01	5.6	5.77
Soil 12	62.5	98.8	16.8	0.0115	3.81	6.2	4.73
Soil 13	73.3	91.5	3.6	0.0109	2.59	5.8	5
Soil 14	30	68.5	1.1	0.00428	0.494	5	3.51
Soil 15	50.8	70.9	1.7	0.00764	1.51	5.3	4.05
Soil 16	74.2	94.7	2.3	0.00573	1.37	6.2	3.54
Soil 17	82.5	96.4	10	0.0137	4.14	5.8	5.88
Soil 19	18.3	47.4	0.375	0.00406	0.625	4.1	6.21
Soil 20	67.5	98.8	7.7	0.01	3.38	6.5	5.92
Soil 21	37.5	75.5	0.861	0.00529	1.03	5.5	5.31
Soil 22	64.2	93.7	0.925	0.00529	1.13	6.3	5.17
Soil 23	61.7	83.2	1.63	0.00443	0.968	6.2	6.43
Soil 24	61.7	100	18.7	0.0243	5.83	4.8	3.91
Soil 25	83.3	100	15.4	0.0153	4.32	6	6.01
Soil 26	83.3	100	18.6	0.014	4	6.3	5.66
Soil 27	80	95	2.1	0.00663	1.58	6	4.91
Soil 28	58.3	97.7	21.9	0.016	4.58	7	6.03
Soil 29	57.5	93.7	2.1	0.00533	0.7	5	5.72
Soil 30	20	81.1	1.78	0.00636	0.828	4.6	4.36
Soil 31	73.3	95	4.2	0.0138	4.52	6.4	4.26
Soil 32	62.5	78.2	1.45	0.00642	0.623	6	5.66
Soil 35	5	0	-	-	-	4.8	4.61
Soil 36	7.5	40	0.75	0.00567	0.25	5.5	4.17

Notes:

a. Results showed that pH tended to decrease over the course of the study using the Kelway Probe. However, tests using the ROSS Electrode showed this was simply due to measurement bias in the Kelway Probe.
b. Soil 1 is abbreviated name of soil labeled STS-PT-2013-1, and the same applies for all soils in this column where Soil X = STS-PT-2013-X.

Results averaged across 10 replicates.

Table D-2. Summary of Field Sideoats Grama Greenhouse Results

Freeport-McMoran Chino Mines Company
Vanadium, New Mexico
Smelter/Tailing Soils IU Phytotoxicity and Vegetation Community Study

Soil	Average Emergence (%)	Average Survival (%)	Average Root Length (cm)	Average Shoot Weight (g dw)	Average Shoot Height (cm)	Initial pH[a] (s.u.)	Average Final pH[a] (s.u.)
Negative Control	64.2	81.8	18.4	0.00864	8.46	5.9	5.44
Soil 1	0	-	-	-	-	6	4.31
Soil 2	85.8	99.2	11.8	0.00287	4.28	6.2	4.37
Soil 3	27.5	80.6	10.3	0.0028	4.16	5.6	3.65
Soil 4	48.3	86.3	14.3	0.00377	5.39	5.2	3.84
Soil 5	45.8	94.1	9.6	0.00256	4.43	5.8	4
Soil 6	34.2	63.3	0.969	0.000793	0.904	6.6	4.2
Soil 7	0	-	-	-	-	5.9	4.02
Soil 8	28.3	30.5	0.542	0.000442	1.17	6	3.29
Soil 9	0	-	-	-	-	6.4	3.74
Soil 10	14.2	25	1	0.00138	0.75	6	3.43
Soil 11	9.17	4.76	0.25	0.0004	0.25	4.4	5.27
Soil 12	91.7	95.6	18	0.00274	4.67	5.8	4.33
Soil 13	37.5	59.2	1.67	0.00185	3.18	5.4	3.64
Soil 14	0	-	-	-	-	5.4	3.08
Soil 15	45	65.2	1.22	0.00137	1.33	5.8	3.38
Soil 16	28.3	63.5	0.75	0.000673	1	5.6	3.28
Soil 17	75.8	96.8	14.5	0.00244	4.28	5.3	3.91
Soil 19	3.33	0	-	-	-	5.6	3.97
Soil 20	80	97.8	12.2	0.00315	6.34	5.9	5.57
Soil 21	13.3	3.13	0.25	0.0012	0.25	6.1	3.71
Soil 22	12.5	20	0.25	0.00355	1.5	5.9	3.79
Soil 23	11.7	40.7	0.9	0.00089	1.4	6.4	4.91
Soil 24	52.5	91.1	16.8	0.00556	8.12	6	4.74
Soil 25	75.8	97	17.6	0.00486	7.57	5.2	5.28
Soil 26	65.8	90.9	18.5	0.00309	4.63	6	5.43
Soil 27	75	65.7	1.08	0.00211	3.01	6.2	3.9
Soil 28	73.3	98	20.3	0.00479	7.03	6.7	4.77
Soil 29	35	30.8	0.719	0.000973	1.24	5.4	4.78
Soil 30	8.33	28.6	0.25	0.0004	0.25	4	3.93
Soil 31	67.5	95.1	5	0.00422	4.53	6.4	3.54
Soil 32	30.8	43.7	0.357	0.00109	0.982	6.6	3.63
Soil 35	0	-	-	-	-	4.8	3.65
Soil 36	0	-	-	-	-	5	3.41

Notes:

a. Results showed that pH tended to decrease over the course of the study using the Kelway Probe. However, tests using the ROSS Electrode showed this was simply due to measurement bias in the Kelway Probe.

Results averaged across 10 replicates.

Table D-3. Summary of Nursery Sideoats Grama Greenhouse Results

Freeport-McMoran Chino Mines Company
Vanadium, New Mexico
Smelter/Tailing Soils IU Phytotoxicity and Vegetation Community Study

Soil	Average Emergence (%)	Average Survival (%)	Average Root Length (cm)	Average Dry Weight (g)	Average Height (cm)	Initial pH[a] (s.u.)	Average Final pH[a] (s.u.)
Negative Control	55	88.4	17.5	0.0138	10.1	5.9	3.59
Soil 1	11.7	25	2.5	0.0003	0.625	5.6	4.36
Soil 2	36.7	100	12.2	0.00661	6.77	6.1	4.59
Soil 3	56.7	90.8	11.5	0.00446	4.98	5.4	3.58
Soil 4	46.7	79	12.6	0.00746	6.53	4.9	3.62
Soil 5	78.3	96.9	12.3	0.00548	5.74	5.8	3.49
Soil 6	27.5	28.5	1.57	0.00109	1.66	6	5.08
Soil 7	0	-	-	-	-	5.5	4.59
Soil 8	54.2	1.43	1	0.0006	1	6.3	3.34
Soil 9	0	-	-	-	-	6	4.62
Soil 10	20	24.1	1.6	0.00166	1.1	5.8	5.03
Soil 11	12.5	21.4	1.5	0.0009	1.5	5.7	5.47
Soil 12	84.2	95.4	21	0.00518	5.87	6	4.55
Soil 13	75.8	77.8	4.2	0.00399	3.62	5.5	3.5
Soil 14	3.33	0	-	-	-	5.4	3.08
Soil 15	45.8	12.3	0.875	0.00242	2.33	5.7	3.7
Soil 16	45	52.1	0.813	0.000824	1.08	5.8	3.2
Soil 17	77.5	100	16.2	0.0038	5.19	5.3	4.49
Soil 19	4.17	25	1	0.0005	0.25	6.3	5.09
Soil 20	84.2	92.4	14	0.00481	6.06	6.2	5.22
Soil 21	20	28.4	1.33	0.0012	1.1	6	4.77
Soil 22	11.7	14.3	0.25	0.0004	1.13	6.1	5.27
Soil 23	22.5	22.8	1.6	0.00069	0.825	6.4	6.24
Soil 24	70.8	97.9	22.9	0.0084	7.98	6	4.79
Soil 25	82.5	97.1	20.2	0.00755	15.9	5.3	5.52
Soil 26	82.5	93.2	17.7	0.00518	5.6	6	4.51
Soil 27	70	76.2	1.3	0.00193	2.63	6.2	4.81
Soil 28	81.7	99.1	21.5	0.00584	6.33	6.8	4.28
Soil 29	54.2	54.9	1.25	0.00107	1.42	5.4	5.65
Soil 30	1.67	0	-	-	-	4.2	5.99
Soil 31	59.2	85.6	8.9	0.00387	4.3	6.3	4.27
Soil 32	40	59.5	1.14	0.000754	0.931	6.6	4.02
Soil 35	0	-	-	-	-	4.9	3.88
Soil 36	0.833	0	-	-	-	5.1	5.32

Notes:

a. Results showed that pH tended to decrease over the course of the study using the Kelway Probe. However, tests using the ROSS Electrode showed this was simply due to measurement bias in the Kelway Probe.

Results averaged across 10 replicates.

Table D-4. Summary of Field Tansyaster Results

Freeport-McMoran Chino Mines Company
Vanadium, New Mexico
Smelter/Tailing Soils IU Phytotoxicity and Vegetation Community Study

Soil	Average Emergence (%)	Average Survival (%)	Average Root Length (cm)	Average Dry Weight (g)	Average Height (cm)	Initial pH[a] (s.u.)	Average Final pH[a], Soil Probe (s.u.)	Average Final pH[a], Lab Meter (s.u.)
Negative Control	27.5	30	26.2	0.221	9.33	5.8	4.62	5.67
Soil 1	0	-	-	-	-	4.5	4.6	4.58
Soil 2	1.67	50	9	0.009	1	4.8	5.39	7.49
Soil 3	4.17	62.5	1	0.002	0.25	5	6.62	5.17
Soil 4	6.67	92.9	3.57	0.007	1.57	5.4	5.07	5.71
Soil 5	4.17	100	5	0.00333	1.21	5	5.01	6.15
Soil 6	0	-	-	-	-	4.1	4.69	4.2
Soil 7	0	-	-	-	-	4	3.63	3.47
Soil 8	0.833	0	-	-	-	5.4	4.32	4.82
Soil 9	0	-	-	-	-	5.5	4.23	4.32
Soil 10	0	-	-	-	-	4.5	5.16	5.31
Soil 11	0	-	-	-	-	5.2	5.36	4
Soil 12	1.67	100	3	0.003	1.5	5.2	6.14	7.02
Soil 13	2.5	100	2.33	0.003	1.33	5.4	5.39	5.58
Soil 14	0.833	0	-	-	-	5.3	5.35	3.92
Soil 15	0.833	0	-	-	-	5.6	6.22	4.73
Soil 16	1.67	0	-	-	-	4.8	5.08	4.79
Soil 17	5.83	100	3.33	0.00875	1.77	4.8	5.37	7.26
Soil 19	0	-	-	-	-	6	5.43	4.74
Soil 20	6.67	71.4	7.4	0.0038	1.45	5.2	5.23	7.46
Soil 21	0	-	-	-	-	5.6	5.52	4.39
Soil 22	0	-	-	-	-	4.8	5.07	4.63
Soil 23	0	-	-	-	-	5.8	4.54	4.47
Soil 24	9.17	73.6	5.6	0.0445	5.2	5.9	4.94	7.42
Soil 25	6.67	85.7	14.8	0.0598	4.58	5.5	5.22	7.62
Soil 26	1.67	100	1.5	0.006	1.63	5	5.34	7.69
Soil 27	1.67	0	-	-	-	5	5.29	4.98
Soil 28	3.33	100	6.5	0.0103	2.5	5.4	4.82	7.79
Soil 29	0	-	-	-	-	5.8	5.31	5.08
Soil 30	0	-	-	-	-	5.4	4.94	3.88
Soil 31	1.67	100	2	0.0015	0.25	5.3	5.14	5.48
Soil 32	0	-	-	-	-	4.5	5.23	5.16
Soil 35	0	-	-	-	-	4.9	4.05	4.72
Soil 36	0	-	-	-	-	5.2	4.64	5.76

Notes:

a. Results showed that pH tended to decrease over the course of the study using the Kelway Probe. However, tests using the ROSS Electrode showed this was simply due to measurement bias in the Kelway Probe.

Results averaged across 10 replicates.

Table D-5. Summary of Nursery Tansyaster Results

Freeport-McMoran Chino Mines Company
Vanadium, New Mexico
Smelter/Tailing Soils IU Phytotoxicity and Vegetation Community Study

Soil	Average Emergence (%)	Average Survival (%)	Average Root Length (cm)	Average Dry Weight (g)	Average Height (cm)	Initial pH[a] (s.u.)	Average Final pH[a], Soil Probe (s.u.)	Average Final pH[a], Lab Meter (s.u.)
Negative Control	45	38.4	21	0.333	14.5	5.8	5.17	6.58
Soil 1	0	-	-	-	-	4.6	4.06	4.35
Soil 2	4.17	100	3.5	0.0124	3.75	4.6	6.44	7.66
Soil 3	8.33	85.7	2.33	0.00261	1	5.2	6.6	5.16
Soil 4	25	97.5	13.2	0.056	6.5	5.8	5.96	5.24
Soil 5	24.2	94.7	2.1	0.00588	2.78	5.1	5.89	6.29
Soil 6	0.833	100	2	0.003	1	4.3	6.66	3.61
Soil 7	0	-	-	-	-	4	4.73	2.97
Soil 8	15.8	91.7	0.8	0.00175	0.413	5.5	6.14	4.84
Soil 9	0	-	-	-	-	6	3.66	3.98
Soil 10	2.5	0	-	-	-	4.4	5.99	5.36
Soil 11	0	-	-	-	-	5.4	5.07	3.78
Soil 12	15	86.7	3.56	0.00259	1.7	4.2	6.5	6.88
Soil 13	9.17	80	10.3	0.0309	5.13	5.6	6.51	5.98
Soil 14	0	-	-	-	-	5	4.24	3.59
Soil 15	10.8	60.4	1.42	0.004	0.792	5.2	7.01	4.45
Soil 16	0	-	-	-	-	4.4	4.99	4.8
Soil 17	25	97.5	3	0.00543	2.01	4.6	6.66	7.23
Soil 19	0	-	-	-	-	5.8	5.84	4.68
Soil 20	22.5	100	4.67	0.00851	2.76	5.4	6.14	7.36
Soil 21	5	0	-	-	-	5.1	5.39	3.87
Soil 22	0	-	-	-	-	5	6.44	4.38
Soil 23	0	-	-	-	-	5.4	5.71	4.3
Soil 24	18.3	100	6.1	0.0417	5.69	5.7	6.3	7.31
Soil 25	9.17	100	5.56	0.0368	4.94	5.2	6.44	7.42
Soil 26	16.7	88.9	4.25	0.00656	1.71	5	6.65	7.68
Soil 27	11.7	37.5	1.33	0.00356	0.542	5	6.09	4.37
Soil 28	10	100	2.44	0.00954	2.44	5.3	6.21	7.41
Soil 29	0	-	-	-	-	5.8	6.2	5.06
Soil 30	0	-	-	-	-	5.4	6.17	3.88
Soil 31	11.7	96.4	1.57	0.00255	0.643	5.2	6.37	5.63
Soil 32	0	-	-	-	-	4.2	6	5.03
Soil 35	0	-	-	-	-	4.7	5.73	4.62
Soil 36	0	-	-	-	-	5.2	6.26	5.6

Notes:

a. Results showed that pH tended to decrease over the course of the study using the Kelway Probe. However, tests using the ROSS Electrode of soils by Energy laboratories after the greenhouse experiments showed this was simply due to measurement bias in the Kelway Probe.

Results averaged across 10 replicates.

APPENDIX E

Cupric Ion Activity Methods

Appendix E: Method Used to Measure pCu in STSIU Soils

1 INTRODUCTION

The objective of the pCu analyses was to measure the chemical activity of the cupric ion (Cu^{2+}) in soils collected from the Chino Mines Smelter Tailings and Soils Investigation Unit (STSIU) and from reference sites in July 2013 as part of a vegetation-community study and in October 2013 as part of a greenhouse phytotoxicity study. The measured Cu^{2+} activities in the soils were converted to pCu values (an index of the Cu^{2+} activity, as explained below) and subsequently used in analyses of concentration-response relationships between vegetation-community endpoints (e.g., richness, cover) and pCu (vegetation-community study in the main text of this report) and between phytotoxicity endpoints (e.g., germination of seeds, and survival and growth of seedlings) and pCu (phytotoxicity study in the main text of this report).

2 METHODS

2.1 Measurement of Cu^{2+} Activity and Conversion to pCu

Details of the method used to measure Cu^{2+} activity with a cupric-ion selective electrode (Cu-ISE) are presented in the Arcadis *Standard Operating Procedures for Measurement of Cu^{2+} Activity in Soil by Ion-Selective Electrode* (Attachment A of STSIU Phytotoxicity and Vegetation Community Work Plan [Work Plan], Arcadis 2014) and are summarized below. The only deviations from that standard operating procedure were (1) to improve stability of the electrode output, all Cu-ISE analyses were performed under reduced-light conditions instead of ambient lighting, and (2) 8 (instead of 5) Cu^{2+}-activity standards were used to develop calibration curves for the Cu-ISE.

For each soil sample collected at STSIU and reference sites in July 2013 for the vegetation-community study, a 1-quart sample was shipped in a plastic bag to ACZ Laboratories, Inc. in Steamboat Springs, Colorado, where subsamples were removed for standard soil-chemistry analyses. Then the remaining soil in each bag was shipped to Energy Laboratories, Inc. in Helena, Montana. For each soil sample collected at STSIU and reference sites in October 2013 for the phytotoxicity study, a 1-gallon subsample was shipped in a plastic bag to Energy Laboratories, Inc. in Helena, Montana. Some of the soils that were used in the phytotoxicity study were collected from vegetation-community-study sites. Those soils were analyzed with the other phytotoxicity-study soils and were not separately analyzed in the batch of vegetation-community-study soils.

In the laboratory, an extract of each soil was prepared by adding 0.01 M $CaCl_2$ to the soil (15 g soil:30 ml $CaCl_2$ solution), shaking the mixture for 20 minutes, centrifuging it for 10 minutes, and filtering the supernatant through a 0.22-μm cellulose-acetate membrane filter (Whatman OE66, GE Life Sciences #10404112). That filtered soil extract was analyzed for pH, Cu^{2+} activity (expressed as pCu units), and dissolved copper concentration. The pH was analyzed by ion-selective electrode (Fisher Scientific™ Accumet™ Liquid-Filled Mercury-Free pH/ATC Epoxy Body Combination Electrode, Model 13-620-631 connected to a Fisher Scientific™ Accumet™ AR25 Dual Channel pH/Ion Meter). The Cu^{2+} activity was analyzed by ion-selective electrode (Orion Products [Thermo Scientific] Combination Cupric Ion Selective Sure-Flow® Electrode, Model 9629BNWP connected to a Fisher Scientific™ Accumet™ AR25 Dual Channel pH/Ion Meter). The dissolved copper concentration was analyzed by inductively coupled plasma emission-mass spectrometry (ICP-MS) (Agilent 7500CE ICP-MS, Model G3272A; using EPA Method 6020, ICP-MS, SW-846, Revision 0, September 1994).

The Cu-ISE does not directly output Cu^{2+} activity; instead, it outputs an electrical potential in units of mV (read on the pH meter) that must be converted to Cu^{2+} activity (or pCu in this case) via a calibration curve. A pCu value is the negative base-10 logarithm of the Cu^{2+} activity [i.e., pCu = $-\log_{10}$(Cu^{2+} activity)].

For these Cu^{2+} (and thus pCu) measurements, the calibration procedure developed by Sauvé et al. (1995) was used to convert electrical output of the Cu-ISE into pCu values. On the days on which soil extracts were analyzed for Cu^{2+} activity (phytotoxicity-study soils analyzed on December 11, 2013 [analyzed in two batches on that day], vegetation-community-study soils analyzed on December 16, 2013 [analyzed in one batch on that day] and phytotoxicity-study soils re-analyzed on February 5, 2015 [analyzed in one batch on that day]), eight calibration standards were prepared by adjusting the pH of separate 100-ml volumes of the Sauvé et al. (1995) iminodiacetic acid-based stock calibration solution to approximately pH 2, 3, 4, 5, 6, 8, 9, and 10 using trace-metal-grade nitric acid (HNO_3). The pH of each calibration standard was measured, and the corresponding pCu of that standard was read (or interpolated) from the list of paired pH and pCu values in Table 1 in Attachment A of the Work Plan (which is taken from Sauvé 1999).

A separate pCu calibration curve was generated for each of the two batches of soil extracts that were analyzed on December 11, 2013, for the batch of soil extracts that were analyzed on December 16, 2013, and for the batch of soil extracts that were analyzed on February 5, 2015. Least-squares regressions of pCu vs. mV were generated in Microsoft Excel for converting measured electrical potentials in the STSIU and reference-soil extracts (i.e., mV output from the Cu-ISE, as read on the pH meter) into pCu values. Three sets of regression equations were developed for each calibration data set: (1) a linear-regression fit to all 8 calibration data points, (2) a linear-regression fit to the 5 calibration data points between pCu 4 and 9, and (3) a quadratic-regression fit to all 8 calibration data points. The latter two regressions were developed because of noticeable nonlinear deviations of the calibration data at pCu values greater than 9, especially in the calibration curves developed on December 11 and 16, 2013.

2.2 pCu Calibration Curves

The pCu calibration curves generated for the STSIU and reference soils analyzed in December 2013 and February 2015 are shown in Figures E-1 to E-4; the calibration data from which those curves were generated are listed in Table E-1. The linear- and quadratic-regression equations for those calibration curves are shown in the figures.

2.3 pCu in STSIU and Reference Soils

The pCu values measured in the $CaCl_2$ extracts of the STSIU and reference soils in December 2013 and February 2015 are presented in Tables E-2 and E-3, along with the corresponding measured mV outputs from the Cu-ISE and the pH values and dissolved Cu concentrations measured in the $CaCl_2$ extracts of the soils. In Tables E-2 and E-3, pCu values are listed for each of the three candidate calibration curves that were developed for each batch of soils analyzed in December 2013 and February 2015.

2.4 Selection of Best pCu Calibration Curves

The three types of pCu vs. mV regressions used in this analysis differed in how they fit the calibration data. The first regression (panel a in Figures E-1 to E-4) was a linear fit to all 8 calibration data points; the second regression (panel b in Figures E-1 to E-4) was a linear fit to only the 5 calibration data points between pCu 4 and 9 (i.e., only 5 data points); and the third regression (panel c in Figures E-1 to E-4) was a quadratic (i.e., nonlinear) fit to all 8 calibration data points. Each type of regression provided a strong fit to the calibration data, based on the percentage of variance in pCu of the calibration standards that was accounted for (R^2 greater than 0.98 in all the regressions in 2013 and 2015; Figures E-1 to E-4). However, for the following reasons, the linear fit to only the 5 calibration data points between pCu 4 and 9 was selected as the best pCu calibration curve.

In theory, an ion-selective electrode such as a pH or a Cu-ISE electrode should have a linear relationship between mV output from the electrode and known pH or pCu values (page 14 in Thermo Fisher 2008). For a monovalent ion like H^+ that is detected by a pH electrode, the theoretical Nernstian slope at 25 °C is -59.2 mV per decade of H^+ activity (i.e., -59.2 mV/pH unit; see for example, page 773 in Brown et al. 2000). For a divalent ion like Cu^{2+} that is detected by a Cu-ISE electrode, the theoretical Nernstian slope at 25 °C is -29.6 mV per decade of Cu^{2+} activity (i.e., -29.6 mV/pCu unit; ½ the theoretical slope for monovalent ions). Demonstrating that this theoretical relationship can be manifested in practice, Sauvé et al. (1995) reported a linear relationship between Cu-ISE potential (as mV) vs. pCu for pCu values ranging from approximately 3 to 13, for which the slope was -33.4 mV/pCu unit, which is close to the theoretical value of -29.6 mv/pCu unit (i.e., -33.4 mV/pCu is the inverse of the slope of -0.02997 pCu units/mV shown in the regression equation in their Figure 1; see Figure E-5 below).

In contrast, the Cu-ISE calibration data that Energy Laboratories generated were nonlinear, especially in the three calibrations on December 11 and 16, 2013 (Figures E-1 to E-3) but also detectable in the calibration on February 5, 2015 (Figure E-4). Although Energy Laboratories used the same recipe for their Cu^{2+} calibration solution as Sauvé et al. (1995) used [i.e., containing $Cu(NO_3)_2$, iminodiacetic acid, $KHC_8H_4O_4$, $CaCl_2$, and NaOH, with pH adjusted using HNO_3; see Electrode Calibration section on page 374 in Sauvé et al. 1995], the calibration data generated by Energy Laboratories were only linear with approximately the theoretical Nernstian slope of -29.6 mV/pCu unit between pCu values of approximately 4 (the lowest pCu used for the calibrations) and 9. At pCu values greater than 9, the plots of pCu vs. electrode potential (as mV) curved upward from a straight line (i.e., the instantaneous slopes became less negative than the theoretical -29.6 mV/pCu unit as pCu increased above 9). The cause of those nonlinear deviations from theoretical and from the experimental results in Sauvé et al. (1995) is not known but might have been related to (1) inherent nonlinear electrode behavior at high pCu values (i.e., at low Cu^{2+} activities), (2) variable background electromagnetic noise, (3) contaminants in the chemicals, the Cu-ISE, or the glassware used for the pCu analyses, or (4) unidentified differences between the pCu calibration standard used by Energy Laboratories and the pCu calibration standard used by Sauvé et al. (1995) that might be important at high pCu values (i.e., at very low Cu^{2+} activities).

The nonlinearity of the pCu calibration curves at high pCu is consistent with a nonlinear calibration curve obtained by Fitch et al. (1986) (Figure E-6), which those authors attributed to possible impurities in the chemicals, glassware, or Cu-ISE. Additionally, Cu-ISE operations manuals mention a nonlinear region of the pCu calibration curve at high pCu (i.e., at low Cu^{2+} concentrations) in which low-level procedures and extra calibration points are required (page 9 in Eutech Instruments, undated; page 12 and Figure 2 in Thermo Fisher 2008).

Additionally, Dr. John Drexler (University of Colorado) obtained a similarly nonlinear pCu calibration curve when he analyzed soil extracts from the STSIU in 2000, as shown in Figure 2 in Tegtmeyer (2001) and Figure 2 in Appendix B in Newfields (2005) (reproduced here in Figure E-7). At pCu values greater than approximately 9.5 in his calibration data, the plot of pCu vs. electrode potential (as mV) curved upward from a straight line. Between pCu 4.5 and 9.5, the Nernstian slope was approximately -30 mV/pCu unit (i.e., only 1% greater than the theoretical Nernstian slope of -29.6 mV/pCu unit). Tegtmeyer (2001) did not explain exactly how the nonlinearity of the pCu calibration data was handled in Drexler's calculations, as indicated in the following quote from page 2 of her memorandum:

> "The electrode response, in mV, was recorded for the range of pH conditions to establish the response to cupric ion activity. Sauve (1999) computed the theoretical cupric ion activity of the buffered solution at various pH conditions (Table 6.2 of Sauve, 1999); these activity data were used in conjunction with the measured mV reading of the electrode to define the linear mV/activity relationship of the ion-selective electrode. These results are presented on Table 1 and Figures 1 to 3."

Therefore, it is unknown whether Drexler (1) used a calibration curve having an approximately theoretical Nernstian slope determined from the pCu calibration data between pCu 4.5 and 9.5 (and thus extrapolated that linear relationship to pCu greater than 9.5) or (2) fit a regression line to all the pCu calibration data (and thus had less than the theoretical Nernstian slope, with biased over-predictions of pCu in the intermediate pCu range and biased under-predictions of pCu in the low pCu range).

Despite the nonlinearity of the pCu calibration data, Energy Laboratories chose to fit a linear calibration curve through all the current study's data ranging from pCu 4 to 14. That caused the Nernstian slopes to decrease considerably to a range of -23.4 to -26.8 mV/pCu unit (i.e., 9 to 21% lower than the theoretical Nernstian slope of -29.6 mV/pCu unit) (Figures E-1a, E-2a, E-3a, and E-4a). Energy Laboratories' linear fits to the nonlinear pCu calibration data also caused predicted pCu values in the mid-range of the calibration curves (i.e., from approximately pCu 6 to 9) to be biased slightly higher than the pCu calibration values, and they caused predicted pCu values in the low range of the calibration curves (i.e., below approximately pCu 5) to be biased slightly lower than the pCu calibration values. Extrapolated to pCu values less than 4, that biased underestimation of pCu at a given electrode potential would become increasingly larger as pCu decreases (i.e., high Cu^{2+} activity would become increasingly overestimated as Cu^{2+} activity increases).

Because the reason for the nonlinear pCu calibration data generated by Energy Laboratories is unknown, Arcadis chose to fit a regression line to the calibration data that only lie between pCu 4 and 9 (thus having Nernstian responses near the theoretical slope of -29.6 mV/pCu unit). Arcadis chose to not fit a regression line to all the calibration data, in order to avoid overestimates of pCu in the mid-range of pCu values (i.e., between pCu values of approximately 4 to 9) and underestimates of pCu in the high range of pCu values (i.e., pCu greater than approximately 4). As a consequence, the Arcadis regressions do not fit the pCu calibration data from Energy Laboratories at pCu values between 11 and 14 (Figures E-1b, E-2b, E-3b, and E-4b). However, Arcadis decided that was an acceptable compromise, because pCu values greater than 9 are quite low (i.e., Cu^{2+} activities less than 10^{-9} moles/L) and not of interest in the reference soils and the elevated-Cu soils in the STSIU. The Nernstian slopes of Arcadis's three pCu calibration curves between pCu 4 and 9 range from -27.0 to -30.6 mV/pCu unit (i.e., less than or equal to 9% different than the theoretical Nernstian slope of -29.6 mV/pCu unit, and much closer to the theoretical slope than the linear calibration curves that Energy Laboratories fit to all the pCu calibration data). The greenhouse-study soils had pCu values less than 9, making the use a linear fit accurate below pCu 9 the best choice.

Quadratic (i.e., second-order polynomial) curves fit all the pCu calibration data from Energy Laboratories better than linear calibration curves (Figures E-1c, E-2c, E-3c, and E-4c). However, adoption of a curvilinear calibration curve assumes that the nonlinearity of the calibration data is not an artifact of an unknown difference(s) between the calibration standards prepared by Sauvé et al. (1995) and by Energy Laboratories. Moreover, the curvature of the quadratic curves at pCu less than 4 (especially noticeable in Figures E-1c, E-2c, and E-3c) tends to overestimate pCu values in the low pCu range (i.e. the Cu^{2+} activity will be underestimated in the high Cu^{2+} activity range), if the relationship between pCu and electrode potential actually is linear in that range (which electrochemical theory suggest it should be). The STSIU soils tested include samples with pCu less than 4 and such biases were potentially avoided by not using the quadratic calibration curve.

Therefore, Arcadis assumed theoretical Nernstian behavior throughout the range of pCu values of interest at the STSIU (i.e., pCu values less than 9) by using the linear fit between pCu of 4 and 9. Adoption of linear Cu-ISE potential vs. pCu calibration curves (Fitch et al. 1986, Sauvé et al. 1995, Sauvé 1999, Thermo Fischer 2008, Eutech Instruments undated) with limitation of the range of applicability of the calibration curves to avoid high pCu values (Pampura et al. 2006, Thermo Fischer 2008, Eutech

Instruments undated) is consistent with standard Cu-ISE practice and recommendations in the published literature. Extrapolation of the linear calibration curves to pCu values lower than 4 (i.e., to high Cu^{2+} concentrations) in the STSIU soil extracts is also consistent with the same standard Cu-ISE practice and recommendations in the published literature.

2.5 Final pCu Values in STSIU and Reference Soils

The pCu values measured in the $CaCl_2$ extracts of the STSIU and reference soils in December 2013 and February 2015 are presented in Tables E-2 and E-3, along with the corresponding measured mV outputs from the Cu-ISE and the pH values and dissolved Cu concentrations measured in the $CaCl_2$ extracts of the soils. In Tables E-2 and E-3, pCu values are listed for each of the three candidate calibration curves that were developed for each batch of soils analyzed in December 2013 and February 2015. The columns titled “Calculated pCu; linear curve, pCu 4-9 calibration data” contain the pCu values that were used in the final analyses of the vegetation-community-study and phytotoxicity-study results.

3 REFERENCES

ARCADIS. 2014. Smelter Tailings Soil Investigation Unit: Phytotoxicity and Vegetation Community Work Plan. Prepared for Freeport-McMoran. March 4, 2014.

Brown, T.L., H.E. LeMay, Jr., and B.E. Bursten. 2000. Chemistry: The Central Science. Eighth Edition. Prentice Hall, Upper Saddle River, NJ.

Eutech Instruments. Undated. Instruction Manual: Cupric (Copper) Ion Electrode. Eutech Instruments PTE Ltd. http://www.eutechinst.com/manuals/english/ion_selective_electrode/copper.pdf .

Fitch, A., F.J. Stevenson, and Y. Chen. 1986. Complexation of Cu(II) with a soil humic acid: Response characteristics of the Cu(II) ion-selective electrode and ligand concentration effects. *Organic Geochemistry* 9:109-116.

Newfields. 2005. Chino Mines Administrative Order on Consent Site-Wide Ecological Risk Assessment. Prepared for New Mexico Environment Department by Newfields, Boulder, Colorado.

Pampura, T., J.E. Groenenberg, and R.P.J.J. Rietra. 2006. Comparison of methods for copper free ion activity determination in soil solutions of contaminated and background soils. *Forest Snow and Landscape Research* 80:305-322.

Sauvé, S.F. 1999. Chemical Speciation, Solubility and Bioavailability of Lead, Copper and Cadmium in Contaminated Soils. Ph.D. Dissertation, Cornell University, Ithaca, NY.

Sauvé, S., M.B. McBride, and W.H. Hendershot. 1995. Ion-selective electrode measurements of copper(II) activity in contaminated soils. *Archives of Environmental Contamination and Toxicology* 29:373-379.

Tegtmeyer, K. 2001. Laboratory methods and results from cupric ion activity measurements. Memorandum to Mark Lewis dated January 20, 2001.

Thermo Fisher. 2008. User Guide: Cupric Ion Selective Electrode. Thermo Fisher Scientific Inc., Beverly, MA. https://www.instrumart.com/assets/ISEcupric_manual.pdf .

Table E-1. Calibration data used for pCu analyses in calcium chloride (CaCl2) extracts of soils from the Chino Mines Smelter Tailings and Soils Investigation Unit and references areas near Hurley, New Mexico. These data are plotted in Figures E-1 to E-3. The cupric-ion selective electrode was calibrated on December 11 and 16, 2013 and February 5, 2015.

Freeport-McMoran Chino Mines Company
Vanadium, New Mexico
Smelter/Tailing Soils IU Phytotoxicity and Vegetation Community Study

Calibration date	Calibration number	Dissolved copper (mM)	Nominal pH (s.u.)	Measured pH (s.u.)	Calibration pCu (s.u.)[1]	Cu-ISE potential (mV)
12/11/13	1	0.1	2	2.20	4.34	83.0
12/11/13	1	0.1	3	3.10	5.43	46.5
12/11/13	1	0.1	4	3.95	6.40	19.8
12/11/13	1	0.1	5	5.00	7.47	-16.3
12/11/13	1	0.1	6	5.85	8.35	-39.2
12/11/13	1	0.1	8	7.95	11.34	-107.2
12/11/13	1	0.1	9	8.70	12.56	-122.6
12/11/13	1	0.1	10	9.70	13.44	-132.8
12/11/13	2	0.1	2	2.20	4.34	89.7
12/11/13	2	0.1	3	3.10	5.43	57.4
12/11/13	2	0.1	4	3.95	6.40	29.1
12/11/13	2	0.1	5	5.00	7.47	-1.8
12/11/13	2	0.1	6	5.85	8.35	-27.0
12/11/13	2	0.1	8	7.95	11.34	-101.1
12/11/13	2	0.1	9	8.70	12.56	-124.5
12/11/13	2	0.1	10	9.70	13.44	-137.5
12/11/13	3	0.1	2	2.15	4.29	81.6
12/11/13	3	0.1	3	3.00	5.31	55.4
12/11/13	3	0.1	4	3.95	6.40	27.9
12/11/13	3	0.1	5	5.00	7.47	-4.4
12/11/13	3	0.1	6	6.05	8.57	-33.1
12/11/13	3	0.1	8	7.90	11.26	-95.7
12/11/13	3	0.1	9	8.90	12.82	-117.5
12/11/13	3	0.1	10	9.70	13.44	-128.4
02/05/15	4	0.1	2	2.05	4.22	27.7
02/05/15	4	0.1	3	3.00	5.31	0.5
02/05/15	4	0.1	4	4.00	6.45	-31.8
02/05/15	4	0.1	5	4.85	7.32	-57.8
02/05/15	4	0.1	6	5.95	8.46	-89.4
02/05/15	4	0.1	8	7.65	10.82	-156.9
02/05/15	4	0.1	9	8.95	12.88	-205.9
02/05/15	4	0.1	10	9.70	13.44	-211.9

Cu-ISE = cupric-ion selective electrode
mM = millimoles per liter
mV = millivolts
s.u. = standard units

Notes:

1. The pCu of the standard was read (or interpolated) from the list of paired pH and pCu values in Table 1 in Attachment A (which is taken from Sauvé 1999).

Table E-2. Results of pCu analyses in calcium chloride (CaCl2) extracts of soils from the Chino Mines Smelter Tailings and Soils Investigation Unit and references areas near Hurley, New Mexico, that were used in the greenhouse phytotoxicity study. Analyzed on December 11, 2013 and February 5, 2015; however, only pCu was analyzed in 2015.

Freeport-McMoran Chino Mines Company
Vanadium, New Mexico
Smelter/Tailing Soils IU Phytotoxicity and Vegetation Community Study

		2013									2015							
Soil	Sample ID	pH in $CaCl_2$ extract (s.u.)	Dissolved Cu in $CaCl_2$ extract (mg/L)	Cu-ISE potential (mV)	Estimate of measured pCu; linear curve, all calibration data	Eqn. [1,2]	Estimate of measured pCu; linear curve, pCu 4-9 calibration data [3]	Eqn. [1,2]	Estimate of measured pCu; quadratic curve, all calibration data	Eqn. [1,2]	Cu-ISE potential (mV)	Estimate of measured pCu; linear curve, all calibration data	Eqn. [1]	Estimate of measured pCu; linear curve, pCu 4-9 calibration data [3]	Eqn. [1]	Estimate of measured pCu; quadratic curve, all calibration data	Eqn. [1]
1	STS-PT-2013-1	4.0	14.0	100.6	3.11	1	3.73	3	4.11	5	44.5	3.56	7	3.67	8	3.78	9
2	STS-PT-2013-2	7.1	0.2	17.1	6.57	1	6.45	3	6.27	5	-57.8	7.38	7	7.34	8	7.28	9
3	STS-PT-2013-3	5.6	0.2	36.6	5.76	1	5.82	3	5.66	5	-10.0	5.60	7	5.63	8	5.60	9
4	STS-PT-2013-4	5.1	0.2	25.7	6.21	1	6.17	3	6.00	5	-22.4	6.06	7	6.07	8	6.03	9
5	STS-PT-2013-5	6.1	0.2	11.6	6.79	1	6.63	3	6.46	5	-31.4	6.40	7	6.40	8	6.35	9
6	STS-PT-2013-6	3.4	1.8	82.0	3.88	1	4.33	3	4.49	5	24.5	4.31	7	4.39	8	4.44	9
7	STS-PT-2013-7	3.2	5.5	88.9	3.59	1	4.11	3	4.34	5	35.2	3.91	7	4.01	8	4.09	9
8	STS-PT-2013-8	5.5	0.3	55.1	4.99	1	5.21	3	5.14	5	3.8	5.08	7	5.13	8	5.13	9
9	STS-PT-2013-9	4.0	57.0	125.1	2.09	1	2.93	3	3.71	5	61.4	2.93	7	3.07	8	3.24	9
10	STS-PT-2013-10	4.5	5.0	94.7	3.87	2	4.16	4	4.28	6	41.9	3.66	7	3.77	8	3.87	9
11	STS-PT-2013-11	3.7	4.2	92.5	3.95	2	4.23	4	4.35	6	29.8	4.11	7	4.20	8	4.26	9
12	STS-PT-2013-12	6.2	0.1	4.1	7.44	2	7.27	4	7.20	6	-57.2	7.36	7	7.32	8	7.26	9
13	STS-PT-2013-13	5.0	0.2	54.3	5.46	2	5.54	4	5.49	6	-2.5	5.32	7	5.36	8	5.35	9
14	STS-PT-2013-14	3.7	18.2	105.8	3.43	2	3.77	4	3.98	6	39.5	3.75	7	3.85	8	3.95	9
15	STS-PT-2013-15	5.5	0.3	58.4	5.30	2	5.40	4	5.36	6	7.8	4.93	7	4.99	8	5.00	9
16	STS-PT-2013-16	5.4	0.5	53.9	5.48	2	5.56	4	5.50	6	22.1	4.40	7	4.48	8	4.52	9
17	STS-PT-2013-17	6.8	0.2	-1.5	7.66	2	7.46	4	7.40	6	-71.8	7.91	7	7.85	8	7.79	9
18	STS-PT-2013-18	3.8	12.7	106.5	3.40	2	3.75	4	3.96	6	NA	NA		NA		NA	
19	STS-PT-2013-19	4.3	14.0	108.6	3.32	2	3.68	4	3.90	6	46.0	3.50	7	3.62	8	3.73	9
20	STS-PT-2013-20	6.5	0.8	-30.2	8.79	2	8.45	4	8.50	6	-90.8	8.62	7	8.53	8	8.49	9
21	STS-PT-2013-21	3.5	1.2	77.5	4.55	2	4.75	4	4.78	6	13.3	4.73	7	4.79	8	4.81	9
22	STS-PT-2013-22	3.6	5.4	90.7	4.03	2	4.29	4	4.40	6	31.9	4.03	7	4.13	8	4.19	9
23	STS-PT-2013-23	3.8	4.6	94.2	3.89	2	4.17	4	4.30	6	26.6	4.23	7	4.32	8	4.37	9
24	STS-PT-2013-24	6.7	<0.05	-24.6	8.57	2	8.26	4	8.28	6	-99.1	8.93	7	8.82	8	8.80	9
25	STS-PT-2013-25	6.6	0.1	-22.4	8.49	2	8.18	4	8.19	6	-97.6	8.87	7	8.77	8	8.74	9
26	STS-PT-2013-26	6.7	0.1	-26.0	8.63	2	8.31	4	8.33	6	-109.7	9.32	7	9.20	8	9.19	9
27	STS-PT-2013-27	4.9	1.2	77.6	4.54	2	4.74	4	4.78	6	12.4	4.76	7	4.83	8	4.84	9
28	STS-PT-2013-28	6.6	0.1	-22.5	8.49	2	8.18	4	8.20	6	-104.1	9.11	7	9.00	8	8.98	9
29	STS-PT-2013-29	4.1	5.6	97.5	3.76	2	4.06	4	4.21	6	23.2	4.36	7	4.44	8	4.48	9
30	STS-PT-2013-30	3.4	2.0	86.0	4.21	2	4.46	4	4.53	6	24.9	4.29	7	4.38	8	4.43	9
31	STS-PT-2013-31	5.4	0.1	38.1	6.10	2	6.10	4	6.02	6	-10.8	5.63	7	5.66	8	5.63	9
32	STS-PT-2013-32	5.4	1.2	75.9	4.61	2	4.80	4	4.83	6	32.1	4.02	7	4.12	8	4.19	9
33	STS-PT-2013-33	4.3	1,705.0	158.1	1.37	2	1.98	4	2.69	6	NA	NA		NA		NA	
34	STS-PT-2013-34	4.7	11.2	105.4	3.45	2	3.79	4	3.99	6	NA	NA		NA		NA	
35	STS-PT-2013-35	4.3	36.8	120.1	2.87	2	3.28	4	3.60	6	55.8	3.14	7	3.27	8	3.42	9
36	STS-PT-2013-36	6.1	15.4	108.3	3.33	2	3.69	4	3.91	6	42.3	3.64	7	3.75	8	3.85	9

Cu-ISE = cupric-ion selective electrode
mg/L = milligrams per liter
mV = millivolts
NA = not analyzed
s.u. = standard units
< = less than

Notes:

1. Calibration equations are:
    1) $pCu = -0.041415*mV + 7.274719$
    2) $pCu = -0.039445*mV + 7.602715$
    3) $pCu = -0.032657*mV + 7.010638$
    4) $pCu = -0.034374*mV + 7.411344$
    5) $pCu = 0.000086*mV^2 - 0.035968*mV + 6.862677$
    6) $pCu = 0.000046*mV^2 - 0.036711*mV + 7.347787$
    7) $pCu = -0.037382*mV + 5.222452$
    8) $pCu = -0.035860*mV + 5.270464$
    9) $pCu = 0.000017*mV^2 - 0.033985*mV + 5.261436$
2. Two batches of soil extracts were analyzed for pCu on December 11, 2013 (soils 1-9, and soils 10-36), each with a separate calibration curve.
3. This column contains the pCu values used in the analysis of the phytotoxicity test results.

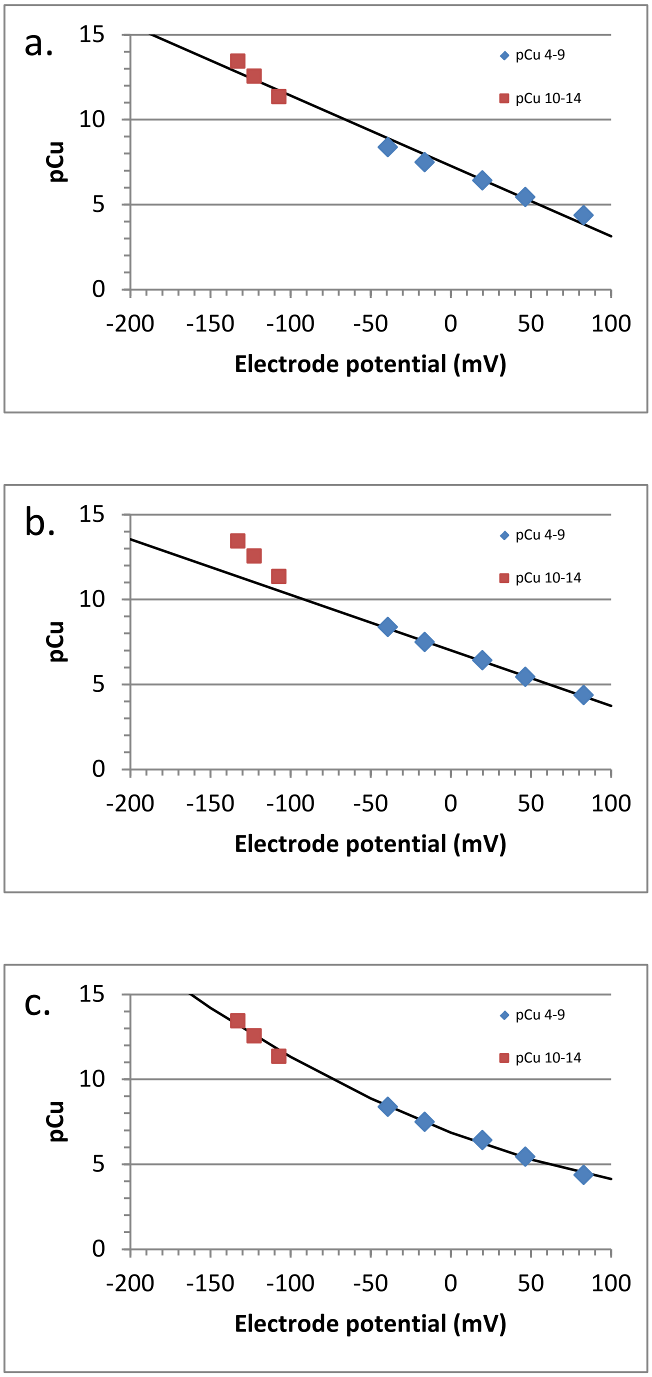
Table E-3. Results of pCu analyses in calcium chloride (CaCl2) extracts of soils from the Chino Mines Smelter Tailings and Soils Investigation Unit and references areas near Hurley, New Mexico, that were collected from the vegetation-community-study locations in 2011 and 2012 and were not also used in the greenhouse-phytotoxicity study. Analyzed on December 16, 2013.

Freeport-McMoran Chino Mines Company
Vanadium, New Mexico
Smelter/Tailing Soils IU Phytotoxicity and Vegetation Community Study

Sample ID	2013						
	Cu-ISE potential (mV)	Estimate of measured pCu; linear curve, all calibration data	Eqn. [1]	Estimate of measured pCu; linear curve, pCu 4-9 calibration data [2]	Eqn. [1]	Estimate of measured pCu; quadratic curve, all calibration data	Eqn. [1]
STS-RWU-2011-4 0-6	-20.9	8.44	10	8.13	11	8.11	12
1# WEST 0-6	-13.7	8.14	10	7.86	11	7.81	12
STS-RWU-2011-15 0-6	86.6	3.84	10	4.14	11	4.28	12
STS-RWU-2011-6 0-6	17.0	6.82	10	6.72	11	6.61	12
STS-RWU-2011-1 0-6	67.3	4.67	10	4.86	11	4.87	12
STS-RWU-2011-3 0-6	85.4	3.89	10	4.19	11	4.32	12
STS-RWU-2011-14 0-6	87.3	3.81	10	4.12	11	4.26	12
STS-RWU-2011-2 0-6	100.7	3.24	10	3.62	11	3.88	12
STS-RWU-2011-8 0-6	44.3	5.65	10	5.71	11	5.63	12
STS-RWU-2011-5 0-6	104.8	3.06	10	3.47	11	3.77	12
STS-RWU-2011-16 0-6	93.6	3.54	10	3.89	11	4.08	12
STS-RWU-2011-7 0-6	112.3	2.74	10	3.19	11	3.57	12
STS-RWU-2011-9 0-6	115.0	2.63	10	3.09	11	3.50	12
STS-RWU-2011-10 0-6	69.9	4.56	10	4.76	11	4.79	12
STS-RWU-2011-11 0-6	100.3	3.25	10	3.64	11	3.89	12
STS-RWU-2011-12 0-6	93.6	3.54	10	3.9	11	4.1	12
STS-RWU-2011-13 0-6	32.7	6.15	10	6.14	11	6.03	12
STS-RWU-2011-17 0-6	89.0	3.74	10	4.06	11	4.21	12
STS-RWU-2012-B1 0-6	90.6	3.67	10	4.00	11	4.17	12
STS-RWU-2012-B2 0-6	92.0	3.61	10	3.94	11	4.13	12
STS-RWU-2012-B3 0-6	78.0	4.21	10	4.46	11	4.54	12
WILDLIFE REF NORTH 0-6	45.5	5.60	10	5.67	11	5.59	12
WILDLIFE REF SOUTH 0-6	98.7	3.32	10	3.70	11	3.94	12
DUP #1 - RWU 9	117.5	2.52	10	3.00	11	3.44	12
DUP #2 - Wildlife Ref North	50.2	5.40	10	5.49	11	5.43	12

Cu-ISE = cupric-ion selective electrode
mV = millivolts

Notes:
1. Calibration equations are:
10) pCu = -0.042810*mV + 7.548756
11) pCu = -0.037029*mV + 7.351500
12) pCu = 0.000059*mV^2 - 0.039472*mV + 7.259101
2. This column contains the pCu values used in the analysis of the phytotoxicity test results.



pCu = -0.041415·mV + 7.274719

R^2 = 0.982 (all data)

Nerstian slope = -24.1 mV/pCu unit

pCu = -0.032657·mV + 7.010638

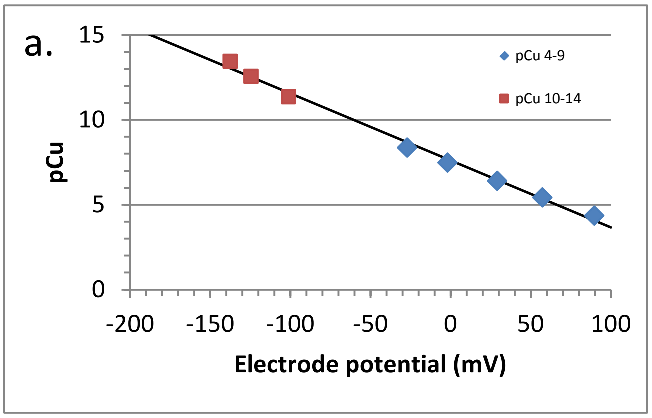
R^2 = 0.998 (pCu 4-9 only)

Nerstian slope = -30.6 mV/pCu unit

pCu = 0.000086·mV^2 - 0.032657·mV + 7.010638

R^2 = 0.996 (all data)

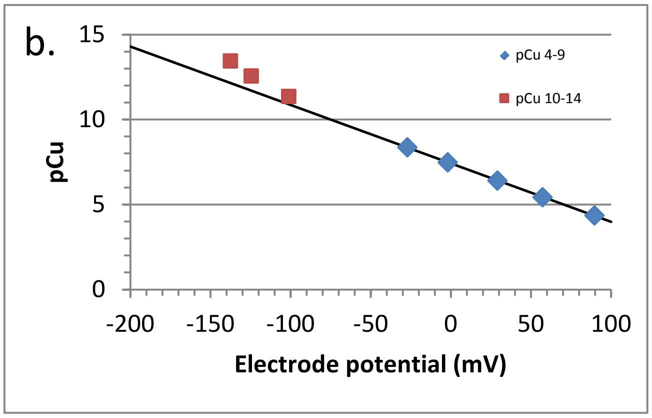
Figure E-1. Energy Laboratories' pCu calibration data on December 11, 2013 (initial calibration on that date). (a) Linear calibration curve fit to all data (pCu 4-14); (b) linear calibration curve fit to data between pCu 4 and 9; and (c) quadratic calibration curve fit to all data (pCu 4-14).



pCu = -0.039445·mV + 7.602715

R^2 = 0.994 (all data)

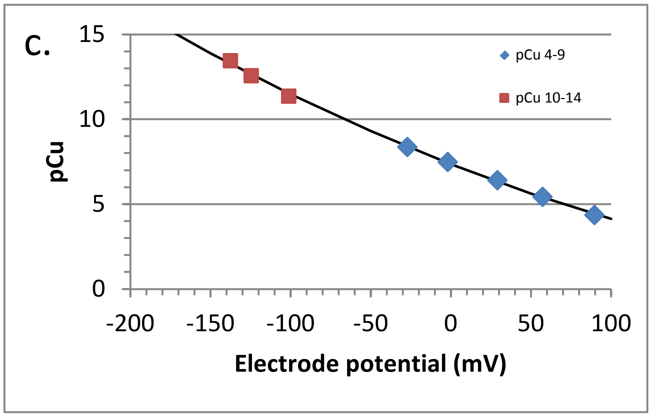
Nerstian slope = -25.4 mV/pCu unit



pCu = -0.034374·mV + 7.411344

R^2 > 0.999 (pCu 4-9 only)

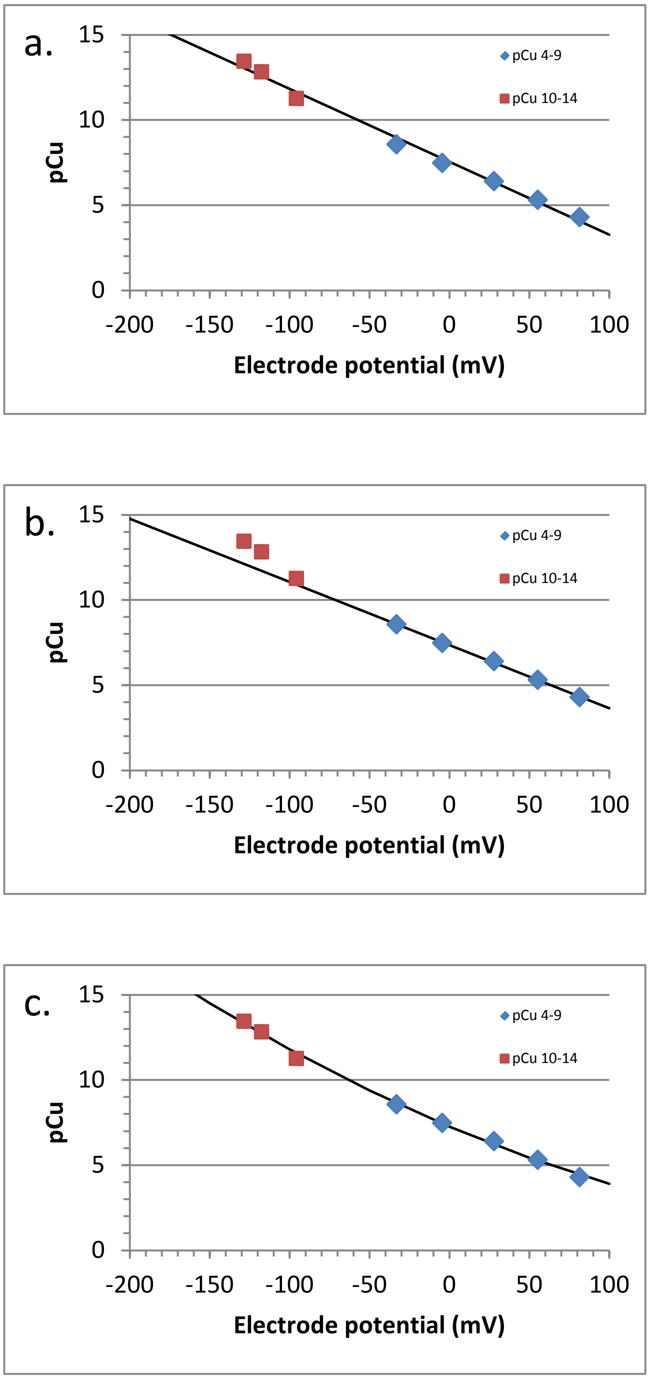
Nerstian slope = -29.1 mV/pCu unit



pCu = 0.000046·mV^2 - 0.036711·mV + 7.347787

R^2 = 0.999 (all data)

Figure E-2. Energy Laboratories' pCu calibration data on December 11, 2013 (second calibration on that date). (a) Linear calibration curve fit to all data (pCu 4-14); (b) linear calibration curve fit to data between pCu 4 and 9; and (c) quadratic calibration curve fit to all data (pCu 4-14).



$\mathrm{pCu} = -0.042810 \cdot \mathrm{mV} + 7.548756$

$R^2 = 0.992$ (all data)

Nerstian slope = -23.4 mV/pCu unit

$\mathrm{pCu} = -0.037029 \cdot \mathrm{mV} + 7.351500$

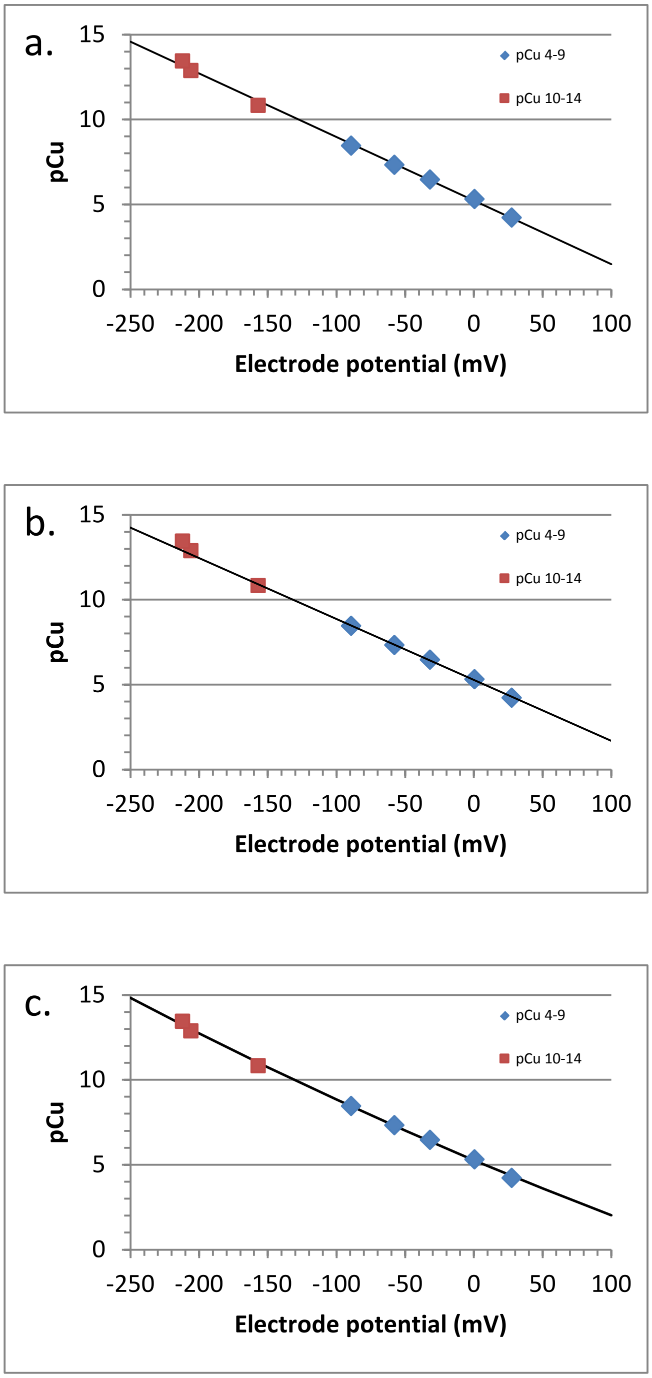
$R^2 = 0.999$ (pCu 4-9 only)

Nerstian slope = -27.0 mV/pCu unit

$\mathrm{pCu} = 0.000059 \cdot \mathrm{mV}^2 - 0.039472 \cdot \mathrm{mV} + 7.259101$

$R^2 = 0.998$ (all data)

Figure E-3. Energy Laboratories' pCu calibration data on December 16, 2013. (a) Linear calibration curve fit to all data (pCu 4-14); (b) linear calibration curve fit to data between pCu 4 and 9; and (c) quadratic calibration curve fit to all data (pCu 4-14).



pCu = -0.037382·mV + 5.222452

R^2 = 0.998 (all data)

Nerstian slope = -26.8 mV/pCu unit

pCu = -0.035860·mV + 5.270464

R^2 = 0.999 (pCu 4-9 only)

Nerstian slope = -27.9 mV/pCu unit

pCu = 0.000017·mV^2 - 0.033985·mV + 5.261436

R^2 = 0.999 (all data)

Figure E-4. Energy Laboratories' pCu calibration data on February 5, 2015. (a) Linear calibration curve fit to all data (pCu 4-14); (b) linear calibration curve fit to data between pCu 4 and 9; and (c) quadratic calibration curve fit to all data (pCu 4-14).

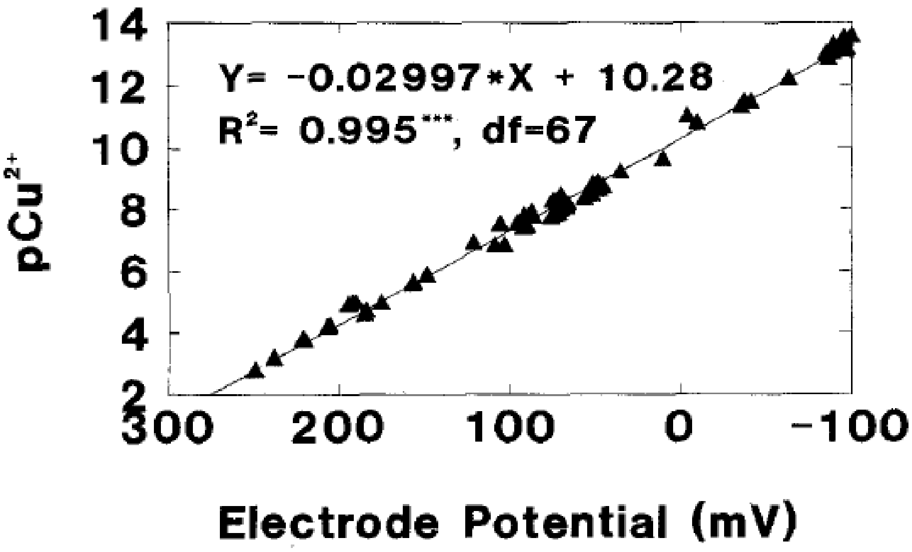


Figure E-5. Calibration curve for pCu vs. Cu-ISE electrode potential in Sauvé et al. (1995). The regression line represents the linear response of the electrode during multiple calibrations over a 6-week period.

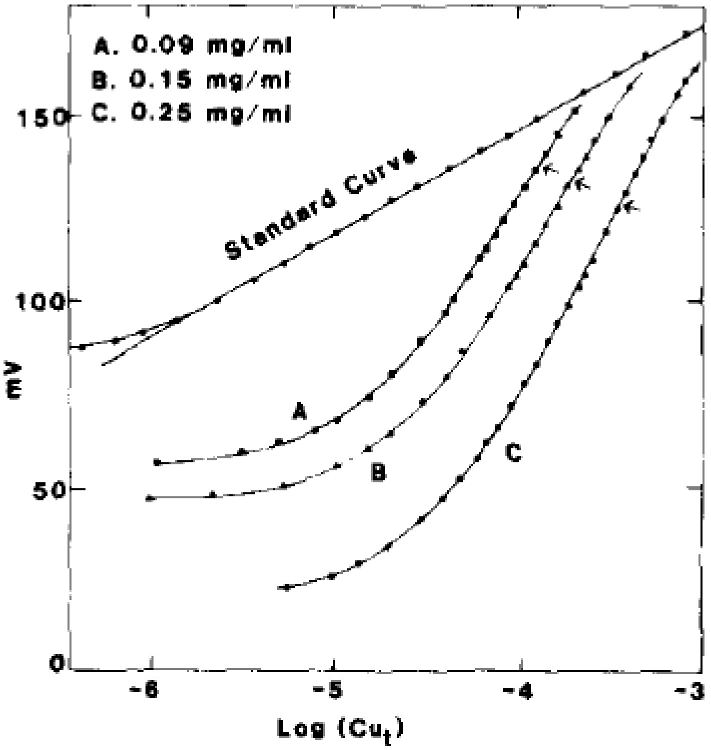


Figure E-6. Calibration curve ("Standard Curve") and responses of a cupric-ion-selective electrode (Cu-ISE) in the presence of a humic acid at three concentrations (curves A, B, and C) (Figure 1 in Fitch et al. 1986). The standard curve and the three humic acid solutions were acidified to pH 4 for these Cu-ISE measurements, thereby converting all forms of copper to the free ion form (Cu^{2+}). Therefore, the Cu^{2+} concentration equaled the total copper concentration (indicated as Cu_t). The calibration curve labeled "Standard Curve" deviated from linearity at pCu values greater than approximately 6 (i.e., at log(Cu_t) values less than approximately -6, and thus at Cu^{2+} activities less than approximately 10^{-6} molar).

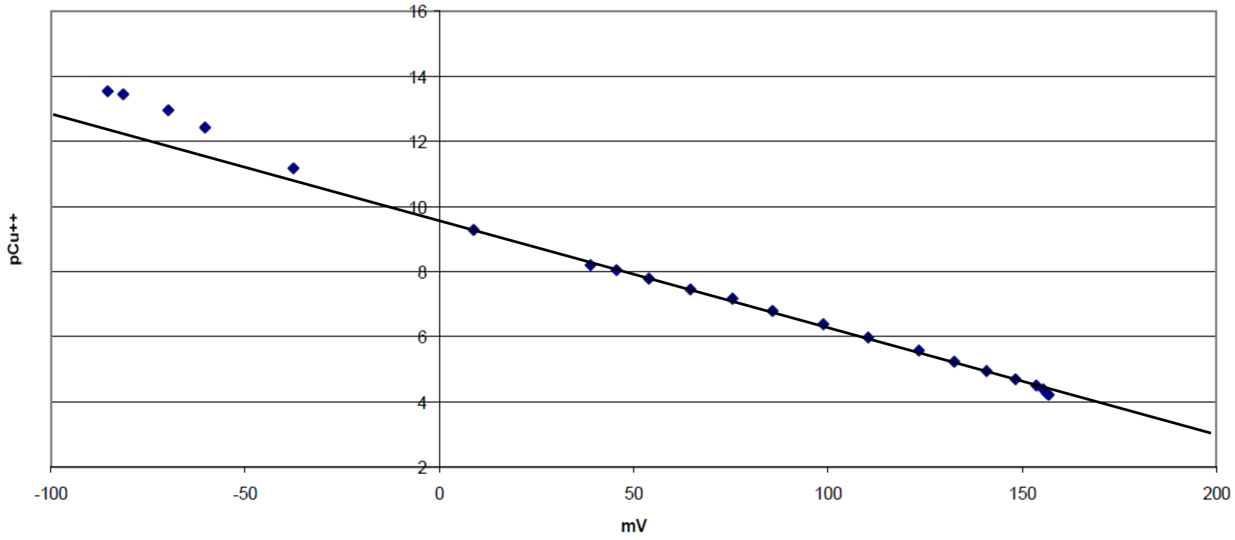


Figure E-7. The pCu calibration data used for analyses of soil extracts from the Chino Mines Smelter Tailings and Soils Investigation Unit by Dr. John Drexler (University of Colorado) in 2000 (Figure 2 in Tegtmeyer 2001, as reproduced in Appendix B in Newfields 2005). The straight line has been inserted to illustrate nonlinearity at pCu values greater than approximately 9.5. The slope of the straight line is -30 mV/pCu unit, which is close to the theoretical Nernstian slope of -29.6 mV/pCu unit.

APPENDIX F

Plant Community Methods and Results

Appendix F: Standard Operating Procedures in Field for Community Study

Years 2011, 2012, 2014

Cover and Richness

1. Proceeded to each sampling location on map (Figure 3 of main report).
2. For wildlife habitat sampling, a transect/quadrat system was used as the framework to collect percent cover and richness data. At the sampling location, a 100 foot by 100 foot plot was established and divided into twenty-five 20 foot by 20 foot blocks (Stars in Figure F-1). Random-grid coordinates were used to select five blocks to be sampled in each 100 by 100 foot area, shown on attached form. Pin flags were used to mark off the 20’ increments on each side of the 100’ plot and then to find and mark the 20’ x 20’ blocks to be sampled. Two 20-foot transects were located in each randomly selected block in a dogleg pattern. The first leg of a transect originated in the southeastern corner of each block and the direction was randomly selected. A 3.3 foot by 3.3 foot quadrat (or 1-meter square) was placed at 5 and 15 feet along each transect (Figure F-1).
3. Ocular estimates of total canopy cover (above ground) were made using percentage categories in Table F-1 below. Canopy cover estimates included the foliage and foliage interspaces of all live individual plants rooted in the quadrat. Also, canopy cover by class (shrub, grass, forb, succulent) were recorded in 2014 (not in 2011). When in the office, the class ranges were converted to their midpoints before averaging to obtain average total cover (also by life form in 2014) per block and then per plot.
4. Species richness was determined by traversing each 20 foot by 20 foot block entirely and counting all the vegetation species encountered in each block for each of the four growth forms: grass, forb, shrub, succulent. Richness was averaged across blocks for each location and by life form. Species names were listed in 2014, after keying out all species identified when counting species for richness.
5. Wildlife habitat forms with the collected information were completed for each site (see Table F-2 and its attachments with field data). Data collected for individual species in 2014 were recorded in field notebooks and summarized in Table F-3.
6. Each site was photographed (see Appendix I) with a GPS camera and the photo number recorded.

Observed Apparent Trend (OAT) Score .

7. A 200-m transect was established on the edge of the each of the above plots (corner of dogleg) and walked in the direction toward the middle of the homogeneous OAT polygon identified in the FS proposal (Appendix A) using a compass/GPS to navigate in a straight line for 200 m (656’), observing OAT variables and recording them for this transect to obtain a final score on an OAT worksheet. The team (ARCADIS, Formation, and NMED biologists) considered slope and landscape position in the rating. Information on the site’s historical/current ecological type, vegetation alliance, soil type, and expected production/condition if available, were identified before the rating to assist with the rating in the field.

Reference Locations

8. For Cover and Richness: Following steps outlined in steps 2 to 6, the team sampled reference sites for wildlife habitat on north- and south-facing slopes (specifically, Wildlife Reference Plot North and Wildlife Reference Plot South of Figure 3 of main report) in 2011 and 2014, and on STS-RWU-2012-B1,B2, and B3 in 2012. These areas were grazed to match the grazed condition

of locations on the impacted Site, but they are not expected to be impacted by copper from the smelter. Chino and the New Mexico Environment Department [NMED]) selected these reference sites in September 2011 while in the field sampling wildlife and rangeland habitat for the Feasibility Study. For the phytotoxicity and community study work plan, NMED requested the terminology of these locations be changed from reference to “de minimus” locations.

9. For Rangeland Conditions identified with OAT Score: Proceeded to “Cell Phone Hill” and “Lampbright Outcrop” (see map in Figure F-2) first to calibrate eye of team of biologists to “good” rangeland conditions for that year’s level of precipitation (performed in September 2011 and September 2014). Scoring of locations on site were relative to this calibration of “good” conditions. In 2014, the team reviewed the previous OAT score at site to re-calibrate the eye to recognizing that score as applicable to that site, even if site conditions had changed (i.e., vegetation was taller and less grazed down in 2014). Average OAT score was 39 on Cell Phone Hill in 2011 and established as the same in 2014 (average of southwest-facing slope, summit, and northeast-facing slope of cell phone hill). Lambright Outcrop OAT score was 36. OAT was also recorded on bedrock reference locations B1, B2, and B3 in 2012. An overgrazed reference was also examined for comparison before starting the site sampling.

Equipment:

Two 100’ measuring tapes

20 pin flags

1 m x 1 m PVC sampling frame (with elbows)

Water bottles and cooler with ice for drinking

Two plant field guides

1 compass

Random numbers-

1 GPS and AA batteries

1 GPS camera

Field notebook

Field forms (OAT and wildlife)

Large Map with point locations and Field IDs

Soil, OAT, and vegetation maps, NRCS historical and current production data

Pencil/pen and clipboard

PPE (level D), bug spray, sun lotion

Snake chaps

Tailgate safety forms

First aid kit including moleskin

Plastic bags for ice

Table F- 1. Vegetation Cover Class Midpoints

Percent Cover Range	**Cover Class Midpoint**
< 5	2.5
6 – 25	15
26 – 50	38
51 – 75	63
76 – 90	85
> 95	98

Figure F-1. Sampling design: Randomly chosen blocks (stars) were sampled for richness, small squares for cover.

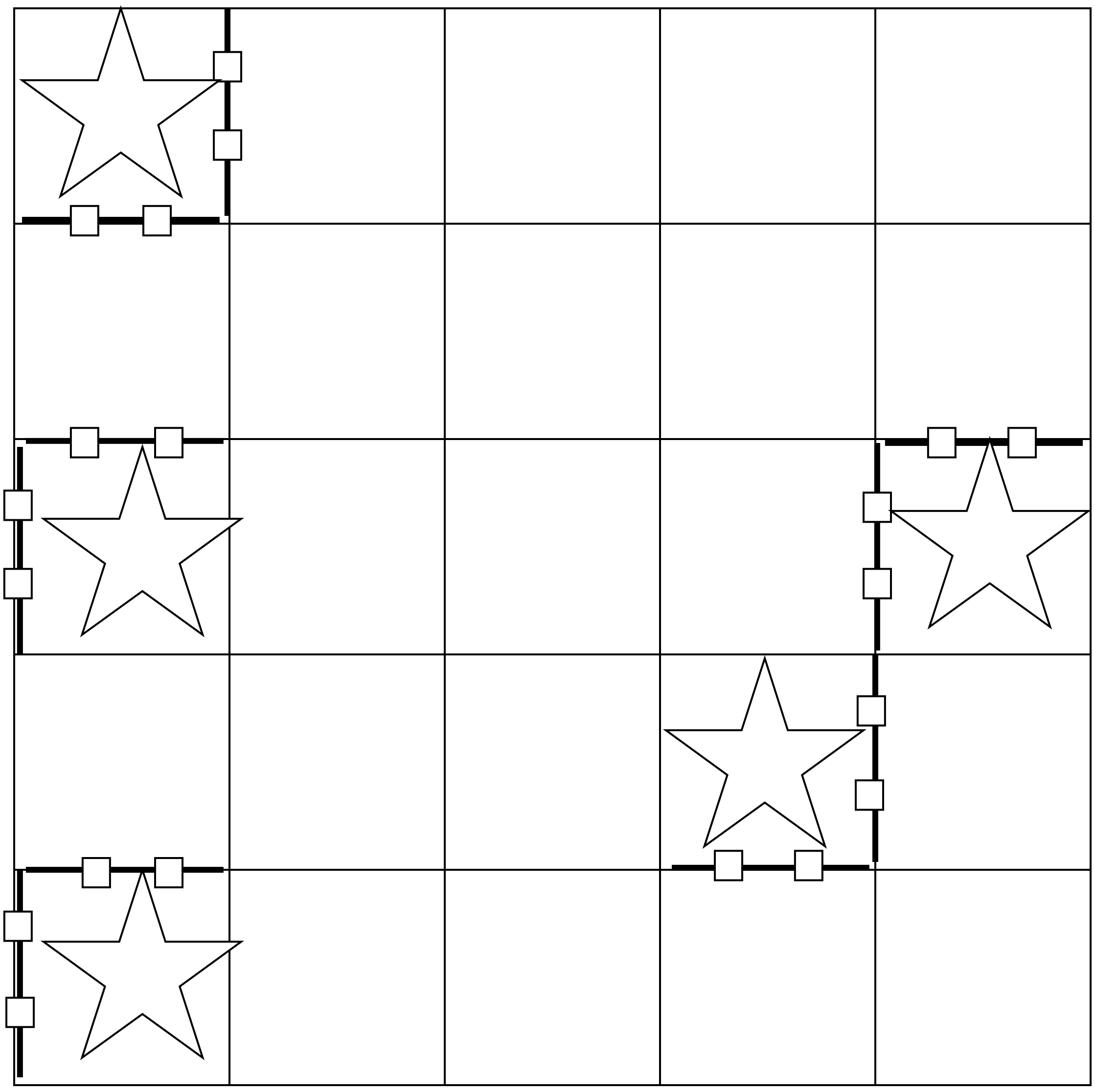


Table F-2. Summary of 2011, 2012, and 2014 Community Data (see attached typed version of field forms

Freeport-McMoran Chino Mines Company
Vanadium, New Mexico
Smelter/Tailing Soils IU Phytotoxicity and Vegetation Community Study

Site ID	Cover						Richness				
	Avg. Cover	Avg. Tree	Avg. Shrub[1]	Avg. Grass	Avg. Forb	Avg. Succ	Avg. Shrub[1]	Avg. Grass	Avg. Forb	Avg. Succ	Avg. Total sp.
2014											
STS-PT-2013-1	31.58	-	31.08	0.00	1.50	0.00	1	0.4	1.6	0.4	3.4
STS-PT-2013-2	30.58	-	29.33	3.00	1.38	0.00	1.2	1	3.2	0	5.2
STS-PT-2013-5	37.78	-	20.23	3.63	0.88	17.65	2.6	1.8	2.8	1.4	8.6
STS-PT-2013-9	5.03	-	4.90	0.00	0.13	0.00	0.6	0	1	0.2	1.8
STS-PT-2013-12	19.73	-	10.13	10.48	2.15	0.00	1.8	3.2	1.8	0.4	7.2
STS-PT-2013-17	18.65	-	18.53	0.63	1.63	0.00	1.6	1.2	3	0	5.8
STS-PT-2013-19	4.65	-	3.40	0.00	1.00	0.00	2.2	0.2	1.6	0.4	4.4
STS-PT-2013-20	24.30	-	1.75	22.00	22.00	0.13	2.2	3.8	6.2	0.6	12.8
STS-PT-2013-26	37.10	-	13.90	16.15	16.15	0.00	1	7	7.8	0	15.8
Wildlife reference plot N	30.3	-	18.35	14.53	14.53	0.00	3.2	4.2	2.8	0	10.2
Wildlife reference plot S	36.75	-	22.58	11.30	11.30	0.13	2.8	5.6	5.2	0.6	14.2
2012											
STS-RWU-2012-B1	17.58	13.20	0.00	3.00	0.13	0.75	1.4	0.6	0.2	1.2	3.4
STS-RWU-2012-B2	2.50	0.00	0.25	2.38	0.00	1.00	1.8	1	1	1.2	5
STS-RWU-2012-B3	3.40	3.28	0.13	0.00	0.00	0.00	1.2	0.8	0.2	0.4	2.6
2011											
STS-RWU-2011-1	5.53	-	-	-	-	-	0	0	0.8	0.2	1
STS-RWU-2011-2	7.90	-	-	-	-	-	0	0	0.4	0	0.4
STS-RWU-2011-3	58.98	-	-	-	-	-	0.6	2.8	1.6	1.2	6.2
STS-RWU-2011-4	63.85	-	-	-	-	-	0.8	4.4	4.4	0.2	9.8
STS-RWU-2011-5	34.10	-	-	-	-	-	2.4	4	3.2	0.4	10
STS-RWU-2011-6	25.00	-	-	-	-	-	2.2	1.4	3.8	0.6	8
STS-RWU-2011-7	10.95	-	-	-	-	-	0.2	0.2	1.2	0.2	1.8
STS-RWU-2011-8	44.95	-	-	-	-	-	4	5.8	11.3	0.4	21.6
STS-RWU-2011-9	2.50	-	-	-	-	-	0.4	0	0	0.4	0.8
STS-RWU-2011-10	24.25	-	-	-	-	-	1	2.6	5.8	0.8	10.2
STS-RWU-2011-11	4.28	-	-	-	-	-	0.8	0	0	0.8	1.6
STS-RWU-2011-12	9.18	-	-	-	-	-	1	0.2	0.4	0	1.6
STS-RWU-2011-13	25.98	-	-	-	-	-	1.4	0.2	1.8	0.2	3.6
STS-RWU-2011-14	26.68	-	-	-	-	-	1.8	2	4	0.2	8
STS-RWU-2011-15	17.63	-	-	-	-	-	1.4	0.6	5.4	0	7.4
STS-RWU-2011-16	22.43	-	-	-	-	-	2.8	5.2	4.2	0.8	13
STS-RWU-2011-17	35.81	-	-	-	-	-	2.8	0	2.6	0	5.4
Wildlife reference plot N	30.00	-	-	-	-	-	1.4	7.6	4.2	0	13.2
Wildlife reference plot S	19.98	-	-	-	-	-	0	0	0	0	0
Notes:											

[1] Shrub cover in 2014 and shrub richness represent combined tree and shrub cover. Tree and shrub cover reported separately in 2012.

2011 Wildlife Habitat Data (page 1)

Date 9/12/2011

cover averaged over 1 m x 1 m areas

Site ID WildRefS

richness is in entire 20 by 20' area

	midpt cover	midpt cover	midpt cover	midpt cover	avg. midpt	# shrub	# grass	# forb	# succ	total # sp.
Block 1	15	15	2.5	2.5	8.75	0	0	0	0	0
Block 2	15	15	38	38	26.50	0	0	0	0	0
Block 3	2.5	15	63	85	41.38	0	0	0	0	0
Block 4	2.5	2.5	2.5	2.5	2.50	0	0	0	0	0
Block 5	38	15	15	15	20.75	0	0	0	0	0
average	14.6	12.5	24.2	28.6	19.98	0	0	0	0	0

Date 9/12/2011

Site ID WildRefN

	midpt cover	midpt cover	midpt cover	midpt cover	avg. midpt	# shrub	# grass	# forb	# succ	total # sp.
Block 1	15	38	38	38	32.25	1	5	5	0	11
Block 2	15	38	15	15	20.75	1	10	5	0	16
Block 3	38	38	38	38	38.00	1	7	4	0	12
Block 4	85	15	15	38	38.25	2	8	4	0	14
Block 5	38	15	15	15	20.75	2	8	3	0	13
average	38.2	28.8	24.2	28.8	30.00	1.4	7.6	4.2	0	13.2

Date 9/12/2011

Site ID 5 (For all 2011 data, Site X is abbreviation of STS-RWU-2011-X)

	midpt cover	midpt cover	midpt cover	midpt cover	avg. midpt	# shrub	# grass	# forb	# succ	total # sp.
Block 1	2.5	98	63	38	50.38	2	4	3	0	9
Block 2	2.5	38	2.5	15	14.50	3	3	4	0	10
Block 3	85	38	15	2.5	35.13	3	5	2	1	11
Block 4	38	38	38	15	32.25	3	5	5	1	14
Block 5	15	15	85	38	38.25	1	3	2	0	6
average	28.6	45.4	40.7	21.7	34.10	2.4	4	3.2	0.4	10

Date 9/12/2011

Site ID 8

	midpt cover	midpt cover	midpt cover	midpt cover	avg. midpt	# shrub	# grass	# forb	# succ	total # sp.
Block 1	63	38	38	85	56.00	6	8	14	1	29
Block 2	63	38	38	63	50.50	5	7	11	0	23
Block 3	15	38	63	38	38.50	2	6	12	1	21
Block 4	15	38	15	15	20.75	3	4	10	0	17
Block 5	38	85	15	98	59.00	4	4	10	0	18
average	38.8	47.4	33.8	59.8	44.95	4	5.8	11.4	0.4	21.6

Wildlife Habitat Data

Date 9/13/2011

Site ID 4

	midpt cove	midpt cove	midpt cove	midpt cove	avg. midpt	# shrub	# grass	# forb	# succ	total # sp.
Block 1	85	38	85	85	73.25	1	7	5	0	13
Block 2	63	98	38	85	71.00	0	4	3	1	8
Block 3	38	85	38	38	49.75	1	3	5	0	9
Block 4	63	63	85	63	68.50	1	4	5	0	10
Block 5	63	38	63	63	56.75	1	4	4	0	9
average	62.4	64.4	61.8	66.8	63.85	0.8	4.4	4.4	0.2	9.8

Date 9/13/2011

Site ID 6

	midpt cove	midpt cove	midpt cove	midpt cove	avg. midpt	# shrub	# grass	# forb	# succ	total # sp.
Block 1	38	63	63	15	44.75	1	2	4	0	7
Block 2	15	2.5	2.5	15	8.75	2	2	6	1	11
Block 3	15	15	2.5	2.5	8.75	4	2	6	0	12
Block 4	15	15	15	15	15.00	3	1	3	1	8
Block 5	98	15	63	15	47.75	1	0	0	1	2
average	36.2	22.1	29.2	12.5	25.00	2.2	1.4	3.8	0.6	8.0

Date 9/13/2011

Site ID 15

	midpt cove	midpt cove	midpt cove	midpt cove	avg. midpt	# shrub	# grass	# forb	# succ	total # sp.
Block 1	15	38	15	38	26.50	1	0	5	0	6
Block 2	15	15	38	2.5	17.63	2	0	6	0	8
Block 3	38	38	2.5	15	23.38	2	1	5	0	8
Block 4	15	2.5	15	15	11.88	1	1	6	0	8
Block 5	2.5	15	15	2.5	8.75	1	1	5	0	7
average	17.1	21.7	17.1	14.6	17.63	1.4	0.6	5.4	0.0	7.4

2011 Wildlife Habitat Data (page 2)

Date 9/13/2011

Site ID 14 (For all 2011 data, Site X is abbreviation of STS-RWU-2011-X)

	midpt cover	midpt cover	midpt cover	midpt cover	avg. midpt	# shrub	# grass	# forb	# succ	total # sp.
Block 1	63	98	15	63	59.75	3	1	2	0	6
Block 2	15	15	2.5	15	11.88	3	2	3	1	9
Block 3	15	38	38	15	26.50	1	2	7	0	10
Block 4	15	38	2.5	15	17.63	1	2	4	0	7
Block 5	2.5	2.5	2.5	63	17.63	1	3	4	0	8
average	22.1	38.3	12.1	34.2	26.68	1.8	2	4	0.2	8

Date 9/13/2011

Site ID 17

	midpt cover	midpt cover	midpt cover	midpt cover	avg. midpt	# shrub	# grass	# forb	# succ	total # sp.
Block 1	2.5	38	15	38	23.38	2	0	1	0	3
Block 2	98	38	--	2.5	46.17	4	0	11	0	15
Block 3	38	2.5	63	15	29.63	3	0	0	0	3
Block 4	15	38	2.5	2.5	14.50	2	0	0	0	2
Block 5	2.5	63	98	98	65.38	3	0	1	0	4
average	31.2	35.9	44.625	31.2	35.81	2.8	0	2.6	0	5.4

Date 9/13/2011

Site ID 13

	midpt cover	midpt cover	midpt cover	midpt cover	avg. midpt	# shrub	# grass	# forb	# succ	total # sp.
Block 1	15	2.5	2.5	2.5	5.63	3	1	5	1	10
Block 2	2.5	15	15	2.5	8.75	1	0	1	0	2
Block 3	2.5	38	63	63	41.63	1	0	0	0	1
Block 4	2.5	63	38	63	41.63	1	0	1	0	2
Block 5	38	38	38	15	32.25	1	0	2	0	3
average	12.1	31.3	31.3	29.2	25.98	1.4	0.2	1.8	0.2	3.6

Date 9/13/2011

Site ID 11 bedrock

	midpt cover	midpt cover	midpt cover	midpt cover	avg. midpt	# shrub	# grass	# forb	# succ	total # sp.
Block 1	2.5	2.5	38	2.5	11.38	0	0	0	1	1
Block 2	2.5	2.5	2.5	2.5	2.50	3	0	0	1	4
Block 3	2.5	2.5	2.5	2.5	2.50	1	0	0	0	1
Block 4	2.5	2.5	2.5	2.5	2.50	0	0	0	1	1
Block 5	2.5	2.5	2.5	2.5	2.50	0	0	0	1	1
average	2.5	2.5	9.6	2.5	4.28	0.8	0	0	0.8	1.6

illegible

Wildlife Habitat Data

Date 9/13/2011

Site ID 10

	midpt cover	midpt cover	midpt cover	midpt cover	avg. midpt	# shrub	# grass	# forb	# succ	total # sp.
Block 1	63	15	63	15	39.00	1	3	6	1	11
Block 2	2.5	15	15	15	11.88	1	1	8	1	11
Block 3	15	38	15	2.5	17.63	0	2	5	0	7
Block 4	15	2.5	15	15	11.88	2	4	5	2	13
Block 5	38	2.5	38	85	40.88	1	3	5	0	9
average	26.7	14.6	29.2	26.5	24.25	1	2.6	5.8	0.8	10.2

Date 9/13/2011

Site ID 12

	midpt cover	midpt cover	midpt cover	midpt cover	avg. midpt	# shrub	# grass	# forb	# succ	total # sp.
Block 1	2.5	2.5	2.5	2.5	2.50	1	0	1	0	2
Block 2	15	2.5	15	15	11.88	0	0	1	0	1
Block 3	2.5	2.5	2.5	2.5	2.50	1	0	0	0	1
Block 4	63	38	2.5	2.5	26.50	1	1	0	0	2
Block 5	2.5	2.5	2.5	2.5	2.50	2	0	0	0	2
average	17.1	9.6	5	5	9.18	1	0.2	0.4	0	1.6

Date 9/13/2011

Site ID 16

	midpt cover	midpt cover	midpt cover	midpt cover	avg. midpt	# shrub	# grass	# forb	# succ	total # sp.
Block 1	2.5	15	2.5	2.5	5.63	3	5	3	0	11
Block 2	38	15	38	15	26.50	3	6	2	2	13
Block 3	15	15	15	15	15.00	2	6	7	1	16
Block 4	38	38	38	15	32.25	3	4	5	0	12
Block 5	15	15	38	63	32.75	3	5	4	1	13
average	21.7	19.6	26.3	22.1	22.43	2.8	5.2	4.2	0.8	13

Date 9/13/2011

Site ID 9 bedrock

	midpt cover	midpt cover	midpt cover	midpt cover	avg. midpt	# shrub	# grass	# forb	# succ	total # sp.
Block 1	2.5	2.5	2.5	2.5	2.50	0	0	0	1	1
Block 2	2.5	2.5	2.5	2.5	2.50	1	0	0	0	1
Block 3	2.5	2.5	2.5	2.5	2.50	1	0	0	1	2
Block 4	2.5	2.5	2.5	2.5	2.50	0	0	0	0	0
Block 5	2.5	2.5	2.5	2.5	2.50	0	0	0	0	0
average	2.5	2.5	2.5	2.5	2.50	0.4	0	0	0.4	0.8

2011 Wildlife Habitat Data (page 3)

Date	9/15/2011									
Site ID	3									
	midpt cover	midpt cover	midpt cover	midpt cover	avg. midpt	# shrub	# grass	# forb	# succ	total # sp.
Block 1	2.5	38	2.5	15	14.50	1	2	1	2	6
Block 2	2.5	2.5	85	63	38.25	1	4	1	1	7
Block 3	85	98	98	98	94.75	1	3	2	0	6
Block 4	85	98	98	85	91.50	0	3	2	2	7
Block 5	2.5	38	98	85	55.88	0	2	2	1	5
average	35.5	54.9	76.3	69.2	58.98	0.6	2.8	1.6	1.2	6.2

Date	9/15/2011									
Site ID	1	bedrock								
	midpt cover	midpt cover	midpt cover	midpt cover	avg. midpt	# shrub	# grass	# forb	# succ	total # sp.
Block 1	2.5	2.5	63	2.5	17.63	0	0	1	1	2
Block 2	2.5	2.5	2.5	2.5	2.50	0	0	1	0	1
Block 3	2.5	2.5	2.5	2.5	2.50	0	0	1	0	1
Block 4	2.5	2.5	2.5	2.5	2.50	0	0	0	0	0
Block 5	2.5	2.5	2.5	2.5	2.50	0	0	1	0	1
average	2.5	2.5	14.6	2.5	5.53	0	0	0.8	0.2	1

Date	9/15/2011									
Site ID	7									
	midpt cover	midpt cover	midpt cover	midpt cover	avg. midpt	# shrub	# grass	# forb	# succ	total # sp.
Block 1	2.5	2.5	63	2.5	17.63	0	0	2	0	2
Block 2	38	2.5	2.5	2.5	11.38	1	0	2	1	4
Block 3	2.5	2.5	2.5	2.5	2.50	0	0	1	0	1
Block 4	15	63	2.5	2.5	20.75	0	0	1	0	1
Block 5	2.5	2.5	2.5	2.5	2.50	0	1	0	0	1
average	12.1	14.6	14.6	2.5	10.95	0.2	0.2	1.2	0.2	1.8

Date	9/15/2011									
Site ID	2		bedrock							
	midpt cover	midpt cover	midpt cover	midpt cover	avg. midpt	# shrub	# grass	# forb	# succ	total # sp.
Block 1	98	2.5	2.5	2.5	26.38	0	0	1	0	1
Block 2	2.5	2.5	2.5	2.5	2.50	0	0	0	0	0
Block 3	2.5	2.5	2.5	2.5	2.50	0	0	0	0	0
Block 4	2.5	15	2.5	2.5	5.63	0	0	1	0	1
Block 5	2.5	2.5	2.5	2.5	2.50	0	0	0	0	0
average	21.6	5	2.5	2.5	7.90	0	0	0.4	0	0.4

2012 Wildlife Habitat Data (page 1)

Date 8/30/2012
Site ID STS-RWU-2012-B1
Exposed
Bedrock 75%

Investigators: Carolyn Meyer, Pam Pinson, Phil Harrigan
Photos: 100-0314 (last)

TOTAL COVER					
	midpt cover	midpt cover	midpt cover	midpt cover	avg. midpt
Block 1	15	0	0	15	7.50
Block 2	0	0	15	0	3.75
Block 3	0	0	15	15	7.50
Block 4	98	98	0	0	49.00
Block 5	63	15	0	2.5	20.13
average	35.2	22.6	6.0	6.5	17.58

TREE COVER					
	midpt cover	midpt cover	midpt cover	midpt cover	avg. midpt
Block 1	2.5	0	2.5	0	1.25
Block 2	0	0	0	0	0.00
Block 3	0	0	0	0	0.00
Block 4	98	98	0	0	49.00
Block 5	63	0	0	0	15.75
average	32.7	19.6	0.5	0	13.20

SHRUB COVER					
	midpt cover	midpt cover	midpt cover	midpt cover	avg. midpt
Block 1	0	0	0	0	0.00
Block 2	0	0	0	0	0.00
Block 3	0	0	0	0	0.00
Block 4	0	0	0	0	0.00
Block 5	0	0	0	0	0.00
average	0	0	0	0	0.00

GRASS COVER					
	midpt cover	midpt cover	midpt cover	midpt cover	avg. midpt
Block 1	0	0	0	0	0.00
Block 2	0	15	0	0	3.75
Block 3	0	0	15	15	7.50
Block 4	0	0	0	0	0.00
Block 5	0	15	0	0	3.75
average	0	6	3	3	3.00

FORB COVER					
	midpt cover	midpt cover	midpt cover	midpt cover	avg. midpt
Block 1	0	0	0	0	0.00
Block 2	0	0	0	0	0.00
Block 3	0	0	0	0	0.00
Block 4	0	0	0	0	0.00
Block 5	0	0	0	2.5	0.63
average	0	0	0	0.5	0.13

SUCCULENT COVER					
	midpt cover	midpt cover	midpt cover	midpt cover	avg. midpt
Block 1	0	0	0	0	0.00
Block 2	0	0	0	0	0.00
Block 3	0	0	0	0	0.00
Block 4	0	15	0	0	3.75
Block 5	0	0	0	0	0.00
average	0	3	0	0	0.75

RICHNESS (# species/block)				
	Grasses	Forbs	Succulents	Shrubs/Trees
Block 1	1	1	1	2
Block 2	1	0	1	1
Block 3	0	0	2	2
Block 4	0	0	1	1
Block 5	1	0	1	1

Wildlife Habitat Data

Date 8/30/2012
Site ID STS-RWU-2012-B2
Exposed
Bedrock 85%

Investigators: Carolyn Meyer, Pam Pinson, Phil Harrigan

TOTAL COVER					
	midpt cover	midpt cover	midpt cover	midpt cover	avg. midpt
Block 1	15	15	0	0	7.50
Block 2	2.5	0	0	0	0.63
Block 3	0	0	0	0	0.00
Block 4	0	0	0	0	0.00
Block 5	0	2.5	15	0	4.38
average	3.5	3.5	3.0	0.0	2.50

TREE COVER					
	midpt cover	midpt cover	midpt cover	midpt cover	avg. midpt
Block 1	0	0	0	0	0.00
Block 2	0	0	0	0	0.00
Block 3	0	0	0	0	0.00
Block 4	0	0	0	0	0.00
Block 5	0	0	0	0	0.00
average	0	0	0	0	0.00

SHRUB COVER					
	midpt cover	midpt cover	midpt cover	midpt cover	avg. midpt
Block 1	2.5	0	0	0	0.63
Block 2	0	0	0	0	0.00
Block 3	0	0	0	0	0.00
Block 4	0	0	0	0	0.00
Block 5	0	2.5	0	0	0.63
average	0.5	0.5	0	0	0.25

GRASS COVER					
	midpt cover	midpt cover	midpt cover	midpt cover	avg. midpt
Block 1	15	15	0	0	7.50
Block 2	0	0	0	0	0.00
Block 3	0	0	0	0	0.00
Block 4	0	0	0	0	0.00
Block 5	0	2.5	15	0	4.38
average	3	3.5	3	0	2.38

FORB COVER					
	midpt cover	midpt cover	midpt cover	midpt cover	avg. midpt
Block 1	0	0	0	0	0.00
Block 2	0	0	0	0	0.00
Block 3	0	0	0	0	0.00
Block 4	0	0	0	0	0.00
Block 5	0	0	0	0	0.00
average	0	0	0	0	0.00

SUCCULENT COVER					
	midpt cover	midpt cover	midpt cover	midpt cover	avg. midpt
Block 1	15	2.5	0	0	4.38
Block 2	2.5	0	0	0	0.63
Block 3	0	0	0	0	0.00
Block 4	0	0	0	0	0.00
Block 5	0	0	0	0	0.00
average	3.5	0.5	0	0	1.00

RICHNESS (# species/block)				
	Grasses	Forbs	Succulents	Shrubs/Trees
Block 1	1	1	1	1
Block 2	1	1	1	1
Block 3	1	2	2	3
Block 4	1	0	1	2
Block 5	1	1	1	2

2012 Wildlife Habitat Data (page 2)

Date 8/30/2012 Investigators: Carolyn Meyer, Pam Pinson, Alicia Fogg, Phil Harrigan
Site ID STS-RWU-2012-B3
Exposed
Bedrock 93%

TOTAL COVER					
	midpt cover	midpt cover	midpt cover	midpt cover	avg. midpt
Block 1	0	2.5	0	0	0.63
Block 2	0	0	0	0	0.00
Block 3	2.5	0	0	63	16.38
Block 4	0	0	0	0	0.00
Block 5	0	0	0	0	0.00
average	0.5	0.5	0.0	12.6	3.40

TREE COVER					
	midpt cover	midpt cover	midpt cover	midpt cover	avg. midpt
Block 1	0	0	0	0	0.00
Block 2	0	0	0	0	0.00
Block 3	2.5	0	0	63	16.38
Block 4	0	0	0	0	0.00
Block 5	0	0	0	0	0.00
average	0.5	0	0	12.6	3.28

SHRUB COVER					
	midpt cover	midpt cover	midpt cover	midpt cover	avg. midpt
Block 1	0	2.5	0	0	0.63
Block 2	0	0	0	0	0.00
Block 3	0	0	0	0	0.00
Block 4	0	0	0	0	0.00
Block 5	0	0	0	0	0.00
average	0	0.5	0	0	0.13

GRASS COVER					
	midpt cover	midpt cover	midpt cover	midpt cover	avg. midpt
Block 1	0	0	0	0	0.00
Block 2	0	0	0	0	0.00
Block 3	0	0	0	0	0.00
Block 4	0	0	0	0	0.00
Block 5	0	0	0	0	0.00
average	0	0	0	0	0.00

FORB COVER					
	midpt cover	midpt cover	midpt cover	midpt cover	avg. midpt
Block 1	0	0	0	0	0.00
Block 2	0	0	0	0	0.00
Block 3	0	0	0	0	0.00
Block 4	0	0	0	0	0.00
Block 5	0	0	0	0	0.00
average	0	0	0	0	0.00

SUCCULENT COVER					
	midpt cover	midpt cover	midpt cover	midpt cover	avg. midpt
Block 1	0	0	0	0	0.00
Block 2	0	0	0	0	0.00
Block 3	0	0	0	0	0.00
Block 4	0	0	0	0	0.00
Block 5	0	0	0	0	0.00
average	0	0	0	0	0.00

RICHNESS (# species/block)				
	Grasses	Forbs	Succulents	Shrubs/Trees
Block 1	2	0	0	1
Block 2	0	0	0	0
Block 3	1	1	1	2
Block 4	1	0	1	2
Block 5	0	0	0	1

2014 Wildlife Habitat Data (page 1)

Date 9/24/2014
Site ID STS-PT-2013-1
Exposed
Bedrock 0%

Investigators: PP, CM, JA, MS
Photo: 3313-3314

TOTAL COVER					
	midpt cover	midpt cover	midpt cover	midpt cover	avg. midpt
Block 1	0	2.5	15	63	20.13
Block 2	15	38	38	63	38.50
Block 3	0	2.5	2.5	2.5	1.88
Block 4	63	15	63	2.5	35.88
Block 5	38	85	38	85	61.50
average	23.2	28.6	31.3	43.2	31.58

TREE/SHRUB COVER					
	midpt cover	midpt cover	midpt cover	midpt cover	avg. midpt
Block 1	0	0	15	63	19.50
Block 2	15	38	38	63	38.50
Block 3	0	0	0	2.5	0.63
Block 4	63	15	63	0	35.25
Block 5	38	85	38	85	61.50
average	23.2	27.6	30.8	42.7	31.08

GRASS COVER					
	midpt cover	midpt cover	midpt cover	midpt cover	avg. midpt
Block 1	0	0	0	0	0.00
Block 2	0	0	0	0	0.00
Block 3	0	0	0	0	0.00
Block 4	0	0	0	0	0.00
Block 5	0	0	0	0	0.00
average	0.0	0.0	0.0	0.0	0.00

FORB COVER					
	midpt cover	midpt cover	midpt cover	midpt cover	avg. midpt
Block 1	0	2.5	0	0	0.63
Block 2	0	2.5	0	2.5	1.25
Block 3	0	2.5	2.5	2.5	1.88
Block 4	2.5	2.5	2.5	2.5	2.50
Block 5	0	0	2.5	2.5	1.25
average	0.5	2.0	1.5	2.0	1.50

CACTUS COVER					
	midpt cover	midpt cover	midpt cover	midpt cover	avg. midpt
Block 1	0	0	0	0	0.00
Block 2	0	0	0	0	0.00
Block 3	0	0	0	0	0.00
Block 4	0	0	0	0	0.00
Block 5	0	0	0	0	0.00
average	0.0	0.0	0.0	0.0	0.00

RICHNESS # of Species					
	#Tree/Shru	# Grass	# Forb	# Cactus	# Species in block
Block 1	1	1	1	0	3
Block 2	1	0	3	1	5
Block 3	1	0	1	0	2
Block 4	1	1	1	1	4
Block 5	1	0	2	0	3
average	1.0	0.4	1.6	0.4	3.4

Wildlife Habitat Data

Date 9/23/2014
Site ID STS-PT-2013-20
Exposed
Bedrock 0%

Investigators CM, Matt Schultz, PP, JA
Photo: 3294-3295

TOTAL COVER					
	midpt cover	midpt cover	midpt cover	midpt cover	avg. midpt
Block 1	15	15	15	15	15.00
Block 2	15	15	15	15	15.00
Block 3	63	15	15	38	32.75
Block 4	15	38	38	15	26.50
Block 5	15	38	38	38	32.25
average	24.6	24.2	24.2	24.2	24.30

TREE/SHRUB COVER					
	midpt cover	midpt cover	midpt cover	midpt cover	avg. midpt
Block 1	2.5	2.5	2.5	2.5	2.50
Block 2	2.5	2.5	2.5	2.5	2.50
Block 3	2.5	2.5	2.5	2.5	2.50
Block 4	0	0	0	0	0.00
Block 5	0	2.5	2.5	0	1.25
average	1.5	2.0	2.0	1.5	1.75

GRASS COVER					
	midpt cover	midpt cover	midpt cover	midpt cover	avg. midpt
Block 1	15	15	15	15	15.00
Block 2	15	15	15	15	15.00
Block 3	63	15	15	38	32.75
Block 4	15	38	15	15	20.75
Block 5	15	15	38	38	26.50
average	24.6	19.6	19.6	24.2	22.00

FORB COVER					
	midpt cover	midpt cover	midpt cover	midpt cover	avg. midpt
Block 1	2.5	15	15	2.5	8.75
Block 2	15	2.5	2.5	2.5	5.63
Block 3	15	2.5	2.5	15	8.75
Block 4	2.5	2.5	15	2.5	5.63
Block 5	15	15	2.5	2.5	8.75
average	10.0	7.5	7.5	5.0	7.50

CACTUS COVER					
	midpt cover	midpt cover	midpt cover	midpt cover	avg. midpt
Block 1	0	0	0	0	0.00
Block 2	0	0	0	0	0.00
Block 3	0	0	0	0	0.00
Block 4	0	0	2.5	0	0.63
Block 5	0	0	0	0	0.00
average	0.0	0.0	0.5	0.0	0.13

RICHNESS # of Species					
	#Tree/Shru	# Grass	# Forb	# Cactus	# Species in block
Block 1	2	3	7	1	13
Block 2	3	2	6	0	11
Block 3	2	4	6	0	12
Block 4	2	5	6	2	15
Block 5	2	5	6	0	13
average	2.2	3.8	6.2	0.6	12.8

2014 Wildlife Habitat Data (page 2)

Date 9/23/2014
Site ID STS-PT-2013-12
Exposed
Bedrock 85%

Investigators CM, Matt Schultz, PP, JA
Photo: 3281-3284

TOTAL COVER					
	midpt cover	midpt cover	midpt cover	midpt cover	avg. midpt
Block 1	100	2.5	100	38	60.13
Block 2	38	0	63	15	29.00
Block 3	0	0	0	38	9.50
Block 4	0	0	0	0	0.00
Block 5	0	0	0	0	0.00
average	27.6	0.5	32.6	18.2	19.73

RICHNESS # of Species					
	#Tree/Shrub	# Grass	# Forb	# Cactus	# Species in block
Block 1	6	6	4	0	16
Block 2	2	5	0	1	8
Block 3	0	0	3	0	3
Block 4	0	0	0	0	0
Block 5	1	5	2	1	9
average	1.8	3.2	1.8	0.4	7.2

TREE/SHRUB COVER					
	midpt cover	midpt cover	midpt cover	midpt cover	avg. midpt
Block 1	100	0	100	2.5	50.63
Block 2	0	0	0	0	0.00
Block 3	0	0	0	0	0.00
Block 4	0	0	0	0	0.00
Block 5	0	0	0	0	0.00
average	20.0	0.0	20.0	0.5	10.13

GRASS COVER					
	midpt cover	midpt cover	midpt cover	midpt cover	avg. midpt
Block 1	0	2.5	15	38	13.88
Block 2	38	0	63	15	29.00
Block 3	0	0	0	38	9.50
Block 4	0	0	0	0	0.00
Block 5	0	0	0	0	0.00
average	7.6	0.5	15.6	18.2	10.48

FORB COVER					
	midpt cover	midpt cover	midpt cover	midpt cover	avg. midpt
Block 1	0	0	38	2.5	10.13
Block 2	2.5	0	0	0	0.63
Block 3	0	0	0	0	0.00
Block 4	0	0	0	0	0.00
Block 5	0	0	0	0	0.00
average	0.5	0.0	7.6	0.5	2.15

CACTUS COVER					
	midpt cover	midpt cover	midpt cover	midpt cover	avg. midpt
Block 1	0	0	0	0	0.00
Block 2	0	0	0	0	0.00
Block 3	0	0	0	0	0.00
Block 4	0	0	0	0	0.00
Block 5	0	0	0	0	0.00
average	0.0	0.0	0.0	0.0	0.00

Wildlife Habitat Data

Date 9/24/2014
Site ID STS-PT-2013-2
Exposed
Bedrock 0%

Investigators CM, Matt Schultz, PP, JA
Photo: 3297-3300

TOTAL COVER					
	midpt cover	midpt cover	midpt cover	midpt cover	avg. midpt
Block 1	15	85	0	63	40.75
Block 2	63	15	0	38	29.00
Block 3	38	63	15	38	38.50
Block 4	15	15	15	15	15.00
Block 5	63	38	2.5	15	29.63
average	38.8	43.2	6.5	33.8	30.58

RICHNESS # of Species					
	#Tree/Shru	# Grass	# Forb	# Cactus	# Species in block
Block 1	1	1	1	0	3
Block 2	1	0	1	0	1
Block 3	2	0	4	0	6
Block 4	1	2	8	0	11
Block 5	1	2	2	0	5
average	1.2	1.0	3.2	0.0	5.2

TREE/SHRUB COVER					
	midpt cover	midpt cover	midpt cover	midpt cover	avg. midpt
Block 1	15	85	0	63	40.75
Block 2	63	15	0	38	29.00
Block 3	38	63	15	38	38.50
Block 4	15	2.5	2.5	15	8.75
Block 5	63	38	2.5	15	29.63
average	38.8	40.7	4.0	33.8	29.33

GRASS COVER					
	midpt cover	midpt cover	midpt cover	midpt cover	avg. midpt
Block 1	0	0	0	0	0.00
Block 2	0	0	0	0	0.00
Block 3	0	0	0	0	0.00
Block 4	15	15	15	15	15.00
Block 5	0	0	0	0	0.00
average	3.0	3.0	3.0	3.0	3.00

FORB COVER					
	midpt cover	midpt cover	midpt cover	midpt cover	avg. midpt
Block 1	0	0	0	0	0.00
Block 2	0	0	0	0	0.00
Block 3	0	0	2.5	0	0.63
Block 4	2.5	15	2.5	0	5.00
Block 5	2.5	0	0	2.5	1.25
average	1.0	3.0	1.0	0.5	1.38

CACTUS COVER					
	midpt cover	midpt cover	midpt cover	midpt cover	avg. midpt
Block 1	0	0	0	0	0.00
Block 2	0	0	0	0	0.00
Block 3	0	0	0	0	0.00
Block 4	0	0	0	0	0.00
Block 5	0	0	0	0	0.00
average	0.0	0.0	0.0	0.0	0.00

2014 Wildlife Habitat Data (page 3)

Date 9/25/2014
Site ID STS-PT-2013-5
Exposed
Bedrock 25%

Investigators CM, Matt Schultz, PP, JA
Photo: 3371-3374

TOTAL COVER					
	midpt cover	midpt cover	midpt cover	midpt cover	avg. midpt
Block 1	2.5	2.5	38	38	20.25
Block 2	38	63	38	38	44.25
Block 3	15	38	15	63	32.75
Block 4	85	63	15	85	62.00
Block 5	63	15	2.5	38	29.63
average	40.7	36.3	21.7	52.4	37.78

RICHNESS # of Species					
	#Tree/Shrub	# Grass	# Forb	# Cactus	# Species in block
Block 1	2	3	3	2	10
Block 2	2	1	2	2	7
Block 3	3	2	3	1	9
Block 4	3	1	3	1	8
Block 5	3	2	3	1	9
average	2.6	1.8	2.8	1.4	8.6

TREE/SHRUB COVER					
	midpt cover	midpt cover	midpt cover	midpt cover	avg. midpt
Block 1	0	0	0	38	9.50
Block 2	38	15	15	2.5	17.63
Block 3	15	15	2.5	63	23.88
Block 4	85	38	15	15	38.25
Block 5	15	15	2.5	15	11.88
average	30.6	16.6	7.0	26.7	20.23

GRASS COVER					
	midpt cover	midpt cover	midpt cover	midpt cover	avg. midpt
Block 1	2.5	2.5	0	0	1.25
Block 2	0	0	15	2.5	4.38
Block 3	2.5	2.5	15	0	5.00
Block 4	0	15	15	0	7.50
Block 5	0	0	0	0	0.00
average	1.0	4.0	9.0	0.5	3.63

FORB COVER					
	midpt cover	midpt cover	midpt cover	midpt cover	avg. midpt
Block 1	2.5	2.5	0	0	1.25
Block 2	0	0	0	0	0.00
Block 3	0	2.5	2.5	2.5	1.88
Block 4	0	0	0	2.5	0.63
Block 5	2.5	0	0	0	0.63
average	1.0	1.0	0.5	1.0	0.88

CACTUS COVER					
	midpt cover	midpt cover	midpt cover	midpt cover	avg. midpt
Block 1	2.5	2.5	38	0	10.75
Block 2	0	63	0	38	25.25
Block 3	0	38	0	15	13.25
Block 4	0	0	0	63	15.75
Block 5	63	15	0	15	23.25
average	13.1	23.7	7.6	26.2	17.65

Wildlife Habitat Data

Date 9/24/2014
Site ID STS-PT-2013-9
Exposed
Bedrock 60%

Investigators CM, Matt Schultz, PP, JA
Photo: 3342-3344

TOTAL COVER					
	midpt cover	midpt cover	midpt cover	midpt cover	avg. midpt
Block 1	0	0	0	0	0.00
Block 2	0	0	0	0	0.00
Block 3	0	0	2.5	0	0.63
Block 4	0	0	0	0	0.00
Block 5	98	0	0	0	24.50
average	19.6	0.0	0.5	0.0	5.03

RICHNESS # of Species					
	#Tree/Shrul	# Grass	# Forb	# Cactus	# Species in block
Block 1	0	0	1	1	2
Block 2	0	0	1	0	1
Block 3	1	0	1	0	2
Block 4	1	0	1	0	2
Block 5	1	0	1	0	2
average	0.6	0.0	1.0	0.2	1.8

TREE/SHRUB COVER					
	midpt cover	midpt cover	midpt cover	midpt cover	avg. midpt
Block 1	0	0	0	0	0.00
Block 2	0	0	0	0	0.00
Block 3	0	0	0	0	0.00
Block 4	0	0	0	0	0.00
Block 5	98	0	0	0	24.50
average	19.6	0.0	0.0	0.0	4.90

GRASS COVER					
	midpt cover	midpt cover	midpt cover	midpt cover	avg. midpt
Block 1	0	0	0	0	0.00
Block 2	0	0	0	0	0.00
Block 3	0	0	0	0	0.00
Block 4	0	0	0	0	0.00
Block 5	0	0	0	0	0.00
average	0.0	0.0	0.0	0.0	0.00

FORB COVER					
	midpt cover	midpt cover	midpt cover	midpt cover	avg. midpt
Block 1	0	0	0	0	0.00
Block 2	0	0	0	0	0.00
Block 3	0	0	2.5	0	0.63
Block 4	0	0	0	0	0.00
Block 5	0	0	0	0	0.00
average	0.0	0.0	0.5	0.0	0.13

CACTUS COVER					
	midpt cover	midpt cover	midpt cover	midpt cover	avg. midpt
Block 1	0	0	0	0	0.00
Block 2	0	0	0	0	0.00
Block 3	0	0	0	0	0.00
Block 4	0	0	0	0	0.00
Block 5	0	0	0	0	0.00
average	0.0	0.0	0.0	0.0	0.00

2014 Wildlife Habitat Data (page 4)

Date 9/24/2014
Site ID STS-PT-2013-19
Exposed
Bedrock 67%

Investigators CM, Matt Schultz, PP, JA
Photo: 3323-3327

TOTAL COVER					
	midpt cover	midpt cover	midpt cover	midpt cover	avg. midpt
Block 1	2.5	2.5	2.5	2.5	2.50
Block 2	2.5	2.5	15	0	5.00
Block 3	15	2.5	0	0	4.38
Block 4	2.5	0	2.5	0	1.25
Block 5	2.5	0	38	0	10.13
average	5.0	1.5	11.6	0.5	4.65

TREE/SHRUB COVER					
	midpt cover	midpt cover	midpt cover	midpt cover	avg. midpt
Block 1	2.5	2.5	2.5	2.5	2.50
Block 2	2.5	0	15	0	4.38
Block 3	2.5	0	0	0	0.63
Block 4	0	0	0	0	0.00
Block 5	0	0	38	0	9.50
average	1.5	0.5	11.1	0.5	3.40

GRASS COVER					
	midpt cover	midpt cover	midpt cover	midpt cover	avg. midpt
Block 1	0	0	0	0	0.00
Block 2	0	0	0	0	0.00
Block 3	0	0	0	0	0.00
Block 4	0	0	0	0	0.00
Block 5	0	0	0	0	0.00
average	0.0	0.0	0.0	0.0	0.00

FORB COVER					
	midpt cover	midpt cover	midpt cover	midpt cover	avg. midpt
Block 1	2.5	0	0	2.5	1.25
Block 2	0	2.5	0	0	0.63
Block 3	2.5	2.5	0	0	1.25
Block 4	2.5	0	2.5	0	1.25
Block 5	2.5	0	0	0	0.63
average	2.0	1.0	0.5	0.5	1.00

CACTUS COVER					
	midpt cover	midpt cover	midpt cover	midpt cover	avg. midpt
Block 1	0	0	0	0	0.00
Block 2	0	0	0	0	0.00
Block 3	0	0	0	0	0.00
Block 4	0	0	0	0	0.00
Block 5	0	0	0	0	0.00
average	0.0	0.0	0.0	0.0	0.00

RICHNESS # of Species					
	#Tree/Shrul	# Grass	# Forb	# Cactus	# Species in block
Block 1	4	0	3	1	8
Block 2	3	0	0	1	4
Block 3	3	0	2	0	5
Block 4	0	0	2	0	2
Block 5	1	1	1	0	3
average	2.2	0.2	1.6	0.4	4.4

Wildlife Habitat Data

Date 9/24/2014
Site ID STS-PT-2013-17
Exposed
Bedrock 0%

Investigators: CM, Matt Schultz, PP, JA
Photo: 3302-3304

TOTAL COVER					
	midpt cover	midpt cover	midpt cover	midpt cover	avg. midpt
Block 1	0	2.5	2.5	63	17.00
Block 2	2.5	15	2.5	2.5	5.63
Block 3	63	38	15	2.5	29.63
Block 4	15	38	15	38	26.50
Block 5	2.5	15	38	2.5	14.50
average	16.6	21.7	14.6	21.7	18.65

TREE/SHRUB COVER					
	midpt cover	midpt cover	midpt cover	midpt cover	avg. midpt
Block 1	0	2.5	2.5	63	17.00
Block 2	2.5	15	2.5	2.5	5.63
Block 3	63	38	15	2.5	29.63
Block 4	15	38	15	38	26.50
Block 5	0	15	38	2.5	13.88
average	16.1	21.7	14.6	21.7	18.53

GRASS COVER					
	midpt cover	midpt cover	midpt cover	midpt cover	avg. midpt
Block 1	0	0	0	0	0.00
Block 2	0	0	0	0	0.00
Block 3	0	0	0	2.5	0.63
Block 4	0	0	2.5	0	0.63
Block 5	2.5	2.5	2.5	0	1.88
average	0.5	0.5	1.0	0.5	0.63

FORB COVER					
	midpt cover	midpt cover	midpt cover	midpt cover	avg. midpt
Block 1	0	2.5	0	0	0.63
Block 2	2.5	0	0	0	0.63
Block 3	2.5	0	2.5	2.5	1.88
Block 4	0	0	2.5	0	0.63
Block 5	0	15	2.5	0	4.38
average	1.0	3.5	1.5	0.5	1.63

CACTUS COVER					
	midpt cover	midpt cover	midpt cover	midpt cover	avg. midpt
Block 1	0	0	0	0	0.00
Block 2	0	0	0	0	0.00
Block 3	0	0	0	0	0.00
Block 4	0	0	0	0	0.00
Block 5	0	0	0	0	0.00
average	0.0	0.0	0.0	0.0	0.00

RICHNESS # of Species					
	#Tree/Shrul	# Grass	# Forb	# Cactus	# Species in block
Block 1	1	0	1	0	2
Block 2	1	0	1	0	2
Block 3	1	2	5	0	8
Block 4	3	2	4	0	9
Block 5	2	2	4	0	8
average	1.6	1.2	3.0	0.0	5.8

2014 Wildlife Habitat Data (page 5)

Date 9/25/2014
Site ID STS-PT-2013-26
Exposed
Bedrock 0%

Investigators CM, Matt Schultz, PP, JA
Photo: 3384-3388

TOTAL COVER					
	midpt cover	midpt cover	midpt cover	midpt cover	avg. midpt
Block 1	15	38	85	63	50.25
Block 2	15	15	15	38	20.75
Block 3	15	38	15	15	20.75
Block 4	38	85	38	85	61.50
Block 5	38	38	38	15	32.25
average	24.2	42.8	38.2	43.2	37.10
TREE/SHRUB COVER					
	midpt cover	midpt cover	midpt cover	midpt cover	avg. midpt
Block 1	0	0	85	2.5	21.88
Block 2	0	2.5	2.5	38	10.75
Block 3	2.5	0	0	0	0.63
Block 4	15	85	15	15	32.50
Block 5	0	0	15	0	3.75
average	3.5	17.5	23.5	11.1	13.90
GRASS COVER					
	midpt cover	midpt cover	midpt cover	midpt cover	avg. midpt
Block 1	15	2.5	0	63	20.13
Block 2	15	2.5	2.5	0	5.00
Block 3	15	15	15	15	15.00
Block 4	15	0	15	85	28.75
Block 5	15	2.5	15	15	11.88
average	15.0	4.5	9.5	35.6	16.15
FORB COVER					
	midpt cover	midpt cover	midpt cover	midpt cover	avg. midpt
Block 1	15	15	15	2.5	11.88
Block 2	15	15	15	15	15.00
Block 3	15	15	15	15	15.00
Block 4	15	15	15	2.5	11.88
Block 5	15	15	15	15	15.00
average	15.0	15.0	15.0	10.0	13.75
CACTUS COVER					
	midpt cover	midpt cover	midpt cover	midpt cover	avg. midpt
Block 1	0	0	0	0	0.00
Block 2	0	0	0	0	0.00
Block 3	0	0	0	0	0.00
Block 4	0	0	0	0	0.00
Block 5	0	0	0	0	0.00
average	0.0	0.0	0.0	0.0	0.00

RICHNESS # of Species					
	#Tree/Shrub	# Grass	# Forb	# Cactus	# Species in block
Block 1	1	7	8	0	16
Block 2	1	6	7	0	14
Block 3	1	7	9	0	17
Block 4	1	7	6	0	14
Block 5	1	8	9	0	18
average	1.0	7.0	7.8	0.0	15.8

Wildlife Habitat Data

Date 9/23/2014
Site ID Wildlife Reference plot S
Exposed
Bedrock 0%

Investigators CM, Matt Schultz, PP, JA
Photo: 3384-3388

TOTAL COVER					
	midpt cover	midpt cover	midpt cover	midpt cover	avg. midpt
Block 1	15	15	38	38	26.50
Block 2	85	63	15	15	44.50
Block 3	38	15	38	63	38.50
Block 4	63	38	15	98	53.50
Block 5	38	15	15	15	20.75
average	47.8	29.2	24.2	45.8	36.75
TREE/SHRUB COVER					
	midpt cover	midpt cover	midpt cover	midpt cover	avg. midpt
Block 1	15	15	0	15	11.25
Block 2	85	38	15	15	38.25
Block 3	38	0	15	15	17.00
Block 4	15	15	15	85	32.50
Block 5	38	0	2.5	15	13.88
average	38.2	13.6	9.5	29.0	22.58
GRASS COVER					
	midpt cover	midpt cover	midpt cover	midpt cover	avg. midpt
Block 1	15	2.5	38	15	17.63
Block 2	0	15	15	0	7.50
Block 3	2.5	15	15	15	11.88
Block 4	2.5	2.5	2.5	38	11.38
Block 5	2.5	15	0	15	8.13
average	4.5	10.0	14.1	16.6	11.30
FORB COVER					
	midpt cover	midpt cover	midpt cover	midpt cover	avg. midpt
Block 1	2.5	2.5	15	2.5	5.63
Block 2	2.5	2.5	0	15	5.00
Block 3	0	15	15	15	11.25
Block 4	15	15	15	0	11.25
Block 5	0	2.5	15	0	4.38
average	4.0	7.5	12.0	6.5	7.50
CACTUS COVER					
	midpt cover	midpt cover	midpt cover	midpt cover	avg. midpt
Block 1	0	0	0	0	0.00
Block 2	0	0	0	0	0.00
Block 3	0	2.5	0	0	0.63
Block 4	0	0	0	0	0.00
Block 5	0	0	0	0	0.00
average	0.0	0.5	0.0	0.0	0.13

RICHNESS # of Species					
	#Tree/Shrub	# Grass	# Forb	# Cactus	# Species in block
Block 1	3	6	8	1	18
Block 2	3	5	3	1	12
Block 3	2	6	4	1	13
Block 4	3	6	6	0	15
Block 5	3	5	5	0	13
average	2.8	5.6	5.2	0.6	14.2

2014 Wildlife Habitat Data (page 6)

Date 9/23/2014
Investigators CM, Matt Schultz, PP, JA
Site ID STS-PT-2013-Reference plot N
Photo: 3278-3279
Exposed Bedrock 0%

TOTAL COVER					
	midpt cover	midpt cover	midpt cover	midpt cover	avg. midpt
Block 1	38	15	38	85	44.00
Block 2	15	63	15	15	27.00
Block 3	15	15	15	63	27.00
Block 4	38	63	15	15	32.75
Block 5	15	15	15	38	20.75
average	24.2	34.2	19.6	43.2	30.30
TREE/SHRUB COVER					
	midpt cover	midpt cover	midpt cover	midpt cover	avg. midpt
Block 1	15	15	15	2.5	11.88
Block 2	15	63	2.5	2.5	20.75
Block 3	15	2.5	15	63	23.88
Block 4	38	63	2.5	2.5	26.50
Block 5	2.5	15	2.5	15	8.75
average	17.1	31.7	7.5	17.1	18.35
GRASS COVER					
	midpt cover	midpt cover	midpt cover	midpt cover	avg. midpt
Block 1	15	2.5	38	85	35.13
Block 2	2.5	2.5	15	15	8.75
Block 3	15	15	0	2.5	8.13
Block 4	2.5	2.5	15	15	8.75
Block 5	15	2.5	15	15	11.88
average	10.0	5.0	16.6	26.5	14.53
FORB COVER					
	midpt cover	midpt cover	midpt cover	midpt cover	avg. midpt
Block 1	15	2.5	2.5	2.5	5.63
Block 2	2.5	2.5	2.5	15	5.63
Block 3	15	2.5	15	2.5	8.75
Block 4	2.5	2.5	2.5	2.5	2.50
Block 5	2.5	15	15	2.5	8.75
average	7.5	5.0	7.5	5.0	6.25
CACTUS COVER					
	midpt cover	midpt cover	midpt cover	midpt cover	avg. midpt
Block 1	0	0	0	0	0.00
Block 2	0	0	0	0	0.00
Block 3	0	0	0	0	0.00
Block 4	0	0	0	0	0.00
Block 5	0	0	0	0	0.00
average	0.0	0.0	0.0	0.0	0.00

# of Species

	#Tree/Shrub	# Grass	# Forb	# Cactus	# Species in block
Block 1	4	4	2	0	10
Block 2	3	2	2	0	7
Block 3	3	4	4	0	11
Block 4	3	6	3	0	12
Block 5	3	5	3	0	11
average	3.2	4.2	2.8	0.0	10.2

Rangeland Health Evaluation Summary Worksheet

Part 1. Area of Interest Documentation

Location Sck #1

UTM Coord

Rpm

Picture # Description

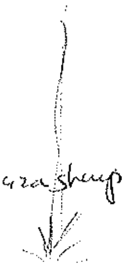
934 - 744

Date/Time: 9-15-11
Observer Carolyn Meyer, Joe Allen
Soil Map Unit Name
Veg Alliance Name
Surface texture
Parent material
Slope %
Elevation (ft)
Topographic position
Aspect

Signs of Disturbance(s) observed

OAT score of 200-m transect 12
OAT score of polygon 12

3



Notes: Dominant

Oak + rock outcrop

Some Yuccas

1 forb
1 tall grass } that's it!

Site 1 Cuy

Criteria used to score Observed Apparent Trend (OAT). ***Check appropriate box in each category which best fits area being observed. Points may vary within each category.***

how do you score plants

☐ **VIGOR** (10 points)	Desirable grasses, forbs and shrubs are vigorous, showing good health. These plants have good size, color, and produce abundant herbage.
☐ (6 points) 7	Desirable grasses, forbs and shrubs have moderate vigor. They are medium size with fair color, and produce moderate amounts of herbage. Some seed stalks and seed heads are present.
☐ (2 points)	Desirable grasses, forbs and shrubs have low vigor. They appear unhealthy with small size and poor color. Portions of clumps or entire plants are dead or dying. Seed stalks and seed heads are non-existent, except in protected areas.
☐ **SEEDLINGS** (10 points)	There is seedling establishment of desirable grasses, forbs and shrubs. Seedlings are present in open spaces between plants and along edges of soil pedestals. Few seedlings of invader or undesirable plants are present.
☐ (6 points)	Some seedlings of desirable grasses, forbs and shrubs may or may not be present in open spaces between plants. Some seedlings of invader or undesirable plant species may or may not be present.
☐ (2 points) NA	Few if any seedlings of desirable grasses, forbs and shrubs are being established. Seedlings of invader or undesirable plants are present in open spaces between plants.
☐ **SURFACE LITTER** (5 points)	Surface litter is accumulating in place.
☐ (3 points) 2	Moderate movement of surface litter is apparent and deposited against obstacles.
☐ (1 point)	Very little surface litter is remaining.
☐ **PEDESTALS** (5 points)	There is little visual evidence of pedestalling. Those pedestals present are sloping or rounding and accumulating litter. Desirable forage grasses may be found along edges of pedestals.
☐ (3 points)	There is moderate pedestalling with no visual evidence of healing or deterioration. Small rock and plant pedestals may be occurring in flow patterns.
☐ (1 point) 1	Most rocks and plants are pedestalled. Pedestals are sharp-sided and eroding, often exposing grass roots.
☐ **SURFACE CRUSTING** (5 points)	There is little visual evidence of surface crusting.
☐ (3 points)	There is moderate surface crusting, with no visual evidence of healing or deterioration. (Note reason for cause)
☐ (1 point) 1	Severe surface crusting. (Note reason for cause)
☐ **RILLS AND GULLIES** (5 points)	Gullies (including rills) may be present in stable condition, with moderate sloping or rounded sides. Perennials are establishing themselves on bottom and sides of channel.
☐ (3 points)	Gullies are well developed, with small amounts of active erosion. Some vegetation may be present.
☐ (1 point) 1	Sharply incised V-shaped gullies cover most of the area, with most of the gullies actively eroding. Gullies are mostly devoid of perennial plants. They have fresh cutting on the bottom.
TOTAL: 12 **FIELD NOTES:**	

Rangeland Health Evaluation Summary Worksheet

Part 1. Area of Interest Documentation

Location Site 2

UTM Coord

Picture #	Description
	779-783

Date/Time: 9/16/11
Observer Carolyn Meyer, Pam Pinson, Nick Lemme
Soil Map Unit Name
Veg Alliance Name
Surface texture
Parent material
Slope %
Elevation (ft)
Topographic position
Aspect

Signs of Disturbance(s) observed

Notes

OATS core Tx 8

OA~~T~~A score polygon 8

Site 2 – RWU

9/16/11

cm 2:40 pm

779 – 783 – as walk North
200-m

Dat – 8

Dormant – oak, some yucca – lots dead

cm

Site 2 9/16/11

Criteria used to score Observed Apparent Trend (OAT). ***Check appropriate box in each category which best fits area being observed. Points may vary within each category.***

☐ **VIGOR** (10 points)	Desirable grasses, forbs and shrubs are vigorous, showing good health. These plants have good size, color, and produce abundant herbage.
☐ (6 points)	Desirable grasses, forbs and shrubs have moderate vigor. They are medium size with fair color, and produce moderate amounts of herbage. Some seed stalks and seed heads are present.
☐ (2 points) 2	Desirable grasses, forbs and shrubs have low vigor. They appear unhealthy with small size and poor color. Portions of clumps or entire plants are dead or dying. Seed stalks and seed heads are non-existent, except in protected areas.
☐ **SEEDLINGS** (10 points)	There is seedling establishment of desirable grasses, forbs and shrubs. Seedlings are present in open spaces between plants and along edges of soil pedestals. Few seedlings of invader or undesirable plants are present.
☐ (6 points)	Some seedlings of desirable grasses, forbs and shrubs may or may not be present in open spaces between plants. Some seedlings of invader or undesirable plant species may or may not be present.
☐ (2 points) NA	Few if any seedlings of desirable grasses, forbs and shrubs are being established. Seedlings of invader or undesirable plants are present in open spaces between plants.
☐ **SURFACE LITTER** (5 points)	Surface litter is accumulating in place.
☐ (3 points)	Moderate movement of surface litter is apparent and deposited against obstacles.
☐ (1 point) 1	Very little surface litter is remaining.
☐ **PEDESTALS** (5 points)	There is little visual evidence of pedestalling. Those pedestals present are sloping or rounding and accumulating litter. Desirable forage grasses may be found along edges of pedestals.
☐ (3 points)	There is moderate pedestalling with no visual evidence of healing or deterioration. Small rock and plant pedestals may be occurring in flow patterns.
☐ (1 point) NA	Most rocks and plants are pedestalled. Pedestals are sharp-sided and eroding, often exposing grass roots.
☐ **SURFACE CRUSTING** (5 points)	There is little visual evidence of surface crusting.
☐ (3 points)	There is moderate surface crusting, with no visual evidence of healing or deterioration. (Note reason for cause)
☐ (1 point) 1	Severe surface crusting. (Note reason for cause)
☐ **RILLS AND GULLIES** (5 points)	Gullies (including rills) may be present in stable condition, with moderate sloping or rounded sides. Perennials are establishing themselves on bottom and sides of channel.
☐ (3 points) 4	Gullies are well developed, with small amounts of active erosion. Some vegetation may be present.
☐ (1 point)	Sharply incised V-shaped gullies cover most of the area, with most of the gullies actively eroding. Gullies are mostly devoid of perennial plants. They have fresh cutting on the bottom.
TOTAL: 8 **FIELD NOTES:**	moving sediment, litter mostly bedrock thin scattered yucca –

Rangeland Health Evaluation Summary Worksheet

Part 1. Area of Interest Documentation

Location site # 3

UTM Coord

Picture #	**Description**
	745-746

Date/Time: 9-15-11

Observer CM, [illegible], JA, [illegible]

Soil Map Unit Name

Veg Alliance Name

Surface texture

Parent material

Slope %

Elevation (ft)

Topographic position

Aspect

Signs of Disturbance(s) observed

OAT score of 200-m transect 24

OAT score of polygon 24

Notes:

dom.

Cat-claw - oak - some yucca

on Slope

Site 3 cm

Criteria used to score Observed Apparent Trend (OAT). ***Check appropriate box in each category which best fits area being observed. Points may vary within each category.***

☐ **VIGOR** (10 points)		Desirable grasses, forbs and shrubs are vigorous, showing good health. These plants have good size, color, and produce abundant herbage.
☑ (6 points)	6	Desirable grasses, forbs and shrubs have moderate vigor. They are medium size with fair color, and produce moderate amounts of herbage. Some seed stalks and seed heads are present.
☐ (2 points)		Desirable grasses, forbs and shrubs have low vigor. They appear unhealthy with small size and poor color. Portions of clumps or entire plants are dead or dying. Seed stalks and seed heads are non-existent, except in protected areas.
☐ **SEEDLINGS** (10 points)		There is seedling establishment of desirable grasses, forbs and shrubs. Seedlings are present in open spaces between plants and along edges of soil pedestals. Few seedlings of invader or undesirable plants are present.
☐ (6 points)	4	Some seedlings of desirable grasses, forbs and shrubs may or may not be present in open spaces between plants. Some seedlings of invader or undesirable plant species may or may not be present.
☐ (2 points)		Few if any seedlings of desirable grasses, forbs and shrubs are being established. Seedlings of invader or undesirable plants are present in open spaces between plants.
☐ **SURFACE LITTER** (5 points)		Surface litter is accumulating in place.
☒ (3 points)	3	Moderate movement of surface litter is apparent and deposited against obstacles.
☐ (1 point)		Very little surface litter is remaining.
☐ **PEDESTALS** (5 points)		There is little visual evidence of pedestalling. Those pedestals present are sloping or rounding and accumulating litter. Desirable forage grasses may be found along edges of pedestals.
☒ (3 points)	3	There is moderate pedestalling with no visual evidence of healing or deterioration. Small rock and plant pedestals may be occurring in flow patterns.
☐ (1 point)		Most rocks and plants are pedestalled. Pedestals are sharp-sided and eroding, often exposing grass roots.
☒ **SURFACE CRUSTING** (5 points)	5	There is little visual evidence of surface crusting.
☐ (3 points)		There is moderate surface crusting, with no visual evidence of healing or deterioration. (Note reason for cause)
☐ (1 point)		Severe surface crusting. (Note reason for cause)
☐ **RILLS AND GULLIES** (5 points)		Gullies (including rills) may be present in stable condition, with moderate sloping or rounded sides. Perennials are establishing themselves on bottom and sides of channel.
☒ (3 points)	3	Gullies are well developed, with small amounts of active erosion. Some vegetation may be present.
☐ (1 point)		Sharply incised V-shaped gullies cover most of the area, with most of the gullies actively eroding. Gullies are mostly devoid of perennial plants. They have fresh cutting on the bottom.
TOTAL: 24 **FIELD NOTES:**		Sideoats grama

PH

Rangeland Health Evaluation Summary Worksheet

Part 1. Area of Interest Documentation

Location Site 4

UTM Coord

Picture # Description pictures to 102-0635
102-0627

Date/Time: 9/13/11 9am
Observer PH, CM VM
Soil Map Unit Name see spreadsheet + maps
Veg Alliance Name
Surface texture
Parent material
Slope %
Elevation (ft)
Topographic position
Aspect

Signs of Disturbance(s) observed
past grazing moderate
many cow-weeds

OAT score of 200-m transect 35
OAT score of polygon 35

Notes:

Slight western-facing slope near to summit
- gila conglomerate

Yucca - sideoats + three awn w/ cow weed \ very patchy,

broom snake horseweed

subdom FluFFgrass

3-awn

black gramma → dom.
Side oats
3 awn
~~Pigweed~~ kochia → domi?

grass & Forb dominant

St 4 PH

Criteria used to score Observed Apparent Trend (OAT). ***Check appropriate box in each category which best fits area being observed. Points may vary within each category.***

☐ **VIGOR** (10 points) 9	Desirable grasses, forbs and shrubs are vigorous, showing good health. These plants have good size, color, and produce abundant herbage.
☐ (6 points)	Desirable grasses, forbs and shrubs have moderate vigor. They are medium size with fair color, and produce moderate amounts of herbage. Some seed stalks and seed heads are present.
☐ (2 points)	Desirable grasses, forbs and shrubs have low vigor. They appear unhealthy with small size and poor color. Portions of clumps or entire plants are dead or dying. Seed stalks and seed heads are non-existent, except in protected areas.
☐ **SEEDLINGS** (10 points) 7	There is seedling establishment of desirable grasses, forbs and shrubs. Seedlings are present in open spaces between plants and along edges of soil pedestals. Few seedlings of invader or undesirable plants are present.
☐ (6 points)	Some seedlings of desirable grasses, forbs and shrubs may or may not be present in open spaces between plants. Some seedlings of invader or undesirable plant species may or may not be present.
☐ (2 points)	Few if any seedlings of desirable grasses, forbs and shrubs are being established. Seedlings of invader or undesirable plants are present in open spaces between plants.
☒ **SURFACE LITTER** (5 points)	Surface litter is accumulating in place.
☐ (3 points)	Moderate movement of surface litter is apparent and deposited against obstacles.
☐ (1 point)	Very little surface litter is remaining.
☐ **PEDESTALS** (5 points)	There is little visual evidence of pedestalling. Those pedestals present are sloping or rounding and accumulating litter. Desirable forage grasses may be found along edges of pedestals.
☒ (3 points)	There is moderate pedestalling with no visual evidence of healing or deterioration. Small rock and plant pedestals may be occurring in flow patterns.
☐ (1 point)	Most rocks and plants are pedestalled. Pedestals are sharp-sided and eroding, often exposing grass roots.
☒ **SURFACE CRUSTING** (5 points)	There is little visual evidence of surface crusting.
☐ (3 points)	There is moderate surface crusting, with no visual evidence of healing or deterioration. (Note reason for cause)
☐ (1 point)	Severe surface crusting. (Note reason for cause)
☐ **RILLS AND GULLIES** (5 points) 4	Gullies (including rills) may be present in stable condition, with moderate sloping or rounded sides. Perennials are establishing themselves on bottom and sides of channel.
☐ (3 points)	Gullies are well developed, with small amounts of active erosion. Some vegetation may be present.
☐ (1 point)	Sharply incised V-shaped gullies cover most of the area, with most of the gullies actively eroding. Gullies are mostly devoid of perennial plants. They have fresh cutting on the bottom.
TOTAL: 38 **FIELD NOTES:**	pack gravely loam rained night b4 pics to 102-0635

PH = Penny Hunter

Rangeland Health Evaluation Summary Worksheet

Part 1. Area of Interest Documentation

Location Site 5

UTM Coord

Picture # Description Pam's camera

Date/Time: 9/2/11
Observer PH, CM, VM
Soil Map Unit Name
Veg Alliance Name
Surface texture
Parent material
Slope %
Elevation (ft)
Topographic position
Aspect

Signs of Disturbance(s) observed

grazing - moderate

OAT score of 200-m transect 33
OAT score of polygon 33

Notes:

rocky outcrop, ~~mahogany~~ mesquite-dominated. N-E facing.

C M

Rangeland Health Evaluation Summary Worksheet

Part 1. Area of Interest Documentation

Location 5

UTM Coord

Picture #	**Description**

Date/Time: 9-12-11 3pm
Observer Penny Hunter, Carolyn Meyer, Vica Meyer
Soil Map Unit Name
Veg Alliance Name
Surface texture
Parent material
Slope %
Elevation (ft)
Topographic position
Aspect

Signs of Disturbance(s) observed

OAT score of 200-m transect 33
OAT score of polygon 33

Notes: Moderate pedestaling – more than reference

Site 5 STS - 2011 - FLX

Criteria used to score Observed Apparent Trend (OAT). *Check appropriate box in each category which best fits area being observed. Points may vary within each category.*

☒ **VIGOR** (10 points)	Desirable grasses, forbs and shrubs are vigorous, showing good health. These plants have good size, color, and produce abundant herbage.
☐ (6 points)	Desirable grasses, forbs and shrubs have moderate vigor. They are medium size with fair color, and produce moderate amounts of herbage. Some seed stalks and seed heads are present.
☐ (2 points)	Desirable grasses, forbs and shrubs have low vigor. They appear unhealthy with small size and poor color. Portions of clumps or entire plants are dead or dying. Seed stalks and seed heads are non-existent, except in protected areas.
☐ **SEEDLINGS** (10 points) ⑦	There is seedling establishment of desirable grasses, forbs and shrubs. Seedlings are present in open spaces between plants and along edges of soil pedestals. Few seedlings of invader or undesirable plants are present.
☐ (6 points)	Some seedlings of desirable grasses, forbs and shrubs may or may not be present in open spaces between plants. Some seedlings of invader or undesirable plant species may or may not be present.
☐ (2 points)	Few if any seedlings of desirable grasses, forbs and shrubs are being established. Seedlings of invader or undesirable plants are present in open spaces between plants.
☐ **SURFACE LITTER** (5 points)	Surface litter is accumulating in place.
☒ (3 points)	Moderate movement of surface litter is apparent and deposited against obstacles.
☐ (1 point)	Very little surface litter is remaining.
☐ **PEDESTALS** (5 points)	There is little visual evidence of pedestalling. Those pedestals present are sloping or rounding and accumulating litter. Desirable forage grasses may be found along edges of pedestals.
☒ (3 points)	There is moderate pedestalling with no visual evidence of healing or deterioration. Small rock and plant pedestals may be occurring in flow patterns.
☐ (1 point)	Most rocks and plants are pedestalled. Pedestals are sharp-sided and eroding, often exposing grass roots.
☑ **SURFACE CRUSTING** (5 points)	There is little visual evidence of surface crusting.
☐ (3 points)	There is moderate surface crusting, with no visual evidence of healing or deterioration. (Note reason for cause)
☐ (1 point)	Severe surface crusting. (Note reason for cause)
☑ **RILLS AND GULLIES** (5 points)	Gullies (including rills) may be present in stable condition, with moderate sloping or rounded sides. Perennials are establishing themselves on bottom and sides of channel.
☐ (3 points)	Gullies are well developed, with small amounts of active erosion. Some vegetation may be present.
☐ (1 point)	Sharply incised V-shaped gullies cover most of the area, with most of the gullies actively eroding. Gullies are mostly devoid of perennial plants. They have fresh cutting on the bottom.
TOTAL: 33 **FIELD NOTES:**	28 35

PH

Rangeland Health Evaluation Summary Worksheet

Part 1. Area of Interest Documentation
Location STS-RWU-2011-6 Site 6

UTM Coord ______

Picture #	**Description**
	-0638 to -0644
	0644 = amended area nearby

Date/Time: 9/13/11 10:30 am
Observer PH, CM, VM
Soil Map Unit Name
Veg Alliance Name
Surface texture
Parent material
Slope %
Elevation (ft)
Topographic position
Aspect

Signs of Disturbance(s) observed
highly eroded, amendments to adjacent area

OAT score of 200-m transect 16
OAT score of polygon 16

Notes:

Oak dominant
& mtn mahog

Site 6

Criteria used to score Observed Apparent Trend (OAT). ***Check appropriate box in each category which best fits area being observed. Points may vary within each category.***

☐ **VIGOR** (10 points)	Desirable grasses, forbs and shrubs are vigorous, showing good health. These plants have good size, color, and produce abundant herbage.
☐ (6 points) 4	Desirable grasses, forbs and shrubs have moderate vigor. They are medium size with fair color, and produce moderate amounts of herbage. Some seed stalks and seed heads are present.
☐ (2 points)	Desirable grasses, forbs and shrubs have low vigor. They appear unhealthy with small size and poor color. Portions of clumps or entire plants are dead or dying. Seed stalks and seed heads are non-existent, except in protected areas.
☐ **SEEDLINGS** (10 points)	There is seedling establishment of desirable grasses, forbs and shrubs. Seedlings are present in open spaces between plants and along edges of soil pedestals. Few seedlings of invader or undesirable plants are present.
☐ (6 points)	Some seedlings of desirable grasses, forbs and shrubs may or may not be present in open spaces between plants. Some seedlings of invader or undesirable plant species may or may not be present.
☐ (2 points) 1	Few if any seedlings of desirable grasses, forbs and shrubs are being established. Seedlings of invader or undesirable plants are present in open spaces between plants.
☐ **SURFACE LITTER** (5 points)	Surface litter is accumulating in place.
☒ (3 points) 3	Moderate movement of surface litter is apparent and deposited against obstacles.
☐ (1 point)	Very little surface litter is remaining.
☐ **PEDESTALS** (5 points)	There is little visual evidence of pedestalling. Those pedestals present are sloping or rounding and accumulating litter. Desirable forage grasses may be found along edges of pedestals.
☐ (3 points) 2	There is moderate pedestalling with no visual evidence of healing or deterioration. Small rock and plant pedestals may be occurring in flow patterns.
☐ (1 point)	Most rocks and plants are pedestalled. Pedestals are sharp-sided and eroding, often exposing grass roots.
☒ **SURFACE CRUSTING** (5 points) 5	There is little visual evidence of surface crusting.
☐ (3 points)	There is moderate surface crusting, with no visual evidence of healing or deterioration. (Note reason for cause)
☐ (1 point)	Severe surface crusting. (Note reason for cause)
☐ **RILLS AND GULLIES** (5 points)	Gullies (including rills) may be present in stable condition, with moderate sloping or rounded sides. Perennials are establishing themselves on bottom and sides of channel.
☐ (3 points)	Gullies are well developed, with small amounts of active erosion. Some vegetation may be present.
☒ (1 point)	Sharply incised V-shaped gullies cover most of the area, with most of the gullies actively eroding. Gullies are mostly devoid of perennial plants. They have fresh cutting on the bottom.
TOTAL: 16 **FIELD NOTES:**	0641 = amended area Transect < 200m, ~~habitat~~

Rangeland Health Evaluation Summary Worksheet

75
150

0.75, [illegible]
/ 150
82

Part 1. Area of Interest Documentation

Location Site 7

UTM Coord ______

Picture #	**Description**
	747-748

Date/Time: 9/16/11
Observer Carolyn Meyer, Pam Pinson, Nick Lenne
Soil Map Unit Name ______
Veg Alliance Name ______
Surface texture ______
Parent material ______
Slope % ______
Elevation (ft) ______
Topographic position ______
Aspect ______

Signs of Disturbance(s) observed

OAT score of 200-m transect 9
OAT score of polygon 8

dominant (oak
juniper

some yucca

Notes:

25
x 3.3
75
75
825

3.28
16
21|328
2
12

9/16/11 Site 7 Con

Criteria used to score Observed Apparent Trend (OAT). ***Check appropriate box in each category which best fits area being observed. Points may vary within each category.***

☐ **VIGOR** (10 points)	Desirable grasses, forbs and shrubs are vigorous, showing good health. These plants have good size, color, and produce abundant herbage.
☐ (6 points) 1 vine mesquite	Desirable grasses, forbs and shrubs have moderate vigor. They are medium size with fair color, and produce moderate amounts of herbage. Some seed stalks and seed heads are present.
☐ (2 points) 6	Desirable grasses, forbs and shrubs have low vigor. They appear unhealthy with small size and poor color. Portions of clumps or entire plants are dead or dying. Seed stalks and seed heads are non-existent, except in protected areas.
☐ **SEEDLINGS** (10 points)	There is seedling establishment of desirable grasses, forbs and shrubs. Seedlings are present in open spaces between plants and along edges of soil pedestals. Few seedlings of invader or undesirable plants are present.
☐ (6 points)	Some seedlings of desirable grasses, forbs and shrubs may or may not be present in open spaces between plants. Some seedlings of invader or undesirable plant species may or may not be present.
☐ (2 points) NA	Few if any seedlings of desirable grasses, forbs and shrubs are being established. Seedlings of invader or undesirable plants are present in open spaces between plants.
☐ **SURFACE LITTER** (5 points)	Surface litter is accumulating in place.
☐ (3 points)	Moderate movement of surface litter is apparent and deposited against obstacles.
☐ (1 point) 1	Very little surface litter is remaining.
☐ **PEDESTALS** (5 points)	There is little visual evidence of pedestalling. Those pedestals present are sloping or rounding and accumulating litter. Desirable forage grasses may be found along edges of pedestals.
☐ (3 points)	There is moderate pedestalling with no visual evidence of healing or deterioration. Small rock and plant pedestals may be occurring in flow patterns.
☐ (1 point)	Most rocks and plants are pedestalled. Pedestals are sharp-sided and eroding, often exposing grass roots.
☐ **SURFACE CRUSTING** (5 points)	There is little visual evidence of surface crusting.
☐ (3 points)	There is moderate surface crusting, with no visual evidence of healing or deterioration. (Note reason for cause)
☐ (1 point) 1	Severe surface crusting. (Note reason for cause)
☐ **RILLS AND GULLIES** (5 points) [illegible]	Gullies (including rills) may be present in stable condition, with moderate sloping or rounded sides. Perennials are establishing themselves on bottom and sides of channel.
☐ (3 points)	Gullies are well developed, with small amounts of active erosion. Some vegetation may be present.
☐ (1 point) 1	Sharply incised V-shaped gullies cover most of the area, with most of the gullies actively eroding. Gullies are mostly devoid of perennial plants. They have fresh cutting on the bottom.
TOTAL: 9 **FIELD NOTES:**	lots of moving sediment thru gullies crusting

PH

Rangeland Health Evaluation Summary Worksheet

Part 1. Area of Interest Documentation

Location Reference - Gila Complex

UTM Coord

Picture # Description 702-0636 & -0637

Date/Time: 9/13/11 10 am
Observer PV, CM, VM
Soil Map Unit Name
Veg Alliance Name
Surface texture
Parent material
Slope %
Elevation (ft)
Topographic position
Aspect

Signs of Disturbance(s) observed

grazing

OAT score of 200-m transect 9, 8, 5, 5 5 5 [illegible] 37
OAT score of polygon

1
15
17
32

Notes:

Dominant species: sideoats
~~pigweed~~ / kochia

more mesquite, less yucca than site 4.

South Fenry; nearer to ~~grazi~~ stock tank

9
8
17

1
17
18
36

18
8

Reference - Gila Conglomerate - near & then West reference plot. p 1+

Criteria used to score Observed Apparent Trend (OAT). ***Check appropriate box in each category which best fits area being observed. Points may vary within each category.***

☐ **VIGOR** (10 points) 9	Desirable grasses, forbs and shrubs are vigorous, showing good health. These plants have good size, color, and produce abundant herbage.
☐ (6 points)	Desirable grasses, forbs and shrubs have moderate vigor. They are medium size with fair color, and produce moderate amounts of herbage. Some seed stalks and seed heads are present.
☐ (2 points)	Desirable grasses, forbs and shrubs have low vigor. They appear unhealthy with small size and poor color. Portions of clumps or entire plants are dead or dying. Seed stalks and seed heads are non-existent, except in protected areas.
☐ **SEEDLINGS** (10 points) 8	There is seedling establishment of desirable grasses, forbs and shrubs. Seedlings are present in open spaces between plants and along edges of soil pedestals. Few seedlings of invader or undesirable plants are present.
☐ (6 points)	Some seedlings of desirable grasses, forbs and shrubs may or may not be present in open spaces between plants. Some seedlings of invader or undesirable plant species may or may not be present.
☐ (2 points)	Few if any seedlings of desirable grasses, forbs and shrubs are being established. Seedlings of invader or undesirable plants are present in open spaces between plants.
☑ **SURFACE LITTER** (5 points)	Surface litter is accumulating in place.
☐ (3 points)	Moderate movement of surface litter is apparent and deposited against obstacles.
☐ (1 point)	Very little surface litter is remaining.
☑ **PEDESTALS** (5 points)	There is little visual evidence of pedestalling. Those pedestals present are sloping or rounding and accumulating litter. Desirable forage grasses may be found along edges of pedestals.
☐ (3 points)	There is moderate pedestalling with no visual evidence of healing or deterioration. Small rock and plant pedestals may be occurring in flow patterns.
☐ (1 point)	Most rocks and plants are pedestalled. Pedestals are sharp-sided and eroding, often exposing grass roots.
☑ **SURFACE CRUSTING** (5 points)	There is little visual evidence of surface crusting.
☐ (3 points)	There is moderate surface crusting, with no visual evidence of healing or deterioration. (Note reason for cause)
☐ (1 point)	Severe surface crusting. (Note reason for cause)
☑ **RILLS AND GULLIES** (5 points)	Gullies (including rills) may be present in stable condition, with moderate sloping or rounded sides. Perennials are establishing themselves on bottom and sides of channel.
☐ (3 points)	Gullies are well developed, with small amounts of active erosion. Some vegetation may be present.
☐ (1 point)	Sharply incised V-shaped gullies cover most of the area, with most of the gullies actively eroding. Gullies are mostly devoid of perennial plants. They have fresh cutting on the bottom.
TOTAL: 37 **FIELD NOTES:**	

PH

Rangeland Health Evaluation Summary Worksheet

Part 1. Area of Interest Documentation

Location Site 8

UTM Coord

Picture #	**Description**
	Pam's camera

Date/Time: 9/12/11 5pm

Observer PH, CM, VM

Soil Map Unit Name

Veg Alliance Name

Surface texture

Parent material

Slope %

Elevation (ft)

Topographic position

Aspect

Signs of Disturbance(s) observed

grazing - minimal

OAT score of 200-m transect 37

OAT score of polygon 37

Notes:

oak ? - common
- common

° (mtn Mahogeny,) Juniper woodland

steep slope

N - Facing (?)

very high forb + grass abundance

Site 8 PH

Criteria used to score Observed Apparent Trend (OAT). ***Check appropriate box in each category which best fits area being observed. Points may vary within each category.***

☒ **VIGOR** (10 points)	Desirable grasses, forbs and shrubs are vigorous, showing good health. These plants have good size, color, and produce abundant herbage.
☐ (6 points)	Desirable grasses, forbs and shrubs have moderate vigor. They are medium size with fair color, and produce moderate amounts of herbage. Some seed stalks and seed heads are present.
☐ (2 points)	Desirable grasses, forbs and shrubs have low vigor. They appear unhealthy with small size and poor color. Portions of clumps or entire plants are dead or dying. Seed stalks and seed heads are non-existent, except in protected areas.
⑩ ☒ **SEEDLINGS** (10 points)	There is seedling establishment of desirable grasses, forbs and shrubs. Seedlings are present in open spaces between plants and along edges of soil pedestals. Few seedlings of invader or undesirable plants are present.
☐ (6 points)	Some seedlings of desirable grasses, forbs and shrubs may or may not be present in open spaces between plants. Some seedlings of invader or undesirable plant species may or may not be present.
☐ (2 points)	Few if any seedlings of desirable grasses, forbs and shrubs are being established. Seedlings of invader or undesirable plants are present in open spaces between plants.
④ ☐ **SURFACE LITTER** (5 points)	Surface litter is accumulating in place.
☐ (3 points)	Moderate movement of surface litter is apparent and deposited against obstacles.
☐ (1 point)	Very little surface litter is remaining.
☐ **PEDESTALS** (5 points)	There is little visual evidence of pedestalling. Those pedestals present are sloping or rounding and accumulating litter. Desirable forage grasses may be found along edges of pedestals.
☒ (3 points)	There is moderate pedestalling with no visual evidence of healing or deterioration. Small rock and plant pedestals may be occurring in flow patterns.
☐ (1 point)	Most rocks and plants are pedestalled. Pedestals are sharp-sided and eroding, often exposing grass roots.
☒ **SURFACE CRUSTING** (5 points)	There is little visual evidence of surface crusting.
☐ (3 points)	There is moderate surface crusting, with no visual evidence of healing or deterioration. (Note reason for cause)
☐ (1 point)	Severe surface crusting. (Note reason for cause)
☒ **RILLS AND GULLIES** (5 points)	Gullies (including rills) may be present in stable condition, with moderate sloping or rounded sides. Perennials are establishing themselves on bottom and sides of channel.
☐ (3 points)	Gullies are well developed, with small amounts of active erosion. Some vegetation may be present.
☐ (1 point)	Sharply incised V-shaped gullies cover most of the area, with most of the gullies actively eroding. Gullies are mostly devoid of perennial plants. They have fresh cutting on the bottom.
TOTAL: 37 **FIELD NOTES:**	

End of site

Cm

Rangeland Health Evaluation Summary Worksheet

Part 1. Area of Interest Documentation

Location Site 9

UTM Coord

Picture # Description 0680 - 0683

Date/Time: 9/14/11 10am
Observer
Soil Map Unit Name
Veg Alliance Name
Surface texture
Parent material
Slope %
Elevation (ft)
Topographic position
Aspect

Signs of Disturbance(s) observed

OAT score of 200-m transect 11
OAT score of polygon 11

Notes:

Oak -
Some ~~dea~~ yucca
lots dead higher up -
lower areas more live
poor vigor
no desirable forage
Soil moving - collect in holes
where oaks grow.

Site 9 Cu

Criteria used to score Observed Apparent Trend (OAT). *Check appropriate box in each category which best fits area being observed. Points may vary within each category.*

☐ **VIGOR** (10 points)	Desirable grasses, forbs and shrubs are vigorous, showing good health. These plants have good size, color, and produce abundant herbage.
☐ (6 points) no desirable	Desirable grasses, forbs and shrubs have moderate vigor. They are medium size with fair color, and produce moderate amounts of herbage. Some seed stalks and seed heads are present.
☐ (2 points) NA forage	Desirable grasses, forbs and shrubs have low vigor. They appear unhealthy with small size and poor color. Portions of clumps or entire plants are dead or dying. Seed stalks and seed heads are non-existent, except in protected areas.
☐ **SEEDLINGS** (10 points)	There is seedling establishment of desirable grasses, forbs and shrubs. Seedlings are present in open spaces between plants and along edges of soil pedestals. Few seedlings of invader or undesirable plants are present.
☐ (6 points)	Some seedlings of desirable grasses, forbs and shrubs may or may not be present in open spaces between plants. Some seedlings of invader or undesirable plant species may or may not be present.
☐ (2 points) NA	Few if any seedlings of desirable grasses, forbs and shrubs are being established. Seedlings of invader or undesirable plants are present in open spaces between plants.
☐ **SURFACE LITTER** (5 points)	Surface litter is accumulating in place.
☐ (3 points)	Moderate movement of surface litter is apparent and deposited against obstacles.
☐ (1 point) 1	Very little surface litter is remaining.
☐ **PEDESTALS** (5 points)	There is little visual evidence of pedestalling. Those pedestals present are sloping or rounding and accumulating litter. Desirable forage grasses may be found along edges of pedestals.
☐ (3 points)	There is moderate pedestalling with no visual evidence of healing or deterioration. Small rock and plant pedestals may be occurring in flow patterns.
☐ (1 point) NA	Most rocks and plants are pedestalled. Pedestals are sharp-sided and eroding, often exposing grass roots.
☐ **SURFACE CRUSTING** (5 points) 5	There is little visual evidence of surface crusting.
☐ (3 points)	There is moderate surface crusting, with no visual evidence of healing or deterioration. (Note reason for cause)
☐ (1 point)	Severe surface crusting. (Note reason for cause)
☐ **RILLS AND GULLIES** (5 points) 5	Gullies (including rills) may be present in stable condition, with moderate sloping or rounded sides. Perennials are establishing themselves on bottom and sides of channel.
☐ (3 points)	Gullies are well developed, with small amounts of active erosion. Some vegetation may be present.
☐ (1 point)	Sharply incised V-shaped gullies cover most of the area, with most of the gullies actively eroding. Gullies are mostly devoid of perennial plants. They have fresh cutting on the bottom.
TOTAL: 11 **FIELD NOTES:**	lots Cu on rocks water deficiency Yucca dying odd low vigor

soil = moving sediment

PH

Rangeland Health Evaluation Summary Worksheet

Part 1. Area of Interest Documentation

Location Site 10

UTM Coord

Picture #	**Description**
0669 - 0674	

Date/Time: 9/13/11 2:30 pm

Observer PH, CM, VM

Soil Map Unit Name

Veg Alliance Name

Surface texture

Parent material

Slope %

Elevation (ft)

Topographic position

Aspect

Signs of Disturbance(s) observed

erosion
manganese staining

OAT score of 200-m transect 16

OAT score of polygon 16

Notes: mesquite - juniper, w/ yucca sub-domin. patchy

Site 10 PH

Criteria used to score Observed Apparent Trend (OAT). ***Check appropriate box in each category which best fits area being observed. Points may vary within each category.***

☐ **VIGOR** (10 points)	Desirable grasses, forbs and shrubs are vigorous, showing good health. These plants have good size, color, and produce abundant herbage.
☐ (6 points) 5	Desirable grasses, forbs and shrubs have moderate vigor. They are medium size with fair color, and produce moderate amounts of herbage. Some seed stalks and seed heads are present.
☐ (2 points)	Desirable grasses, forbs and shrubs have low vigor. They appear unhealthy with small size and poor color. Portions of clumps or entire plants are dead or dying. Seed stalks and seed heads are non-existent, except in protected areas.
☐ **SEEDLINGS** (10 points)	There is seedling establishment of desirable grasses, forbs and shrubs. Seedlings are present in open spaces between plants and along edges of soil pedestals. Few seedlings of invader or undesirable plants are present.
☐ (6 points) 4	Some seedlings of desirable grasses, forbs and shrubs may or may not be present in open spaces between plants. Some seedlings of invader or undesirable plant species may or may not be present.
☐ (2 points)	Few if any seedlings of desirable grasses, forbs and shrubs are being established. Seedlings of invader or undesirable plants are present in open spaces between plants.
☐ **SURFACE LITTER** (5 points)	Surface litter is accumulating in place.
☐ (3 points) 2	Moderate movement of surface litter is apparent and deposited against obstacles.
☐ (1 point)	Very little surface litter is remaining.
☐ **PEDESTALS** (5 points)	There is little visual evidence of pedestalling. Those pedestals present are sloping or rounding and accumulating litter. Desirable forage grasses may be found along edges of pedestals.
☐ (3 points)	There is moderate pedestalling with no visual evidence of healing or deterioration. Small rock and plant pedestals may be occurring in flow patterns.
☒ (1 point)	Most rocks and plants are pedestalled. Pedestals are sharp-sided and eroding, often exposing grass roots.
☐ **SURFACE CRUSTING** (5 points)	There is little visual evidence of surface crusting.
☒ (3 points)	There is moderate surface crusting, with no visual evidence of healing or deterioration. (Note reason for cause)
☐ (1 point)	Severe surface crusting. (Note reason for cause)
☐ **RILLS AND GULLIES** (5 points)	Gullies (including rills) may be present in stable condition, with moderate sloping or rounded sides. Perennials are establishing themselves on bottom and sides of channel.
☐ (3 points)	Gullies are well developed, with small amounts of active erosion. Some vegetation may be present.
☒ (1 point)	Sharply incised V-shaped gullies cover most of the area, with most of the gullies actively eroding. Gullies are mostly devoid of perennial plants. They have fresh cutting on the bottom.
TOTAL: 16 **FIELD NOTES:**	Patchy - Some - lots gullies - other areas - lots small grasses - seedlg

PH

Rangeland Health Evaluation Summary Worksheet

Part 1. Area of Interest Documentation

Location Site 11

UTM Coord

Picture # **Description** 0666 - 0668

Date/Time: 9/13/11 3pm

Observer PA, CM, VM

Soil Map Unit Name

Veg Alliance Name

Surface texture

Parent material

Slope %

Elevation (ft)

Topographic position

Aspect

Signs of Disturbance(s) observed

none

OAT score of 200-m transect 6

OAT score of polygon 6

Notes:

Bedrock outcrop - mostly bedrock

Santana rock complex

mahogeny/oak dominated

Site 11 P 4

Criteria used to score Observed Apparent Trend (OAT). ***Check appropriate box in each category which best fits area being observed. Points may vary within each category.***

☐ **VIGOR** (10 points)	Desirable grasses, forbs and shrubs are vigorous, showing good health. These plants have good size, color, and produce abundant herbage.
☐ (6 points) N/A	Desirable grasses, forbs and shrubs have moderate vigor. They are medium size with fair color, and produce moderate amounts of herbage. Some seed stalks and seed heads are present.
☐ (2 points)	Desirable grasses, forbs and shrubs have low vigor. They appear unhealthy with small size and poor color. Portions of clumps or entire plants are dead or dying. Seed stalks and seed heads are non-existent, except in protected areas.
☐ **SEEDLINGS** (10 points)	There is seedling establishment of desirable grasses, forbs and shrubs. Seedlings are present in open spaces between plants and along edges of soil pedestals. Few seedlings of invader or undesirable plants are present.
☐ (6 points) N/A	Some seedlings of desirable grasses, forbs and shrubs may or may not be present in open spaces between plants. Some seedlings of invader or undesirable plant species may or may not be present.
☐ (2 points) ⓪	Few if any seedlings of desirable grasses, forbs and shrubs are being established. Seedlings of invader or undesirable plants are present in open spaces between plants.
☐ **SURFACE LITTER** (5 points)	Surface litter is accumulating in place.
☐ (3 points)	Moderate movement of surface litter is apparent and deposited against obstacles.
☒ (1 point)	Very little surface litter is remaining.
☐ **PEDESTALS** (5 points)	There is little visual evidence of pedestalling. Those pedestals present are sloping or rounding and accumulating litter. Desirable forage grasses may be found along edges of pedestals.
☐ (3 points) N/A	There is moderate pedestalling with no visual evidence of healing or deterioration. Small rock and plant pedestals may be occurring in flow patterns.
☐ (1 point) 0	Most rocks and plants are pedestalled. Pedestals are sharp-sided and eroding, often exposing grass roots.
☐ **SURFACE CRUSTING** (5 points)	There is little visual evidence of surface crusting.
☐ (3 points) ④	There is moderate surface crusting, with no visual evidence of healing or deterioration. (Note reason for cause)
☐ (1 point)	Severe surface crusting. (Note reason for cause)
☐ **RILLS AND GULLIES** (5 points)	Gullies (including rills) may be present in stable condition, with moderate sloping or rounded sides. Perennials are establishing themselves on bottom and sides of channel.
☐ (3 points)	Gullies are well developed, with small amounts of active erosion. Some vegetation may be present.
☒ (1 point)	Sharply incised V-shaped gullies cover most of the area, with most of the gullies actively eroding. Gullies are mostly devoid of perennial plants. They have fresh cutting on the bottom.
TOTAL: 6 **FIELD NOTES:**	

PH

Rangeland Health Evaluation Summary Worksheet

Part 1. Area of Interest Documentation

Location Site 12

UTM Coord

Picture #	**Description**
	0675 – 0677

Date/Time: 9/13/11 5:30pm
Observer PH, CM, VM
Soil Map Unit Name
Veg Alliance Name
Surface texture
Parent material
Slope %
Elevation (ft)
Topographic position
Aspect

Signs of Disturbance(s) observed

OAT score of 200-m transect 10
OAT score of polygon 10

Notes:
mesquite dominated
some juniper
yucca on far summit
E-facing

Block 1
1 Shrub
1 Forb ~~false mesquite?~~

Block 2
1 Forb

Block 3
1 Shrub

Block 4
mesquite
1 Forb

Block 5
2 shrub

Site 12

P11

Criteria used to score Observed Apparent Trend (OAT). *Check appropriate box in each category which best fits area being observed. Points may vary within each category.*

☐ **VIGOR** (10 points)	Desirable grasses, forbs and shrubs are vigorous, showing good health. These plants have good size, color, and produce abundant herbage.
☐ (6 points)	Desirable grasses, forbs and shrubs have moderate vigor. They are medium size with fair color, and produce moderate amounts of herbage. Some seed stalks and seed heads are present.
☐ (2 points) (1)	Desirable grasses, forbs and shrubs have low vigor. They appear unhealthy with small size and poor color. Portions of clumps or entire plants are dead or dying. Seed stalks and seed heads are non-existent, except in protected areas.
☐ **SEEDLINGS** (10 points)	There is seedling establishment of desirable grasses, forbs and shrubs. Seedlings are present in open spaces between plants and along edges of soil pedestals. Few seedlings of invader or undesirable plants are present.
☐ (6 points)	Some seedlings of desirable grasses, forbs and shrubs may or may not be present in open spaces between plants. Some seedlings of invader or undesirable plant species may or may not be present.
☐ (2 points) (1)	Few if any seedlings of desirable grasses, forbs and shrubs are being established. Seedlings of invader or undesirable plants are present in open spaces between plants.
☐ **SURFACE LITTER** (5 points)	Surface litter is accumulating in place.
☐ (3 points)	Moderate movement of surface litter is apparent and deposited against obstacles.
☒ (1 point)	Very little surface litter is remaining.
☐ **PEDESTALS** (5 points) N/A	There is little visual evidence of pedestalling. Those pedestals present are sloping or rounding and accumulating litter. Desirable forage grasses may be found along edges of pedestals.
☐ (3 points)	There is moderate pedestalling with no visual evidence of healing or deterioration. Small rock and plant pedestals may be occurring in flow patterns.
☐ (1 point)	Most rocks and plants are pedestalled. Pedestals are sharp-sided and eroding, often exposing grass roots.
☐ **SURFACE CRUSTING** (5 points)	There is little visual evidence of surface crusting.
☐ (3 points) (4)	There is moderate surface crusting, with no visual evidence of healing or deterioration. (Note reason for cause)
☐ (1 point)	Severe surface crusting. (Note reason for cause)
☐ **RILLS AND GULLIES** (5 points)	Gullies (including rills) may be present in stable condition, with moderate sloping or rounded sides. Perennials are establishing themselves on bottom and sides of channel.
☒ (3 points)	Gullies are well developed, with small amounts of active erosion. Some vegetation may be present.
☐ (1 point)	Sharply incised V-shaped gullies cover most of the area, with most of the gullies actively eroding. Gullies are mostly devoid of perennial plants. They have fresh cutting on the bottom.
TOTAL: 10 **FIELD NOTES:**	

PH

Rangeland Health Evaluation Summary Worksheet

Part 1. Area of Interest Documentation

Location Site 13

UTM Coord

Picture # Description

0662 — 0665

Date/Time: 9/13/11 7pm
Observer PH, CM, VM
Soil Map Unit Name
Veg Alliance Name
Surface texture
Parent material
Slope %
Elevation (ft)
Topographic position
Aspect

Signs of Disturbance(s) observed

grazing - ?

OAT score of 200-m transect 8
OAT score of polygon 8

Notes:

~~creo~~ mesquite w/ juniper/oak - encroaching

mesquite trampling

Site 13 pk

Criteria used to score Observed Apparent Trend (OAT). ***Check appropriate box in each category which best fits area being observed. Points may vary within each category.***

☐ **VIGOR** (10 points)	Desirable grasses, forbs and shrubs are vigorous, showing good health. These plants have good size, color, and produce abundant herbage.
☐ (6 points)	Desirable grasses, forbs and shrubs have moderate vigor. They are medium size with fair color, and produce moderate amounts of herbage. Some seed stalks and seed heads are present.
☐ (2 points) ①	Desirable grasses, forbs and shrubs have low vigor. They appear unhealthy with small size and poor color. Portions of clumps or entire plants are dead or dying. Seed stalks and seed heads are non-existent, except in protected areas.
☐ **SEEDLINGS** (10 points)	There is seedling establishment of desirable grasses, forbs and shrubs. Seedlings are present in open spaces between plants and along edges of soil pedestals. Few seedlings of invader or undesirable plants are present.
☐ (6 points)	Some seedlings of desirable grasses, forbs and shrubs may or may not be present in open spaces between plants. Some seedlings of invader or undesirable plant species may or may not be present.
☐ (2 points) ②	Few if any seedlings of desirable grasses, forbs and shrubs are being established. Seedlings of invader or undesirable plants are present in open spaces between plants.
☐ **SURFACE LITTER** (5 points)	Surface litter is accumulating in place.
☐ (3 points)	Moderate movement of surface litter is apparent and deposited against obstacles.
☐ (1 point) ②	Very little surface litter is remaining.
☐ **PEDESTALS** (5 points) N/8	There is little visual evidence of pedestalling. Those pedestals present are sloping or rounding and accumulating litter. Desirable forage grasses may be found along edges of pedestals.
☐ (3 points) 2	There is moderate pedestalling with no visual evidence of healing or deterioration. Small rock and plant pedestals may be occurring in flow patterns.
☐ (1 point)	Most rocks and plants are pedestalled. Pedestals are sharp-sided and eroding, often exposing grass roots.
☐ **SURFACE CRUSTING** (5 points)	There is little visual evidence of surface crusting.
☐ (3 points) ③	There is moderate surface crusting, with no visual evidence of healing or deterioration. (Note reason for cause)
☐ (1 point)	Severe surface crusting. (Note reason for cause)
☐ **RILLS AND GULLIES** (5 points)	Gullies (including rills) may be present in stable condition, with moderate sloping or rounded sides. Perennials are establishing themselves on bottom and sides of channel.
☐ (3 points)	Gullies are well developed, with small amounts of active erosion. Some vegetation may be present.
☐ (1 point) ②	Sharply incised V-shaped gullies cover most of the area, with most of the gullies actively eroding. Gullies are mostly devoid of perennial plants. They have fresh cutting on the bottom.
TOTAL: 8 **FIELD NOTES:**	

PH

Rangeland Health Evaluation Summary Worksheet

Part 1. Area of Interest Documentation

Location Site 14

UTM Coord

Picture #	Description
	-0653 to 0656

Date/Time: 9/13/11 1:30pm
Observer Penny Hunter, CM, VM
Soil Map Unit Name
Veg Alliance Name
Surface texture
Parent material
Slope %
Elevation (ft)
Topographic position
Aspect

Signs of Disturbance(s) observed

grazing occured up to 7 yrs ago. no apparent signs of grazing when at the site.

OAT score of 200-m transect 26
OAT score of polygon 26

Notes:

west slope

15-45% slope

mesquite + oak dominant

yucca subdominant

patchy.

Site 14 PH

Criteria used to score Observed Apparent Trend (OAT). *Check appropriate box in each category which best fits area being observed. Points may vary within each category.*

☐ **VIGOR** (10 points)	Desirable grasses, forbs and shrubs are vigorous, showing good health. These plants have good size, color, and produce abundant herbage.
☒ (6 points)	Desirable grasses, forbs and shrubs have moderate vigor. They are medium size with fair color, and produce moderate amounts of herbage. Some seed stalks and seed heads are present.
☐ (2 points)	Desirable grasses, forbs and shrubs have low vigor. They appear unhealthy with small size and poor color. Portions of clumps or entire plants are dead or dying. Seed stalks and seed heads are non-existent, except in protected areas.
☐ **SEEDLINGS** (10 points)	There is seedling establishment of desirable grasses, forbs and shrubs. Seedlings are present in open spaces between plants and along edges of soil pedestals. Few seedlings of invader or undesirable plants are present.
☐ (6 points) ⑤	Some seedlings of desirable grasses, forbs and shrubs may or may not be present in open spaces between plants. Some seedlings of invader or undesirable plant species may or may not be present.
☐ (2 points)	Few if any seedlings of desirable grasses, forbs and shrubs are being established. Seedlings of invader or undesirable plants are present in open spaces between plants.
☐ **SURFACE LITTER** (5 points)	Surface litter is accumulating in place.
☐ (3 points) ④	Moderate movement of surface litter is apparent and deposited against obstacles.
☐ (1 point)	Very little surface litter is remaining.
☐ **PEDESTALS** (5 points)	There is little visual evidence of pedestalling. Those pedestals present are sloping or rounding and accumulating litter. Desirable forage grasses may be found along edges of pedestals.
☒ (3 points)	There is moderate pedestalling with no visual evidence of healing or deterioration. Small rock and plant pedestals may be occurring in flow patterns.
☐ (1 point)	Most rocks and plants are pedestalled. Pedestals are sharp-sided and eroding, often exposing grass roots.
☒ **SURFACE CRUSTING** (5 points)	There is little visual evidence of surface crusting.
☐ (3 points)	There is moderate surface crusting, with no visual evidence of healing or deterioration. (Note reason for cause)
☐ (1 point)	Severe surface crusting. (Note reason for cause)
☐ **RILLS AND GULLIES** (5 points)	Gullies (including rills) may be present in stable condition, with moderate sloping or rounded sides. Perennials are establishing themselves on bottom and sides of channel.
☒ (3 points)	Gullies are well developed, with small amounts of active erosion. Some vegetation may be present.
☐ (1 point)	Sharply incised V-shaped gullies cover most of the area, with most of the gullies actively eroding. Gullies are mostly devoid of perennial plants. They have fresh cutting on the bottom.
TOTAL: 26 **FIELD NOTES:**	13 0656

P 11

Rangeland Health Evaluation Summary Worksheet

Part 1. Area of Interest Documentation

Location Site 15

UTM Coord

Picture #	**Description**
	0645 to 0652
	~~Sandstone~~ .

Date/Time: 9/13/11 12pm

Observer P Hunter / C Meyer, VM

Soil Map Unit Name

Veg Alliance Name

Surface texture

Parent material

Slope %

Elevation (ft)

Topographic position

Aspect

Signs of Disturbance(s) observed

copper deposition noted
earth moving excavation

OAT score of 200-m transect 14

OAT score of polygon 14

Notes:

N-W ~~NE~~ W facing slope - ?

mesquite dominated

5. k 15 PH

Criteria used to score Observed Apparent Trend (OAT). ***Check appropriate box in each category which best fits area being observed. Points may vary within each category.***

☐ **VIGOR** (10 points)	Desirable grasses, forbs and shrubs are vigorous, showing good health. These plants have good size, color, and produce abundant herbage.
☐ (6 points)	Desirable grasses, forbs and shrubs have moderate vigor. They are medium size with fair color, and produce moderate amounts of herbage. Some seed stalks and seed heads are present.
☒ (2 points)	Desirable grasses, forbs and shrubs have low vigor. They appear unhealthy with small size and poor color. Portions of clumps or entire plants are dead or dying. Seed stalks and seed heads are non-existent, except in protected areas.
☐ **SEEDLINGS** (10 points)	There is seedling establishment of desirable grasses, forbs and shrubs. Seedlings are present in open spaces between plants and along edges of soil pedestals. Few seedlings of invader or undesirable plants are present.
☐ (6 points)	Some seedlings of desirable grasses, forbs and shrubs may or may not be present in open spaces between plants. Some seedlings of invader or undesirable plant species may or may not be present.
☐ (2 points) 6	Few if any seedlings of desirable grasses, forbs and shrubs are being established. Seedlings of invader or undesirable plants are present in open spaces between plants.
☐ **SURFACE LITTER** (5 points)	Surface litter is accumulating in place.
☐ (3 points) 2	Moderate movement of surface litter is apparent and deposited against obstacles.
☐ (1 point)	Very little surface litter is remaining.
☐ **PEDESTALS** (5 points)	There is little visual evidence of pedestalling. Those pedestals present are sloping or rounding and accumulating litter. Desirable forage grasses may be found along edges of pedestals.
☒ (3 points)	There is moderate pedestalling with no visual evidence of healing or deterioration. Small rock and plant pedestals may be occurring in flow patterns.
☐ (1 point)	Most rocks and plants are pedestalled. Pedestals are sharp-sided and eroding, often exposing grass roots.
☐ **SURFACE CRUSTING** (5 points)	There is little visual evidence of surface crusting.
☐ (3 points) 4	There is moderate surface crusting, with no visual evidence of healing or deterioration. (Note reason for cause)
☐ (1 point)	Severe surface crusting. (Note reason for cause)
☐ **RILLS AND GULLIES** (5 points)	Gullies (including rills) may be present in stable condition, with moderate sloping or rounded sides. Perennials are establishing themselves on bottom and sides of channel.
☒ (3 points)	Gullies are well developed, with small amounts of active erosion. Some vegetation may be present.
☐ (1 point)	Sharply incised V-shaped gullies cover most of the area, with most of the gullies actively eroding. Gullies are mostly devoid of perennial plants. They have fresh cutting on the bottom.
TOTAL: 14 **FIELD NOTES:**	

CM

Rangeland Health Evaluation Summary Worksheet

Part 1. Area of Interest Documentation

Location Site 16

UTM Coord

Picture #	**Description**
	0678 - 0679 - at a distance forgot to take pics on plot

Date/Time: 9/14/11 9:00am
Observer CM, VM, PH, JA, PP
Soil Map Unit Name
Veg Alliance Name
Surface texture
Parent material
Slope %
Elevation (ft)
Topographic position
Aspect

actually PP - PH did not contribute to scoring ~~the~~ any OAT

Signs of Disturbance(s) observed

OAT score of 200-m transect 23
OAT score of polygon 23

Lowest production area.

Notes: Oak - Juniper, minor mtn mohagony

Shrubs ~~Forb~~ whiteball what shrub - acacia, called shrub false mesquite

Grasses - Vine mesquite, sideoats, cane bluestem

mesquite in open areas - sampled open area for wildlife

200 m - into oak - uphill

OAT - steep + flat - mixed.

9-14-11 Site/6 CM

Criteria used to score Observed Apparent Trend (OAT). *Check appropriate box in each category which best fits area being observed. Points may vary within each category.*

☐ **VIGOR** (10 points)	Desirable grasses, forbs and shrubs are vigorous, showing good health. These plants have good size, color, and produce abundant herbage.
☐ (6 points) 7	Desirable grasses, forbs and shrubs have moderate vigor. They are medium size with fair color, and produce moderate amounts of herbage. Some seed stalks and seed heads are present.
☐ (2 points)	Desirable grasses, forbs and shrubs have low vigor. They appear unhealthy with small size and poor color. Portions of clumps or entire plants are dead or dying. Seed stalks and seed heads are non-existent, except in protected areas.
☐ **SEEDLINGS** (10 points)	There is seedling establishment of desirable grasses, forbs and shrubs. Seedlings are present in open spaces between plants and along edges of soil pedestals. Few seedlings of invader or undesirable plants are present.
☐ (6 points) 6	Some seedlings of desirable grasses, forbs and shrubs may or may not be present in open spaces between plants. Some seedlings of invader or undesirable plant species may or may not be present.
☐ (2 points)	Few if any seedlings of desirable grasses, forbs and shrubs are being established. Seedlings of invader or undesirable plants are present in open spaces between plants.
☐ **SURFACE LITTER** (5 points)	Surface litter is accumulating in place.
☐ (3 points) 2	Moderate movement of surface litter is apparent and deposited against obstacles.
☐ (1 point)	Very little surface litter is remaining.
☐ **PEDESTALS** (5 points)	There is little visual evidence of pedestalling. Those pedestals present are sloping or rounding and accumulating litter. Desirable forage grasses may be found along edges of pedestals.
☐ (3 points) 2	There is moderate pedestalling with no visual evidence of healing or deterioration. Small rock and plant pedestals may be occurring in flow patterns.
☐ (1 point)	Most rocks and plants are pedestalled. Pedestals are sharp-sided and eroding, often exposing grass roots.
☐ **SURFACE CRUSTING** (5 points) 4	There is little visual evidence of surface crusting.
☐ (3 points)	There is moderate surface crusting, with no visual evidence of healing or deterioration. (Note reason for cause)
☐ (1 point)	Severe surface crusting. (Note reason for cause)
☐ **RILLS AND GULLIES** (5 points)	Gullies (including rills) may be present in stable condition, with moderate sloping or rounded sides. Perennials are establishing themselves on bottom and sides of channel.
☐ (3 points)	Gullies are well developed, with small amounts of active erosion. Some vegetation may be present.
☐ (1 point) 2	Sharply incised V-shaped gullies cover most of the area, with most of the gullies actively eroding. Gullies are mostly devoid of perennial plants. They have fresh cutting on the bottom.
TOTAL: 23 **FIELD NOTES:**	

pit

Rangeland Health Evaluation Summary Worksheet

Part 1. Area of Interest Documentation

Location Site 17

UTM Coord

Picture # Description

0657 – 0662

Date/Time: 9/13/11
Observer CM, PH, VM
Soil Map Unit Name
Veg Alliance Name
Surface texture
Parent material
Slope %
Elevation (ft)
Topographic position
Aspect

Signs of Disturbance(s) observed

OAT score of 200-m transect 10
OAT score of polygon 10

Notes:

South Facing

mesquite dominated

possible creosote sub-dominate.

no grasses

mesquite ~~grazing~~ trampling?

Site 17 PH

Criteria used to score Observed Apparent Trend (OAT). ***Check appropriate box in each category which best fits area being observed. Points may vary within each category.***

☐ **VIGOR** (10 points)	Desirable grasses, forbs and shrubs are vigorous, showing good health. These plants have good size, color, and produce abundant herbage.
☐ (6 points)	Desirable grasses, forbs and shrubs have moderate vigor. They are medium size with fair color, and produce moderate amounts of herbage. Some seed stalks and seed heads are present.
☐ (2 points) 6	Desirable grasses, forbs and shrubs have low vigor. They appear unhealthy with small size and poor color. Portions of clumps or entire plants are dead or dying. Seed stalks and seed heads are non-existent, except in protected areas.
☐ **SEEDLINGS** (10 points)	There is seedling establishment of desirable grasses, forbs and shrubs. Seedlings are present in open spaces between plants and along edges of soil pedestals. Few seedlings of invader or undesirable plants are present.
☐ (6 points)	Some seedlings of desirable grasses, forbs and shrubs may or may not be present in open spaces between plants. Some seedlings of invader or undesirable plant species may or may not be present.
☐ (2 points) 6	Few if any seedlings of desirable grasses, forbs and shrubs are being established. Seedlings of invader or undesirable plants are present in open spaces between plants.
☐ **SURFACE LITTER** (5 points)	Surface litter is accumulating in place.
☐ (3 points)	Moderate movement of surface litter is apparent and deposited against obstacles.
☒ (1 point)	Very little surface litter is remaining.
☐ **PEDESTALS** (5 points) NA	There is little visual evidence of pedestalling. Those pedestals present are sloping or rounding and accumulating litter. Desirable forage grasses may be found along edges of pedestals.
☐ (3 points) 0	There is moderate pedestalling with no visual evidence of healing or deterioration. Small rock and plant pedestals may be occurring in flow patterns.
☐ (1 point)	Most rocks and plants are pedestalled. Pedestals are sharp-sided and eroding, often exposing grass roots.
☐ **SURFACE CRUSTING** (5 points)	There is little visual evidence of surface crusting.
☐ (3 points) 4	There is moderate surface crusting, with no visual evidence of healing or deterioration. (Note reason for cause)
☐ (1 point)	Severe surface crusting. (Note reason for cause)
☐ **RILLS AND GULLIES** (5 points) 4	Gullies (including rills) may be present in stable condition, with moderate sloping or rounded sides. Perennials are establishing themselves on bottom and sides of channel.
☐ (3 points)	Gullies are well developed, with small amounts of active erosion. Some vegetation may be present.
☐ (1 point)	Sharply incised V-shaped gullies cover most of the area, with most of the gullies actively eroding. Gullies are mostly devoid of perennial plants. They have fresh cutting on the bottom.
TOTAL: 10 **FIELD NOTES:**	

Cell Phone Hill 2011 data — calibrate ~~dat~~ in 2014 to these areas to give same scores

Summit

vigor	9
seedlings	9
litter	5
pedestal	4
crusting	5
gully	5
OAT =	37

SW facing

Vigor	10
Seedling	10
litter	5
pedestal	4
crusting	5
gully	5
OAT =	39

NE-facing

Vigor	10
Seedling	10
litter	5
pedestal	5
crusting	5
gully	5
OAT =	40

Lamplight Outcrop

Vigor	10
Seedling	10
litter	4
pedestal	3
crusting	4
gully	5
OAT =	36

Reference   Langbright Outcrop   9/12/11.   CM, VM, DH

Criteria used to score Observed Apparent Trend (OAT). ***Check appropriate box in each category which best fits area being observed. Points may vary within each category.***

☒ **VIGOR** (10 points) 10	Desirable grasses, forbs and shrubs are vigorous, showing good health. These plants have good size, color, and produce abundant herbage. dry year – but set as best for grazing
☐ (6 points)	Desirable grasses, forbs and shrubs have moderate vigor. They are medium size with fair color, and produce moderate amounts of herbage. Some seed stalks and seed heads are present.
☐ (2 points)	Desirable grasses, forbs and shrubs have low vigor. They appear unhealthy with small size and poor color. Portions of clumps or entire plants are dead or dying. Seed stalks and seed heads are non-existent, except in protected areas.
☒ **SEEDLINGS** (10 points) 10	There is seedling establishment of desirable grasses, forbs and shrubs. Seedlings are present in open spaces between plants and along edges of soil pedestals. Few seedlings of invader or undesirable plants are present. dry year little but set as best for grazing
☐ (6 points)	Some seedlings of desirable grasses, forbs and shrubs may or may not be present in open spaces between plants. Some seedlings of invader or undesirable plant species may or may not be present.
☐ (2 points)	Few if any seedlings of desirable grasses, forbs and shrubs are being established. Seedlings of invader or undesirable plants are present in open spaces between plants.
☒ **SURFACE LITTER** (5 points) 4	Surface litter is accumulating in place.
☐ (3 points)	Moderate movement of surface litter is apparent and deposited against obstacles.
☐ (1 point)	Very little surface litter is remaining.
☐ **PEDESTALS** (5 points)	There is little visual evidence of pedestalling. Those pedestals present are sloping or rounding and accumulating litter. Desirable forage grasses may be found along edges of pedestals.
☒ (3 points) 3	There is moderate pedestalling with no visual evidence of healing or deterioration. Small rock and plant pedestals may be occurring in flow patterns.
☐ (1 point)	Most rocks and plants are pedestalled. Pedestals are sharp-sided and eroding, often exposing grass roots.
☐ **SURFACE CRUSTING** (5 points)	There is little visual evidence of surface crusting.
☐ (3 points) 4	There is moderate surface crusting, with no visual evidence of healing or deterioration. (Note reason for cause)
☐ (1 point)	Severe surface crusting. (Note reason for cause)
☒ **RILLS AND GULLIES** (5 points) 5	Gullies (including rills) may be present in stable condition, with moderate sloping or rounded sides. Perennials are establishing themselves on bottom and sides of channel.
☐ (3 points)	Gullies are well developed, with small amounts of active erosion. Some vegetation may be present.
☐ (1 point)	Sharply incised V-shaped gullies cover most of the area, with most of the gullies actively eroding. Gullies are mostly devoid of perennial plants. They have fresh cutting on the bottom.
TOTAL: ~~36~~ ~~37~~ 36 **FIELD NOTES:**	mesquite – dominant Sideoats grama – common prickly pear cacti litter moving some w/ sheet erosion 2-3' patches minor crusting moderate pedestalling oak in drainage Mormon tea wild holly lots seed heads

Scour + deposit.

Reference Cell phone hill SW facing slope 9/12 [illegible]

Criteria used to score Observed Apparent Trend (OAT). ***Check appropriate box in each category which best fits area being observed. Points may vary within each category.***

☒ **VIGOR** (10 points) 10	Desirable grasses, forbs and shrubs are vigorous, showing good health. These plants have good size, color, and produce abundant herbage. for dry year for forage levels
☐ (6 points)	Desirable grasses, forbs and shrubs have moderate vigor. They are medium size with fair color, and produce moderate amounts of herbage. Some seed stalks and seed heads are present.
☐ (2 points)	Desirable grasses, forbs and shrubs have low vigor. They appear unhealthy with small size and poor color. Portions of clumps or entire plants are dead or dying. Seed stalks and seed heads are non-existent, except in protected areas.
☒ **SEEDLINGS** (10 points) 10	There is seedling establishment of desirable grasses, forbs and shrubs. Seedlings are present in open spaces between plants and along edges of soil pedestals. Few seedlings of invader or undesirable plants are present.
☐ (6 points)	Some seedlings of desirable grasses, forbs and shrubs may or may not be present in open spaces between plants. Some seedlings of invader or undesirable plant species may or may not be present.
☐ (2 points)	Few if any seedlings of desirable grasses, forbs and shrubs are being established. Seedlings of invader or undesirable plants are present in open spaces between plants.
☒ **SURFACE LITTER** (5 points) 5	Surface litter is accumulating in place.
☐ (3 points)	Moderate movement of surface litter is apparent and deposited against obstacles.
☐ (1 point)	Very little surface litter is remaining.
☒ **PEDESTALS** (5 points) min 5	There is little visual evidence of pedestalling. Those pedestals present are sloping or rounding and accumulating litter. Desirable forage grasses may be found along edges of pedestals.
☐ (3 points)	There is moderate pedestalling with no visual evidence of healing or deterioration. Small rock and plant pedestals may be occurring in flow patterns.
☐ (1 point)	Most rocks and plants are pedestalled. Pedestals are sharp-sided and eroding, often exposing grass roots.
☒ **SURFACE CRUSTING** (5 points) 5	There is little visual evidence of surface crusting.
☐ (3 points)	There is moderate surface crusting, with no visual evidence of healing or deterioration. (Note reason for cause)
☐ (1 point)	Severe surface crusting. (Note reason for cause)
☒ **RILLS AND GULLIES** (5 points) 5	Gullies (including rills) may be present in stable condition, with moderate sloping or rounded sides. Perennials are establishing themselves on bottom and sides of channel.
☐ (3 points)	Gullies are well developed, with small amounts of active erosion. Some vegetation may be present.
☐ (1 point)	Sharply incised V-shaped gullies cover most of the area, with most of the gullies actively eroding. Gullies are mostly devoid of perennial plants. They have fresh cutting on the bottom.
TOTAL: 40 **FIELD NOTES:**	Snake broomweed - dead mostly Tobosa grass - low growth relative to last year - only 1 seedling pedestaling Fluff grass ← not great for ~~grz~~ forage

<2' for patches is good (patches smaller than this)

Refuge Cell phone hill NE-facing 9/13/11 [illegible]

Criteria used to score Observed Apparent Trend (OAT). ***Check appropriate box in each category which best fits area being observed. Points may vary within each category.***

☒ **VIGOR** (10 points) 10	Desirable grasses, forbs and shrubs are vigorous, showing good health. These plants have good size, color, and produce abundant herbage.
☐ (6 points) ~~10~~	Desirable grasses, forbs and shrubs have moderate vigor. They are medium size with fair color, and produce moderate amounts of herbage. Some seed stalks and seed heads are present.
☐ (2 points)	Desirable grasses, forbs and shrubs have low vigor. They appear unhealthy with small size and poor color. Portions of clumps or entire plants are dead or dying. Seed stalks and seed heads are non-existent, except in protected areas.
☒ **SEEDLINGS** (10 points) 10	There is seedling establishment of desirable grasses, forbs and shrubs. Seedlings are present in open spaces between plants and along edges of soil pedestals. Few seedlings of invader or undesirable plants are present.
☐ (6 points)	Some seedlings of desirable grasses, forbs and shrubs may or may not be present in open spaces between plants. Some seedlings of invader or undesirable plant species may or may not be present.
☐ (2 points)	Few if any seedlings of desirable grasses, forbs and shrubs are being established. Seedlings of invader or undesirable plants are present in open spaces between plants.
☒ **SURFACE LITTER** (5 points) 5	Surface litter is accumulating in place.
☐ (3 points)	Moderate movement of surface litter is apparent and deposited against obstacles.
☐ (1 point)	Very little surface litter is remaining.
☐ **PEDESTALS** (5 points) 4	There is little visual evidence of pedestalling. Those pedestals present are sloping or rounding and accumulating litter. Desirable forage grasses may be found along edges of pedestals.
☐ (3 points)	There is moderate pedestalling with no visual evidence of healing or deterioration. Small rock and plant pedestals may be occurring in flow patterns.
☐ (1 point)	Most rocks and plants are pedestalled. Pedestals are sharp-sided and eroding, often exposing grass roots.
☒ **SURFACE CRUSTING** (5 points) 5	There is little visual evidence of surface crusting.
☐ (3 points)	There is moderate surface crusting, with no visual evidence of healing or deterioration. (Note reason for cause)
☐ (1 point)	Severe surface crusting. (Note reason for cause)
☐ **RILLS AND GULLIES** (5 points) 5	Gullies (including rills) may be present in stable condition, with moderate sloping or rounded sides. Perennials are establishing themselves on bottom and sides of channel.
☐ (3 points)	Gullies are well developed, with small amounts of active erosion. Some vegetation may be present.
☐ (1 point)	Sharply incised V-shaped gullies cover most of the area, with most of the gullies actively eroding. Gullies are mostly devoid of perennial plants. They have fresh cutting on the bottom.
TOTAL: 39 **FIELD NOTES:**	↑ variety of grasses relative to SW side more Snakeweed growth Tobosa, etc. Mormon tea anthill – accumulated seed pods more pedestalling than ~~Do~~ southwest side

Reference Cell phone hill Summit 9/12/11 PH, CM, VM

Criteria used to score Observed Apparent Trend (OAT). ***Check appropriate box in each category which best fits area being observed. Points may vary within each category.***

☒ **VIGOR** (10 points) 9	Desirable grasses, forbs and shrubs are vigorous, showing good health. These plants have good size, color, and produce abundant herbage.
☐ (6 points)	Desirable grasses, forbs and shrubs have moderate vigor. They are medium size with fair color, and produce moderate amounts of herbage. Some seed stalks and seed heads are present.
☐ (2 points)	Desirable grasses, forbs and shrubs have low vigor. They appear unhealthy with small size and poor color. Portions of clumps or entire plants are dead or dying. Seed stalks and seed heads are non-existent, except in protected areas.
☐ **SEEDLINGS** (10 points) 9	There is seedling establishment of desirable grasses, forbs and shrubs. Seedlings are present in open spaces between plants and along edges of soil pedestals. Few seedlings of invader or undesirable plants are present.
☐ (6 points)	Some seedlings of desirable grasses, forbs and shrubs may or may not be present in open spaces between plants. Some seedlings of invader or undesirable plant species may or may not be present.
☐ (2 points)	Few if any seedlings of desirable grasses, forbs and shrubs are being established. Seedlings of invader or undesirable plants are present in open spaces between plants.
☐ **SURFACE LITTER** (5 points) 5	Surface litter is accumulating in place.
☐ (3 points)	Moderate movement of surface litter is apparent and deposited against obstacles.
☐ (1 point)	Very little surface litter is remaining.
☒ **PEDESTALS** (5 points) 4	There is little visual evidence of pedestalling. Those pedestals present are sloping or rounding and accumulating litter. Desirable forage grasses may be found along edges of pedestals.
☐ (3 points)	There is moderate pedestalling with no visual evidence of healing or deterioration. Small rock and plant pedestals may be occurring in flow patterns.
☐ (1 point)	Most rocks and plants are pedestalled. Pedestals are sharp-sided and eroding, often exposing grass roots.
☐ **SURFACE CRUSTING** (5 points) 5	There is little visual evidence of surface crusting.
☐ (3 points)	There is moderate surface crusting, with no visual evidence of healing or deterioration. (Note reason for cause)
☐ (1 point)	Severe surface crusting. (Note reason for cause)
☐ **RILLS AND GULLIES** (5 points) 5	Gullies (including rills) may be present in stable condition, with moderate sloping or rounded sides. Perennials are establishing themselves on bottom and sides of channel.
☐ (3 points)	Gullies are well developed, with small amounts of active erosion. Some vegetation may be present.
☐ (1 point)	Sharply incised V-shaped gullies cover most of the area, with most of the gullies actively eroding. Gullies are mostly devoid of perennial plants. They have fresh cutting on the bottom.
TOTAL: 37 **FIELD NOTES:**	Yucca added to species seen on SE cell phone slope.

Rangeland Health Evaluation Summary Worksheet

Part 1. Area of Interest Documentation

Location STS - PT - 2013 - 1

UTM Coord

Picture #	**Description**

Date/Time: 9-24-14 11:47 am
Observer DM, PP, MS, JA
Soil Map Unit Name
Veg Alliance Name
Surface texture
Parent material
Slope %
Elevation (ft)
Topographic position
Aspect

See Excel file w/ OAT score

Signs of Disturbance(s) observed

OAT score of 200-m transect 15
OAT score of polygon

Notes: almost 100% mesquite dominated

1 or 2 grasses Aristida
Sporobolus alkali sacaton (~~dropseed~~)

seed rain effect from ripped road ↑ score for seedlings?

lots forbs = cotyledons, seedlings (nightshade, woolly aster)

near ripped haul road - one in plot - avoided

but fewer farther downhill

red rock - armored

15 - 3 (pedestals) = 12

STS - PT - 2013 - 1

Criteria used to score Observed Apparent Trend (OAT). ***Check appropriate box in each category which best fits area being observed. Points may vary within each category.***

☐ **VIGOR** (10 points)		Desirable grasses, forbs and shrubs are vigorous, showing good health. These plants have good size, color, and produce abundant herbage.
☐ (6 points)		Desirable grasses, forbs and shrubs have moderate vigor. They are medium size with fair color, and produce moderate amounts of herbage. Some seed stalks and seed heads are present.
☐ (2 points)	1	Desirable grasses, forbs and shrubs have low vigor. They appear unhealthy with small size and poor color. Portions of clumps or entire plants are dead or dying. Seed stalks and seed heads are non-existent, except in protected areas.
☐ **SEEDLINGS** (10 points)		There is seedling establishment of desirable grasses, forbs and shrubs. Seedlings are present in open spaces between plants and along edges of soil pedestals. Few seedlings of invader or undesirable plants are present.
☐ (6 points)		Some seedlings of desirable grasses, forbs and shrubs may or may not be present in open spaces between plants. Some seedlings of invader or undesirable plant species may or may not be present.
☐ (2 points)	2	Few if any seedlings of desirable grasses, forbs and shrubs are being established. Seedlings of invader or undesirable plants are present in open spaces between plants.
☐ **SURFACE LITTER** (5 points)		Surface litter is accumulating in place.
☐ (3 points)		Moderate movement of surface litter is apparent and deposited against obstacles.
☐ (1 point)	2	Very little surface litter is remaining.
☐ **PEDESTALS** (5 points)	3	There is little visual evidence of pedestalling. Those pedestals present are sloping or rounding and accumulating litter. Desirable forage grasses may be found along edges of pedestals.
☐ (3 points)		There is moderate pedestalling with no visual evidence of healing or deterioration. Small rock and plant pedestals may be occurring in flow patterns.
☐ (1 point)		Most rocks and plants are pedestalled. Pedestals are sharp-sided and eroding, often exposing grass roots.
☐ **SURFACE CRUSTING** (5 points)		There is little visual evidence of surface crusting.
☐ (3 points)	3	There is moderate surface crusting, with no visual evidence of healing or deterioration. (Note reason for cause)
☐ (1 point)		Severe surface crusting. (Note reason for cause)
☐ **RILLS AND GULLIES** (5 points)	4	Gullies (including rills) may be present in stable condition, with moderate sloping or rounded sides. Perennials are establishing themselves on bottom and sides of channel.
☐ (3 points)		Gullies are well developed, with small amounts of active erosion. Some vegetation may be present.
☐ (1 point)		Sharply incised V-shaped gullies cover most of the area, with most of the gullies actively eroding. Gullies are mostly devoid of perennial plants. They have fresh cutting on the bottom.
TOTAL: 15		
FIELD NOTES:		no diversity

Skunk bush

mesquite lotebush 1 to 2 dead

even shrubs unhealthy (lotebush later?)

seems high seedling giving it seasonal bias

Rangeland Health Evaluation Summary Worksheet

Part 1. Area of Interest Documentation

Location STS -PT-2013 – 2

UTM Coord

Picture # Description

Date/Time: 9-24-14 9:00am
Observer JA, CM, PP, MS
Soil Map Unit Name
Veg Alliance Name
Surface texture
Parent material
Slope %
Elevation (ft)
Topographic position
Aspect

Signs of Disturbance(s) observed

OAT score of 200-m transect 12
OAT score of polygon

Mesquite dominated

a little Sporobolus

red rock armored

Notes: bristlegrass

nightshade

Portulaca ?

rocky bottom - colluvial soil accumulated

dug in colluvial soil

Small Spurge

~~1 Mormon te~~

1 Mormon tea

-3 = 9? pedestals

Russian thistle

road - block - capture

STS-PT-2013-2

Criteria used to score Observed Apparent Trend (OAT). ***Check appropriate box in each category which best fits area being observed. Points may vary within each category.***

☐ **VIGOR** (10 points)	Desirable grasses, forbs and shrubs are vigorous, showing good health. These plants have good size, color, and produce abundant herbage.
☐ (6 points)	Desirable grasses, forbs and shrubs have moderate vigor. They are medium size with fair color, and produce moderate amounts of herbage. Some seed stalks and seed heads are present.
☑ (2 points)	Desirable grasses, forbs and shrubs have low vigor. They appear unhealthy with small size and poor color. Portions of clumps or entire plants are dead or dying. Seed stalks and seed heads are non-existent, except in protected areas.
☐ **SEEDLINGS** (10 points)	There is seedling establishment of desirable grasses, forbs and shrubs. Seedlings are present in open spaces between plants and along edges of soil pedestals. Few seedlings of invader or undesirable plants are present.
☐ (6 points)	Some seedlings of desirable grasses, forbs and shrubs may or may not be present in open spaces between plants. Some seedlings of invader or undesirable plant species may or may not be present.
☑ (2 points) 1	Few if any seedlings of desirable grasses, forbs and shrubs are being established. Seedlings of invader or undesirable plants are present in open spaces between plants.
☐ **SURFACE LITTER** (5 points)	Surface litter is accumulating in place.
☐ (3 points) 2	Moderate movement of surface litter is apparent and deposited against obstacles.
☐ (1 point)	Very little surface litter is remaining.
☐ **PEDESTALS** (5 points)	There is little visual evidence of pedestalling. Those pedestals present are sloping or rounding and accumulating litter. Desirable forage grasses may be found along edges of pedestals.
☑ (3 points) 3	There is moderate pedestalling with no visual evidence of healing or deterioration. Small rock and plant pedestals may be occurring in flow patterns.
☐ (1 point)	Most rocks and plants are pedestalled. Pedestals are sharp-sided and eroding, often exposing grass roots.
☐ **SURFACE CRUSTING** (5 points)	There is little visual evidence of surface crusting.
☐ (3 points) 2	There is moderate surface crusting, with no visual evidence of healing or deterioration. (Note reason for cause)
☐ (1 point)	Severe surface crusting. (Note reason for cause)
☐ **RILLS AND GULLIES** (5 points) 4	Gullies (including rills) may be present in stable condition, with moderate sloping or rounded sides. Perennials are establishing themselves on bottom and sides of channel.
☐ (3 points)	Gullies are well developed, with small amounts of active erosion. Some vegetation may be present.
☐ (1 point)	Sharply incised V-shaped gullies cover most of the area, with most of the gullies actively eroding. Gullies are mostly devoid of perennial plants. They have fresh cutting on the bottom.
TOTAL: 12 **FIELD NOTES:**	

Rangeland Health Evaluation Summary Worksheet

Part 1. Area of Interest Documentation

Location STS-PT-2013-5

UTM Coord ____

Picture #	**Description**

Date/Time: 9-25-14 9:00 am
Observer CM, JA, MS, PP
Soil Map Unit Name
Veg Alliance Name
Surface texture
Parent material
Slope %
Elevation (ft)
Topographic position
Aspect

Signs of Disturbance(s) observed

OAT score of 200-m transect ____
OAT score of polygon ____

Notes: On ~50% Slope

25% bedrock

lots armoring

Oak -

Tabosa
sideoats
vine mesquite

mesquite / catclaw
lots yucca & cacti
some surviving yucca
(cholla still dead)

2 shrub sp. dominate in patches

27

high mass (Alyosia
shrub wrightii)

STS - PT-2013-5

Criteria used to score Observed Apparent Trend (OAT). ***Check appropriate box in each category which best fits area being observed. Points may vary within each category.***

☐ **VIGOR** (10 points)	Desirable grasses, forbs and shrubs are vigorous, showing good health. These plants have good size, color, and produce abundant herbage.
☐ (6 points) 7	Desirable grasses, forbs and shrubs have moderate vigor. They are medium size with fair color, and produce moderate amounts of herbage. Some seed stalks and seed heads are present.
☐ (2 points)	Desirable grasses, forbs and shrubs have low vigor. They appear unhealthy with small size and poor color. Portions of clumps or entire plants are dead or dying. Seed stalks and seed heads are non-existent, except in protected areas.
☐ **SEEDLINGS** (10 points)	There is seedling establishment of desirable grasses, forbs and shrubs. Seedlings are present in open spaces between plants and along edges of soil pedestals. Few seedlings of invader or undesirable plants are present.
☐ (6 points) 6	Some seedlings of desirable grasses, forbs and shrubs may or may not be present in open spaces between plants. Some seedlings of invader or undesirable plant species may or may not be present.
☐ (2 points)	Few if any seedlings of desirable grasses, forbs and shrubs are being established. Seedlings of invader or undesirable plants are present in open spaces between plants.
☐ **SURFACE LITTER** (5 points)	Surface litter is accumulating in place.
☐ (3 points) 3	Moderate movement of surface litter is apparent and deposited against obstacles.
☐ (1 point)	Very little surface litter is remaining.
☐ **PEDESTALS** (5 points)	There is little visual evidence of pedestalling. Those pedestals present are sloping or rounding and accumulating litter. Desirable forage grasses may be found along edges of pedestals.
☐ (3 points) 4	There is moderate pedestalling with no visual evidence of healing or deterioration. Small rock and plant pedestals may be occurring in flow patterns.
☐ (1 point)	Most rocks and plants are pedestalled. Pedestals are sharp-sided and eroding, often exposing grass roots.
☐ **SURFACE CRUSTING** (5 points) 4	There is little visual evidence of surface crusting.
☐ (3 points)	There is moderate surface crusting, with no visual evidence of healing or deterioration. (Note reason for cause)
☐ (1 point)	Severe surface crusting. (Note reason for cause)
☐ **RILLS AND GULLIES** (5 points)	Gullies (including rills) may be present in stable condition, with moderate sloping or rounded sides. Perennials are establishing themselves on bottom and sides of channel.
☐ (3 points) 3	Gullies are well developed, with small amounts of active erosion. Some vegetation may be present.
☐ (1 point)	Sharply incised V-shaped gullies cover most of the area, with most of the gullies actively eroding. Gullies are mostly devoid of perennial plants. They have fresh cutting on the bottom.
TOTAL: 27 **FIELD NOTES:**	

Rangeland Health Evaluation Summary Worksheet

Part 1. Area of Interest Documentation

Location 2

UTM Coord STS - PT - 2013 - 9

Picture #	Description

Date/Time: 9-24-14 2:30pm
Observer CM, PP, JA, MS
Soil Map Unit Name
Veg Alliance Name
Surface texture
Parent material
Slope %
Elevation (ft)
Topographic position
Aspect

Signs of Disturbance(s) observed

OAT score of 200-m transect 7
OAT score of polygon

Notes: Dom: mesquite - mostly, some alligator juniper

Tobosa - rare - few patches

- 1 patch sacaton

near model T road

soil moving
green
rocks
side plane shrubs

60% bedrock

STS-PT-2013-9

Criteria used to score Observed Apparent Trend (OAT). *Check appropriate box in each category which best fits area being observed. Points may vary within each category.*

☐ **VIGOR** (10 points)	Desirable grasses, forbs and shrubs are vigorous, showing good health. These plants have good size, color, and produce abundant herbage.
☐ (6 points)	Desirable grasses, forbs and shrubs have moderate vigor. They are medium size with fair color, and produce moderate amounts of herbage. Some seed stalks and seed heads are present.
☐ (2 points) 0	Desirable grasses, forbs and shrubs have low vigor. They appear unhealthy with small size and poor color. Portions of clumps or entire plants are dead or dying. Seed stalks and seed heads are non-existent, except in protected areas.
☐ **SEEDLINGS** (10 points)	There is seedling establishment of desirable grasses, forbs and shrubs. Seedlings are present in open spaces between plants and along edges of soil pedestals. Few seedlings of invader or undesirable plants are present.
☐ (6 points)	Some seedlings of desirable grasses, forbs and shrubs may or may not be present in open spaces between plants. Some seedlings of invader or undesirable plant species may or may not be present.
☐ (2 points) 1	Few if any seedlings of desirable grasses, forbs and shrubs are being established. Seedlings of invader or undesirable plants are present in open spaces between plants.
☐ **SURFACE LITTER** (5 points)	Surface litter is accumulating in place.
☐ (3 points)	Moderate movement of surface litter is apparent and deposited against obstacles.
☐ (1 point) 1	Very little surface litter is remaining.
☐ **PEDESTALS** (5 points)	There is little visual evidence of pedestalling. Those pedestals present are sloping or rounding and accumulating litter. Desirable forage grasses may be found along edges of pedestals.
☐ (3 points)	There is moderate pedestalling with no visual evidence of healing or deterioration. Small rock and plant pedestals may be occurring in flow patterns.
☐ (1 point) 1	Most rocks and plants are pedestalled. Pedestals are sharp-sided and eroding, often exposing grass roots.
☐ **SURFACE CRUSTING** (5 points)	There is little visual evidence of surface crusting.
☐ (3 points) 2	There is moderate surface crusting, with no visual evidence of healing or deterioration. (Note reason for cause)
☐ (1 point)	Severe surface crusting. (Note reason for cause)
☐ **RILLS AND GULLIES** (5 points)	Gullies (including rills) may be present in stable condition, with moderate sloping or rounded sides. Perennials are establishing themselves on bottom and sides of channel.
☐ (3 points) 2	Gullies are well developed, with small amounts of active erosion. Some vegetation may be present.
☐ (1 point)	Sharply incised V-shaped gullies cover most of the area, with most of the gullies actively eroding. Gullies are mostly devoid of perennial plants. They have fresh cutting on the bottom.
TOTAL: 7 **FIELD NOTES:**	

Rangeland Health Evaluation Summary Worksheet

Part 1. Area of Interest Documentation

Location SB - DTS-2013 - 12

UTM Coord

Picture #	**Description**

Date/Time: 9-23-14 1:35 pm
Observer CM, PP, JA, MS
Soil Map Unit Name
Veg Alliance Name
Surface texture
Parent material
Slope %
Elevation (ft)
Topographic position
Aspect

Signs of Disturbance(s) observed

OAT score of 200-m transect 17
OAT score of polygon

Notes:

Desirable

sideoats grama
hairy grama
Indian ricegrass
deergrass (muhlenbergia)
vine mesquite
3-awn - purple + Arizona ~ more spread out

85% bedrock

healthy plants

Bedrock → oak-juniper → (yucca) dominated

STJ-PI-2013-12
Site 12 9-23-14

Criteria used to score Observed Apparent Trend (OAT). ***Check appropriate box in each category which best fits area being observed. Points may vary within each category.***

☐ **VIGOR** (10 points)	Desirable grasses, forbs and shrubs are vigorous, showing good health. These plants have good size, color, and produce abundant herbage.
☑ (6 points) 6	Desirable grasses, forbs and shrubs have moderate vigor. They are medium size with fair color, and produce moderate amounts of herbage. Some seed stalks and seed heads are present.
☐ (2 points)	Desirable grasses, forbs and shrubs have low vigor. They appear unhealthy with small size and poor color. Portions of clumps or entire plants are dead or dying. Seed stalks and seed heads are non-existent, except in protected areas.
☐ **SEEDLINGS** (10 points)	There is seedling establishment of desirable grasses, forbs and shrubs. Seedlings are present in open spaces between plants and along edges of soil pedestals. Few seedlings of invader or undesirable plants are present.
☐ (6 points)	Some seedlings of desirable grasses, forbs and shrubs may or may not be present in open spaces between plants. Some seedlings of invader or undesirable plant species may or may not be present.
☑ (2 points) 2	Few if any seedlings of desirable grasses, forbs and shrubs are being established. Seedlings of invader or undesirable plants are present in open spaces between plants.
☐ **SURFACE LITTER** (5 points)	Surface litter is accumulating in place.
☐ (3 points) 2	Moderate movement of surface litter is apparent and deposited against obstacles.
☐ (1 point)	Very little surface litter is remaining.
☐ **PEDESTALS** (5 points)	There is little visual evidence of pedestalling. Those pedestals present are sloping or rounding and accumulating litter. Desirable forage grasses may be found along edges of pedestals.
☑ (3 points) 3	There is moderate pedestalling with no visual evidence of healing or deterioration. Small rock and plant pedestals may be occurring in flow patterns.
☐ (1 point)	Most rocks and plants are pedestalled. Pedestals are sharp-sided and eroding, often exposing grass roots.
☐ **SURFACE CRUSTING** (5 points)	There is little visual evidence of surface crusting.
☑ (3 points)	There is moderate surface crusting, with no visual evidence of healing or deterioration. (Note reason for cause)
☐ (1 point)	Severe surface crusting. (Note reason for cause)
☐ **RILLS AND GULLIES** (5 points)	Gullies (including rills) may be present in stable condition, with moderate sloping or rounded sides. Perennials are establishing themselves on bottom and sides of channel.
☐ (3 points)	Gullies are well developed, with small amounts of active erosion. Some vegetation may be present.
☑ (1 point)	Sharply incised V-shaped gullies cover most of the area, with most of the gullies actively eroding. Gullies are mostly devoid of perennial plants. They have fresh cutting on the bottom.
TOTAL: 17 **FIELD NOTES:**	

Rangeland Health Evaluation Summary Worksheet

Part 1. Area of Interest Documentation

Location STS-PT-2013-17

East Reference Plot

UTM Coord

Picture # Description

Date/Time: 9-24-14 10:19am
Observer CM, MS, JA, PP
Soil Map Unit Name
Veg Alliance Name
Surface texture
Parent material
Slope %
Elevation (ft)
Topographic position
Aspect

Signs of Disturbance(s) observed

OAT score of 200-m transect 19
OAT score of polygon

Mesquite - dominated

no pedestalling
gaining soil

Notes: Setaria
Cane Bluestem, Sporobolus
~~Ip~~ sixweeks grama - small grama
Aristida -
golden crownbeard
Boerhavia -

lemonrant

STS-PT-2013-17

Criteria used to score Observed Apparent Trend (OAT). ***Check appropriate box in each category which best fits area being observed. Points may vary within each category.***

☐ **VIGOR** (10 points)	Desirable grasses, forbs and shrubs are vigorous, showing good health. These plants have good size, color, and produce abundant herbage.
☐ (6 points) 3	Desirable grasses, forbs and shrubs have moderate vigor. They are medium size with fair color, and produce moderate amounts of herbage. Some seed stalks and seed heads are present.
☐ (2 points)	Desirable grasses, forbs and shrubs have low vigor. They appear unhealthy with small size and poor color. Portions of clumps or entire plants are dead or dying. Seed stalks and seed heads are non-existent, except in protected areas.
☐ **SEEDLINGS** (10 points)	There is seedling establishment of desirable grasses, forbs and shrubs. Seedlings are present in open spaces between plants and along edges of soil pedestals. Few seedlings of invader or undesirable plants are present.
☐ (6 points) 5	Some seedlings of desirable grasses, forbs and shrubs may or may not be present in open spaces between plants. Some seedlings of invader or undesirable plant species may or may not be present.
☐ (2 points)	Few if any seedlings of desirable grasses, forbs and shrubs are being established. Seedlings of invader or undesirable plants are present in open spaces between plants.
☐ **SURFACE LITTER** (5 points)	Surface litter is accumulating in place.
☐ (3 points) 2	Moderate movement of surface litter is apparent and deposited against obstacles.
☐ (1 point)	Very little surface litter is remaining.
☐ **PEDESTALS** (5 points) 5	There is little visual evidence of pedestalling. Those pedestals present are sloping or rounding and accumulating litter. Desirable forage grasses may be found along edges of pedestals.
☐ (3 points)	There is moderate pedestalling with no visual evidence of healing or deterioration. Small rock and plant pedestals may be occurring in flow patterns.
☐ (1 point)	Most rocks and plants are pedestalled. Pedestals are sharp-sided and eroding, often exposing grass roots.
☐ **SURFACE CRUSTING** (5 points)	There is little visual evidence of surface crusting.
☐ (3 points)	There is moderate surface crusting, with no visual evidence of healing or deterioration. (Note reason for cause)
☑ (1 point) 1	Severe surface crusting. (Note reason for cause)
☐ **RILLS AND GULLIES** (5 points)	Gullies (including rills) may be present in stable condition, with moderate sloping or rounded sides. Perennials are establishing themselves on bottom and sides of channel.
☑ (3 points) 3	Gullies are well developed, with small amounts of active erosion. Some vegetation may be present.
☐ (1 point)	Sharply incised V-shaped gullies cover most of the area, with most of the gullies actively eroding. Gullies are mostly devoid of perennial plants. They have fresh cutting on the bottom.
TOTAL: 19 **FIELD NOTES:**	

Rangeland Health Evaluation Summary Worksheet

Part 1. Area of Interest Documentation

Location STFAR013 - 49

UTM Coord

Picture #	**Description**

Date/Time: 9-24-14 12:52pm
Observer MS, PP, CM, JA
Soil Map Unit Name
Veg Alliance Name
Surface texture
Parent material
Slope %
Elevation (ft)
Topographic position
Aspect

Signs of Disturbance(s) observed

OAT score of 200-m transect 15 0
OAT score of polygon

67% bedrock - large boulders/bedrock

Notes:

mesquite/ juniper, Alligator (juniper) trees, catclaw
~~very few~~
- lambsquarters
Portulaca
Amaranth
Yucca
trace grass - Aristida
cane ~~gram~~ bluestem

CA brickelbush under juniper

shrubs not as healthy - lots ½ dead or ¼ dead mesquite

See Ca on side

15 maybe too high
2011
0 for pedestal?
0 for vigor
⑩

STS-PT-2013-19 bedrock type

Criteria used to score Observed Apparent Trend (OAT). *Check appropriate box in each category which best fits area being observed. Points may vary within each category.*

☐ **VIGOR** (10 points)	Desirable grasses, forbs and shrubs are vigorous, showing good health. These plants have good size, color, and produce abundant herbage.
☐ (6 points)	Desirable grasses, forbs and shrubs have moderate vigor. They are medium size with fair color, and produce moderate amounts of herbage. Some seed stalks and seed heads are present.
☐ (2 points) 1	Desirable grasses, forbs and shrubs have low vigor. They appear unhealthy with small size and poor color. Portions of clumps or entire plants are dead or dying. Seed stalks and seed heads are non-existent, except in protected areas.
☐ **SEEDLINGS** (10 points)	There is seedling establishment of desirable grasses, forbs and shrubs. Seedlings are present in open spaces between plants and along edges of soil pedestals. Few seedlings of invader or undesirable plants are present.
☐ (6 points)	Some seedlings of desirable grasses, forbs and shrubs may or may not be present in open spaces between plants. Some seedlings of invader or undesirable plant species may or may not be present.
☐ (2 points) 2	Few if any seedlings of desirable grasses, forbs and shrubs are being established. Seedlings of invader or undesirable plants are present in open spaces between plants.
☐ **SURFACE LITTER** (5 points)	Surface litter is accumulating in place.
☐ (3 points) 2	Moderate movement of surface litter is apparent and deposited against obstacles.
☐ (1 point)	Very little surface litter is remaining.
☐ **PEDESTALS** (5 points) 4	There is little visual evidence of pedestalling. Those pedestals present are sloping or rounding and accumulating litter. Desirable forage grasses may be found along edges of pedestals.
☐ (3 points)	There is moderate pedestalling with no visual evidence of healing or deterioration. Small rock and plant pedestals may be occurring in flow patterns.
☐ (1 point)	Most rocks and plants are pedestalled. Pedestals are sharp-sided and eroding, often exposing grass roots.
☐ **SURFACE CRUSTING** (5 points)	There is little visual evidence of surface crusting.
☐ (3 points) 3	There is moderate surface crusting, with no visual evidence of healing or deterioration. (Note reason for cause)
☐ (1 point)	Severe surface crusting. (Note reason for cause)
☐ **RILLS AND GULLIES** (5 points)	Gullies (including rills) may be present in stable condition, with moderate sloping or rounded sides. Perennials are establishing themselves on bottom and sides of channel.
☐ (3 points) 3	Gullies are well developed, with small amounts of active erosion. Some vegetation may be present.
☐ (1 point)	Sharply incised V-shaped gullies cover most of the area, with most of the gullies actively eroding. Gullies are mostly devoid of perennial plants. They have fresh cutting on the bottom.
TOTAL: 15 **FIELD NOTES:**	

Rangeland Health Evaluation Summary Worksheet

Part 1. Area of Interest Documentation

Location STS-PT-2013 -20

UTM Coord

Picture # Description

Date/Time: 4:28 9-23-14
Observer CM, PP, MS, TA
Soil Map Unit Name
Veg Alliance Name
Surface texture
Parent material
Slope %
Elevation (ft)
Topographic position
Aspect

Signs of Disturbance(s) observed

OAT score of 200-m transect 36
OAT score of polygon

West side

Notes:

Aristida ← dominant
Sideoats grama
blue grama
ring muhly? - poor forage?

(note except ref + amendment are grazed — other amendment allots are not since 2008 fenced out

STS-PT-2015-20

Criteria used to score Observed Apparent Trend (OAT). ***Check appropriate box in each category which best fits area being observed. Points may vary within each category.***

☐ **VIGOR** (10 points) 8	Desirable grasses, forbs and shrubs are vigorous, showing good health. These plants have good size, color, and produce abundant herbage.
☐ (6 points)	Desirable grasses, forbs and shrubs have moderate vigor. They are medium size with fair color, and produce moderate amounts of herbage. Some seed stalks and seed heads are present.
☐ (2 points)	Desirable grasses, forbs and shrubs have low vigor. They appear unhealthy with small size and poor color. Portions of clumps or entire plants are dead or dying. Seed stalks and seed heads are non-existent, except in protected areas.
☐ **SEEDLINGS** (10 points) 8	There is seedling establishment of desirable grasses, forbs and shrubs. Seedlings are present in open spaces between plants and along edges of soil pedestals. Few seedlings of invader or undesirable plants are present.
☐ (6 points)	Some seedlings of desirable grasses, forbs and shrubs may or may not be present in open spaces between plants. Some seedlings of invader or undesirable plant species may or may not be present.
☐ (2 points)	Few if any seedlings of desirable grasses, forbs and shrubs are being established. Seedlings of invader or undesirable plants are present in open spaces between plants.
☐ **SURFACE LITTER** (5 points) 4	Surface litter is accumulating in place.
☐ (3 points)	Moderate movement of surface litter is apparent and deposited against obstacles.
☐ (1 point)	Very little surface litter is remaining.
☐ **PEDESTALS** (5 points)	There is little visual evidence of pedestalling. Those pedestals present are sloping or rounding and accumulating litter. Desirable forage grasses may be found along edges of pedestals.
☐ (3 points)	There is moderate pedestalling with no visual evidence of healing or deterioration. Small rock and plant pedestals may be occurring in flow patterns.
☐ (1 point) 2	Most rocks and plants are pedestalled. Pedestals are sharp-sided and eroding, often exposing grass roots.
☐ **SURFACE CRUSTING** (5 points)	There is little visual evidence of surface crusting.
☑ (3 points) 3	There is moderate surface crusting, with no visual evidence of healing or deterioration. (Note reason for cause)
☐ (1 point)	Severe surface crusting. (Note reason for cause)
☑ **RILLS AND GULLIES** (5 points) 5	Gullies (including rills) may be present in stable condition, with moderate sloping or rounded sides. Perennials are establishing themselves on bottom and sides of channel.
☐ (3 points)	Gullies are well developed, with small amounts of active erosion. Some vegetation may be present.
☐ (1 point)	Sharply incised V-shaped gullies cover most of the area, with most of the gullies actively eroding. Gullies are mostly devoid of perennial plants. They have fresh cutting on the bottom.
TOTAL: 30 **FIELD NOTES:**	

Rangeland Health Evaluation Summary Worksheet

Part 1. Area of Interest Documentation

Location STS-PT-2013-26

UTM Coord ______

Picture #	**Description**

Date/Time: 9-25-14 12:55pm
Observer CM, DDP, MS, JA
Soil Map Unit Name ______
Veg Alliance Name ______
Surface texture ______
Parent material ______
Slope % ______
Elevation (ft) ______
Topographic position ______
Aspect ______

Signs of Disturbance(s) observed

OAT score of 200-m transect ______
OAT score of polygon ______

Notes: mesquite-grama — dominant

- sideoats grama
- (a little blue grama)

vine mesquite

Tobosa

less desirable → ring muhly

Aristida

less desirable → fluff grass

horse-grazed

Tobosa - less attractive

like backyard of 2 ranches

less moisture - can't sustain as much grazing?

ETS-PT-2013-26

Criteria used to score Observed Apparent Trend (OAT). ***Check appropriate box in each category which best fits area being observed. Points may vary within each category.***

☐ **VIGOR** (10 points)	Desirable grasses, forbs and shrubs are vigorous, showing good health. These plants have good size, color, and produce abundant herbage.
☐ (6 points) 5	Desirable grasses, forbs and shrubs have moderate vigor. They are medium size with fair color, and produce moderate amounts of herbage. Some seed stalks and seed heads are present.
☐ (2 points)	Desirable grasses, forbs and shrubs have low vigor. They appear unhealthy with small size and poor color. Portions of clumps or entire plants are dead or dying. Seed stalks and seed heads are non-existent, except in protected areas.
☐ **SEEDLINGS** (10 points)	There is seedling establishment of desirable grasses, forbs and shrubs. Seedlings are present in open spaces between plants and along edges of soil pedestals. Few seedlings of invader or undesirable plants are present.
☐ (6 points) 4	Some seedlings of desirable grasses, forbs and shrubs may or may not be present in open spaces between plants. Some seedlings of invader or undesirable plant species may or may not be present.
☐ (2 points)	Few if any seedlings of desirable grasses, forbs and shrubs are being established. Seedlings of invader or undesirable plants are present in open spaces between plants.
☐ **SURFACE LITTER** (5 points)	Surface litter is accumulating in place.
☐ (3 points)	Moderate movement of surface litter is apparent and deposited against obstacles.
☐ (1 point) 1	Very little surface litter is remaining.
☐ **PEDESTALS** (5 points)	There is little visual evidence of pedestalling. Those pedestals present are sloping or rounding and accumulating litter. Desirable forage grasses may be found along edges of pedestals.
☐ (3 points)	There is moderate pedestalling with no visual evidence of healing or deterioration. Small rock and plant pedestals may be occurring in flow patterns.
☐ (1 point) 2	Most rocks and plants are pedestalled. Pedestals are sharp-sided and eroding, often exposing grass roots.
☐ **SURFACE CRUSTING** (5 points)	There is little visual evidence of surface crusting.
☐ (3 points) 3	There is moderate surface crusting, with no visual evidence of healing or deterioration. (Note reason for cause)
☐ (1 point)	Severe surface crusting. (Note reason for cause)
☐ **RILLS AND GULLIES** (5 points) 5	Gullies (including rills) may be present in stable condition, with moderate sloping or rounded sides. Perennials are establishing themselves on bottom and sides of channel.
☐ (3 points)	Gullies are well developed, with small amounts of active erosion. Some vegetation may be present.
☐ (1 point)	Sharply incised V-shaped gullies cover most of the area, with most of the gullies actively eroding. Gullies are mostly devoid of perennial plants. They have fresh cutting on the bottom.
TOTAL: 20 **FIELD NOTES:**	

Rangeland Health Evaluation Summary Worksheet

Part 1. Area of Interest Documentation

Location Cell phone Hill NE, Summit (worst), SW (best)

UTM Coord

Picture #	**Description**

Date/Time: 9-23-14 12:19 pm
Observer Carolyn Meyer, Dana Pinson, Matt Schultz, Joe Allen
Soil Map Unit Name
Veg Alliance Name
Surface texture
Parent material
Slope %
Elevation (ft)
Topographic position
Aspect NE

Signs of Disturbance(s) observed

OAT score of 200-m transect 39
OAT score of polygon

Notes: Calibrated to 2011 values of 40, 39, 38

NE + SW are reversed
-so fix on map

East Amendment Plot

Criteria used to score Observed Apparent Trend (OAT). ***Check appropriate box in each category which best fits area being observed. Points may vary within each category.***

☑ **VIGOR** (10 points)	Desirable grasses, forbs and shrubs are vigorous, showing good health. These plants have good size, color, and produce abundant herbage.
☐ (6 points)	Desirable grasses, forbs and shrubs have moderate vigor. They are medium size with fair color, and produce moderate amounts of herbage. Some seed stalks and seed heads are present.
☐ (2 points)	Desirable grasses, forbs and shrubs have low vigor. They appear unhealthy with small size and poor color. Portions of clumps or entire plants are dead or dying. Seed stalks and seed heads are non-existent, except in protected areas.
☐ **SEEDLINGS** (10 points) crested seedling not desirable	There is seedling establishment of desirable grasses, forbs and shrubs. Seedlings are present in open spaces between plants and along edges of soil pedestals. Few seedlings of invader or undesirable plants are present.
☐ (6 points)	Some seedlings of desirable grasses, forbs and shrubs may or may not be present in open spaces between plants. Some seedlings of invader or undesirable plant species may or may not be present.
☐ (2 points)	Few if any seedlings of desirable grasses, forbs and shrubs are being established. Seedlings of invader or undesirable plants are present in open spaces between plants.
☑ **SURFACE LITTER** (5 points)	Surface litter is accumulating in place.
☐ (3 points)	Moderate movement of surface litter is apparent and deposited against obstacles.
☐ (1 point)	Very little surface litter is remaining.
☑ **PEDESTALS** (5 points)	There is little visual evidence of pedestalling. Those pedestals present are sloping or rounding and accumulating litter. Desirable forage grasses may be found along edges of pedestals.
☐ (3 points)	There is moderate pedestalling with no visual evidence of healing or deterioration. Small rock and plant pedestals may be occurring in flow patterns.
☐ (1 point)	Most rocks and plants are pedestalled. Pedestals are sharp-sided and eroding, often exposing grass roots.
☑ **SURFACE CRUSTING** (5 points)	There is little visual evidence of surface crusting.
☐ (3 points)	There is moderate surface crusting, with no visual evidence of healing or deterioration. (Note reason for cause)
☐ (1 point)	Severe surface crusting. (Note reason for cause)
☑ **RILLS AND GULLIES** (5 points)	Gullies (including rills) may be present in stable condition, with moderate sloping or rounded sides. Perennials are establishing themselves on bottom and sides of channel.
☐ (3 points)	Gullies are well developed, with small amounts of active erosion. Some vegetation may be present.
☐ (1 point)	Sharply incised V-shaped gullies cover most of the area, with most of the gullies actively eroding. Gullies are mostly devoid of perennial plants. They have fresh cutting on the bottom.
TOTAL: 39 **FIELD NOTES:**	

bristle grass
sideoats
& golden crownbeard

Table F-3. Names of Species in Species Richness Dataset of 2014

Freeport-McMoran Chino Mines Company
Vanadium, New Mexico
Smelter/Tailing Soils IU Phytotoxicity and Vegetation Community Study

Site ID	Block	Date	# Trees/ Shrub sp.	Trees/ Shrub sp. ID*	# Grass sp.	Grass sp. ID*	# Forb sp.	Forb sp. ID*	# Cactus sp.	Cactus sp. ID*	# Species in Block
STS-PT-2013-1	1	9/24/2014	1	Prosopis glandulosa Torrey	1	*Aristida purpurea* Nuttall -red three awn	1	(1) unknown forb	0		3
STS-PT-2013-1	2	9/24/2014	1	Prosopis glandulosa Torrey	0		3	*Pseudognaphalium stramineum (Kunth) W.A. Weber* *Solanum elaeagnifolium* Cavanilles (1) unknown forb	1	*Yucca elata* Engelmann	5
STS-PT-2013-1	3	9/24/2014	1	Prosopis glandulosa Torrey	0		1	*Solanum elaeagnifolium* Cavanilles	0		2
STS-PT-2013-1	4	9/24/2014	1	Prosopis glandulosa Torrey	1	*Sporobolus cryptandrus* (Torrey) A. Gray- sand dropseed	1	*Hybanthus verticillatus* (Ortega) Baillon	1	*Yucca elata* Engelmann	4
STS-PT-2013-1	5	9/24/2014	1	Prosopis glandulosa Torrey	0		2	*Pseudognaphalium stramineum* (Kunth) W.A. Weber *Sphaeralcea* sp.	0		3
STS-PT-2013-2	1	9/24/2014	1	Prosopis glandulosa Torrey	1	*Bothriochloa barbinodis* (Lagasca) Herter--cane bluestem	1	*Solanum elaeagnifolium* Cavanilles	0		3
STS-PT-2013-2	2	9/24/2014	1	Prosopis glandulosa Torrey	0		1	*Solanum elaeagnifolium* Cavanilles	0		2
STS-PT-2013-2	3	9/24/2014	2	Prosopis glandulosa Torrey *Condalia spathulata* A. Gray	0		4	*Amaranthus palmeri* S. Watson *Salsola tragus* Linnaeus *Portulaca* sp. (1) unknown forb	0		6
STS-PT-2013-2	4	9/24/2014	1	Prosopis glandulosa Torrey	2	*Bothriochloa barbinodis* (Lagasca) Herter *Setaria* sp.	8	*Amaranthus palmeri* S. Watson *Physaria* sp. *Salsola tragus* Linnaeus *Solanum elaeagnifolium* Cavanilles *Sphaeralcea coccinea* (Nuttall) Rydberg (3) unknown forbs	0		11
STS-PT-2013-2	5	9/24/2014	1	Prosopis glandulosa Torrey	2	*Bothriochloa barbinodis* (Lagasca) Herter *Setaria* sp.	2	*Solanum elaeagnifolium* Cavanilles (1) unknown forb	0		5
STS-PT-2013-5	1	9/25/2014	2	*Acourtia wrightii* (Gray) Reveal & King - brownfoot *Mimosa aculeaticarpa* Ortega var. *biuncifera* (Bentham) Barneby - catclaw mimosa	3	*Hopia obtusa* (Kunth) Zuloaga & Morrone - vine mesquite *Pleuraphis mutica* Buckley *Setaria* sp.	3	*Hybanthus verticillatus* (Ortega) Baillon *Solanum elaeagnifolium* Cavanilles (1) unknown forb	2	*Nolina microcarpa* S. Watson--sacahuista *Dasylirion wheeleri* S. Watson--desert spoon	10
STS-PT-2013-5	2	9/25/2014	2	*Acourtia wrightii* (Gray) Reveal & King *Mimosa aculeaticarpa* Ortega var. *biuncifera* (Bentham) Barneby	1	*Hopia obtusa* (Kunth) Zuloaga & Morrone	2	*Rhynchosia senna* Gillies ex Hooker *Solanum elaeagnifolium* Cavanilles	2	*Nolina microcarpa* S. Watson *Dasylirion wheeleri* S. Watson	7
STS-PT-2013-5	3	9/25/2014	3	*Acourtia wrightii* (Gray) Reveal & King *Mimosa aculeaticarpa* Ortega var. *biuncifera* (Bentham) Barneby *Prosopis glandulosa* Torrey	2	*Bouteloua curtipendula* (Michaux) Torrey - sideoats grama *Hopia obtusa* (Kunth) Zuloaga & Morrone	3	*Rhynchosia senna* Gillies ex Hooker *Solanum elaeagnifolium* Cavanilles (1) unknown forb	1	*Dasylirion wheeleri* S. Watson	9
STS-PT-2013-5	4	9/25/2014	3	*Aloysia wrightii* (Gray) Heller ex Abrams--Wright's beebrush *Mimosa aculeaticarpa* Ortega var. *biuncifera* (Bentham) Barneby *Prosopis glandulosa* Torrey	1	*Bouteloua curtipendula* (Michaux) Torrey	3	*Chenopodium album* Linnaeus *Solanum elaeagnifolium* Cavanilles (1) unknown forb	1	*Dasylirion wheeleri* S. Watson	8
STS-PT-2013-5	5	9/25/2014	3	*Acourtia wrightii* (Gray) Reveal & King *Mimosa aculeaticarpa* Ortega var. *biuncifera* (Bentham) Barneby *Prosopis glandulosa* Torrey	2	*Bouteloua curtipendula* (Michaux) Torrey *Hopia obtusa* (Kunth) Zuloaga & Morrone	3	*Rhynchosia senna* Gillies ex Hooker *Solanum elaeagnifolium* Cavanilles (1) unknown forb	1	*Dasylirion wheeleri* S. Watson	9
STS-PT-2013-9	1	9/24/2014	0		0		1	*Hybanthus verticillatus* (Ortega) Baillon	1	*Nolina microcarpa* S. Watson	2
STS-PT-2013-9	2	9/24/2014	0		0		1	*Hybanthus verticillatus* (Ortega) Baillon	0		1
STS-PT-2013-9	3	9/24/2014	1	*Mimosa aculeaticarpa* Ortega var. *biuncifera* (Bentham) Barneby	0		1	(1) unknown forb	0		2
STS-PT-2013-9	4	9/24/2014	1	*Mimosa aculeaticarpa* Ortega var. *biuncifera* (Bentham) Barneby	0		1	(1) unknown forb	0		2
STS-PT-2013-9	5	9/24/2014	1	*Juniperus deppeana* Steudel	0		1	*Amaranthus palmeri* S. Watson	0		2
STS-PT-2013-12	1	9/23/2014	6	Brickellia californica (Torrey & Gray) Gray-- California bricklebush *Brickellia lemmonii* Gray - skunkbush *Juniperus monosperma* (Engelmann) Sargent-one-seed juniper *Mimosa aculeaticarpa* Ortega var. *biuncifera* (Bentham) Barneby *Quercus emoryi* Torrey - Emory oak *Rhus trilobata* Nuttall	6	*Achnatherum hymenoides* (Roemer & J.A. Schultes) Barkworth-Indian ricegrass *Aristida purpurea* Nuttall *Bouteloua curtipendula* (Michaux) Torrey *Bouteloua hirsuta* Lagasca - hairy grama *Hopia obtusa* (Kunth) Zuloaga & Morrone *Muhlenbergia emersleyi* Vasey bullgrass	4	*Boerhavia* sp. (1) unknown Asteraceae (2) unknown forbs	0		16
STS-PT-2013-12	2	9/23/2014	2	Brickellia californica (Torrey & Gray) Gray *Brickellia lemmonii* Gray -- Lemmon's brickelbush	5	*Achnatherum hymenoides* (Roemer & J.A. Schultes) Barkworth *Aristida arizonica* Vasey--Arizona threeawn *Bothriochloa barbinodis* (Lagasca) Herter *Bouteloua curtipendula* (Michaux) Torrey *Setaria* sp. - bristlegrass	0		1	*Nolina microcarpa* S. Watson	8
STS-PT-2013-12	3	9/23/2014	0		3	*Bothriochloa barbinodis* (Lagasca) Herter *Bouteloua curtipendula* (Michaux) Torrey *Eragrostis* sp. - lovegrass	0		0		3
STS-PT-2013-12	4	9/23/2014	0	(no vegetation due to bedrock according to Pam Pinson)	0	(no vegetation due to bedrock according to Pam Pinson)	0	(no vegetation due to bedrock according to Pam Pinson)	0	(no vegetation due to bedrock according to Pam Pinson)	0
STS-PT-2013-12	5	9/23/2014	1	Brickellia lemmonii Gray	5	*Aristida adscensionis* Linnaeus - six weeks 3-awn *Aristida schiedeana* var. *orcuttiana* (Vasey) Allred & Valdes *Bothriochloa barbinodis* (Lagasca) Herter *Bouteloua curtipendula* (Michaux) Torrey *Bouteloua hirsuta* Lagasca	2	(1) unknown Asteraceae(1) unknown forb	1	*Nolina microcarpa* S. Watson	9
STS-PT-2013-17	1	9/24/2014	1	Prosopis glandulosa Torrey	0		1	Verbesina encelioides	0		2
STS-PT-2013-17	2	9/24/2014	1	Prosopis glandulosa Torrey	0		1	Verbesina encelioides	0		2
STS-PT-2013-17	3	9/24/2014	1	Prosopis glandulosa Torrey	2	*Bothriochloa barbinodis* (Lagasca) Herter *Setaria* sp.	5	*Boerhavia* sp. *Hybanthus verticillatus* (Ortega) Baillon *Salsola tragus* Linnaeus *Solanum elaeagnifolium* Cavanilles *Verbesina encelioides*	0		8

Table F-3. Names of Species in Species Richness Dataset of 2014

Freeport-McMoran Chino Mines Company
Vanadium, New Mexico
Smelter/Tailing Soils IU Phytotoxicity and Vegetation Community Study

Site ID	Block	Date	# Trees/ Shrub sp.	Trees/ Shrub sp. ID*	# Grass sp.	Grass sp. ID*	# Forb sp.	Forb sp. ID*	# Cactus sp.	Cactus sp. ID*	# Species in Block
STS-PT-2013-17	4	9/24/2014	3	Gutierrezia sarothrae (Pursh) Britton & Rusby --Broom snakeweed *Mimosa aculeaticarpa* Ortega var. *biuncifera* (Bentham) Barneby *Prosopis glandulosa* Torrey	2	*Bothriochloa barbinodis* (Lagasca) Herter *Sporobolus cryptandrus* (Torrey) A. Gray	4	*Pseudognaphalium stramineum* (Kunth) W.A. Weber *Salsola tragus* Linnaeus *Solanum elaeagnifolium* Cavanilles *Verbesina encelioides*	0		9
STS-PT-2013-17	5	9/24/2014	2	Mimosa aculeaticarpa Ortega var. biuncifera (Bentham) Barneby Prosopis glandulosa Torrey	2	*Bouteloua barbata* Lagasca *Setaria* sp.	4	*Boerhavia* sp. *Salsola tragus* Linnaeus *Verbesina encelioides* (1) unknown *Euphorbiaceae*	0		8
STS-PT-2013-19	1	9/24/2014	4	*Juniperus deppeana* Steudel--Alligator juniper *Brickellia californica* (Torrey & Gray) Gray *Mimosa aculeaticarpa* Ortega var. *biuncifera* (Bentham) Barneby *Prosopis glandulosa* Torrey	0		3	*Amaranthus palmeri* S. Watson *Portulaca* sp. (1) unknown *Euphorbiaceae*	1	*Yucca* sp.	8
STS-PT-2013-19	2	9/24/2014	3	*Juniperus deppeana* Steudel *Mimosa aculeaticarpa* Ortega var. *biuncifera* (Bentham) Barneby *Prosopis glandulosa* Torrey	0		0		1	*Yucca* sp.	4
STS-PT-2013-19	3	9/24/2014	3	*Juniperus deppeana* Steudel *Brickellia californica* (Torrey & Gray) Gray (1) unknown tree/shrub	0		2	*Amaranthus palmeri* S. Watson *Chenopodium album* Linnaeus	0		5
STS-PT-2013-19	4	9/24/2014	0		0		2	*Amaranthus palmeri* S. Watson *Chenopodium album* Linnaeus	0		2
STS-PT-2013-19	5	9/24/2014	1	Mimosa aculeaticarpa Ortega var. biuncifera (Bentham) Barneby	1	(1) unknown *Poaceae*	1	*Portulaca* sp.	0		3
STS-PT-2013-20	1	9/23/2014	2	*Krascheninnikovia lanata* (Pursh) Meeuse & Smits *Mimosa aculeaticarpa* Ortega var. *biuncifera* (Bentham) Barneby	3	*Aristida purpurea* Nuttall *Dasyochloa pulchella* (Kunth) Willdenow ex Rydberg *Hopia obtusa* (Kunth) Zuloaga & Morrone	7	*Boerhavia* sp. *Convolvulus* sp. *Physaria* sp. (4) unknown forbs	1	*Opuntia* sp.	13
STS-PT-2013-20	2	9/23/2014	3	*Krascheninnikovia lanata* (Pursh) Meeuse & Smits *Mimosa aculeaticarpa* Ortega var. *biuncifera* (Bentham) Barneby (1) unknown Fabaceae	2	*Aristida purpurea* Nuttall *Dasyochloa pulchella* (Kunth) Willdenow ex Rydberg--desert fluffgrass	6	*Boerhavia* sp. *Physaria* sp. (4) unknown forbs	0		11
STS-PT-2013-20	3	9/23/2014	2	*Krascheninnikovia lanata* (Pursh) Meeuse & Smits *Mimosa aculeaticarpa* Ortega var. *biuncifera* (Bentham) Barneby	4	*Aristida purpurea* Nuttall *Bouteloua curtipendula* (Michaux) Torrey *Dasyochloa pulchella* (Kunth) Willdenow ex Rydberg *Pleuraphis mutica* Buckley	6	*Boerhavia* sp. *Physaria* sp. (1) unknown Asteraceae (3) unknown forbs	0		12
STS-PT-2013-20	4	9/23/2014	2	*Kraschenninikovia lanata* (Pursh) Meeuse & Smits -winterfat *Mimosa aculeaticarpa* Ortega var. *biuncifera* (Bentham) Barneby	5	*Aristida purpurea* Nuttall *Bouteloua curtipendula* (Michaux) Torrey *Dasyochloa pulchella* (Kunth) Willdenow ex Rydberg - desert fluffgrass *Hopia obtusa* (Kunth) Zuloaga & Morrone *Muhlenbergia torreyi* (Kunth) A.S. Hitchcock ex Bush	6	*Boerhavia* sp. *Physaria* sp. (4) unknown forbs	2	*Cylindropuntia* sp. *Opuntia* sp.	15
STS-PT-2013-20	5	9/23/2014	2	*Krascheninnikovia lanata* (Pursh) Meeuse & Smits *Mimosa aculeaticarpa* Ortega var. *biuncifera* (Bentham) Barneby	5	*Aristida purpurea* Nuttall *Bouteloua curtipendula* (Michaux) Torrey *Bouteloua gracilis* (Willdenow ex Kunth) Lagasca ex Griffiths *Dasyochloa pulchella* (Kunth) Willdenow ex Rydberg *Muhlenbergia torreyi* (Kunth) A.S. Hitchcock ex Bush	6	*Boerhavia* sp. *Physaria* sp. (4) unknown forbs	0		13
STS-PT-2013-26	1	9/25/2014	1	Prosopis glandulosa Torrey	7	*Aristida arizonica* Vasey *Aristida purpurea* Nuttall *Bouteloua curtipendula* (Michaux) Torrey *Dasyochloa pulchella* (Kunth) Willdenow ex Rydberg *Hopia obtusa* (Kunth) Zuloaga & Morrone *Muhlenbergia torreyi* (Kunth) A.S. Hitchcock ex Bush *Pleuraphis mutica* Buckley	8	*Boerhavia* sp. *Solanum elaeagnifolium* Cavanilles (1) unknown Asteraceae (5) unknown forbs	0		16
STS-PT-2013-26	2	9/25/2014	1	Prosopis glandulosa Torrey	6	*Aristida arizonica* Vasey *Aristida purpurea* Nuttall *Bouteloua curtipendula* (Michaux) Torrey *Dasyochloa pulchella* (Kunth) Willdenow ex Rydberg *Muhlenbergia torreyi* (Kunth) A.S. Hitchcock ex Bush *Pleuraphis mutica* Buckley	7	*Boerhavia* sp. *Physaria* sp. (1) unknown Asteraceae (4) unknown forbs	0		14
STS-PT-2013-26	3	9/25/2014	1	Prosopis glandulosa Torrey	7	*Aristida purpurea* Nuttall *Bouteloua curtipendula* (Michaux) Torrey *Bouteloua gracilis* (Willdenow ex Kunth) Lagasca ex Griffiths *Dasyochloa pulchella* (Kunth) Willdenow ex Rydberg *Hopia obtusa* (Kunth) Zuloaga & Morrone *Muhlenbergia torreyi* (Kunth) A.S. Hitchcock ex Bush *Pleuraphis mutica* Buckley	9	*Baileya multiradiata* Harvey & Gray ex Gray *Boerhavia* sp. *Erigeron* sp. *Physaria* sp. (5) unknown forbs	0		17
STS-PT-2013-26	4	9/25/2014	1	Prosopis glandulosa Torrey	7	*Bouteloua curtipendula* (Michaux) Torrey *Bouteloua gracilis* (Willdenow ex Kunth) Lagasca ex Griffiths *Dasyochloa pulchella* (Kunth) Willdenow ex Rydberg *Hopia obtusa* (Kunth) Zuloaga & Morrone *Muhlenbergia torreyi* (Kunth) A.S. Hitchcock ex Bush *Pleuraphis mutica* Buckley *Setaria* sp.	6	*Physaria* sp. (1) unknown Asteraceae (4) unknown forbs	0		14

Table F-3. Names of Species in Species Richness Dataset of 2014

Freeport-McMoran Chino Mines Company
Vanadium, New Mexico
Smelter/Tailing Soils IU Phytotoxicity and Vegetation Community Study

Site ID	Block	Date	# Trees/ Shrub sp.	Trees/ Shrub sp. ID*	# Grass sp.	Grass sp. ID*	# Forb sp.	Forb sp. ID*	# Cactus sp.	Cactus sp. ID*	# Species in Block
STS-PT-2013-26	5	9/25/2014	1	Prosopis glandulosa Torrey	8	*Aristida purpurea* Nuttall *Bouteloua curtipendula* (Michaux) Torrey *Bouteloua gracilis* (Willdenow ex Kunth) Lagasca ex Griffiths *Dasyochloa pulchella* (Kunth) Willdenow ex Rydberg *Hopia obtusa* (Kunth) Zuloaga & Morrone *Muhlenbergia torreyi* (Kunth) A.S. Hitchcock ex Bush - ring muhly *Pleuraphis mutica* Buckley *Setaria* sp.	9	*Baileya multiradiata* Harvey & Gray ex Gray *Boerhavia* sp. *Physaria* sp. (1) unknown Asteraceae (5) unknown forbs	0		18
Wildlife reference plot N	1	9/23/2014	4	Baccharis pteronioides A.P. de Candolle *Mimosa aculeaticarpa* Ortega var. *biuncifera* (Bentham) Barneby *Prosopis glandulosa* Torrey (1) unknown Fabaceae	4	*Aristida purpurea* Nuttall *Hopia obtusa* (Kunth) Zuloaga & Morrone *Pleuraphis mutica* Buckley - tobosa *Setaria* sp.	2	*Amaranthus palmeri* S. Watson *Solanum elaeagnifolium* Cavanilles	0		10
Wildlife reference plot N	2	9/23/2014	3	Mimosa aculeaticarpa Ortega var. *biuncifera* (Bentham) Barneby *Prosopis glandulosa* Torrey (1) unknown Fabaceae	2	*Hopia obtusa* (Kunth) Zuloaga & Morrone *Setaria* sp.	2	*Amaranthus palmeri* S. Watson *Solanum elaeagnifolium* Cavanilles	0		7
Wildlife reference plot N	3	9/23/2014	3	Mimosa aculeaticarpa Ortega var. *biuncifera* (Bentham) Barneby *Prosopis glandulosa* Torrey (1) unknown Fabaceae	4	*Aristida adscensionis* Linnaeus *Bouteloua curtipendula* (Michaux) Torrey *Hopia obtusa* (Kunth) Zuloaga & Morrone *Setaria* sp.	4	*Amaranthus palmeri* S. Watson *Solanum elaeagnifolium* Cavanilles (2) unknown forbs	0		11
Wildlife reference plot N	4	9/23/2014	3	Mimosa aculeaticarpa Ortega var. *biuncifera* (Bentham) Barneby *Prosopis glandulosa* Torrey (1) unknown Fabaceae	6	*Aristida purpurea* Nuttall *Aristida adscensionis* Linnaeus *Bouteloua curtipendula* (Michaux) Torrey *Hopia obtusa* (Kunth) Zuloaga & Morrone *Pleuraphis mutica* Buckley *Setaria* sp.	3	*Amaranthus palmeri* S. Watson *Solanum elaeagnifolium* Cavanilles *Sphaeralcea coccinea* (Nuttall) Rydberg	0		12
Wildlife reference plot N	5	9/23/2014	3	Mimosa aculeaticarpa Ortega var. *biuncifera* (Bentham) Barneby *Prosopis glandulosa* Torrey (1) unknown Fabaceae	5	*Aristida purpurea* Nuttall *Bothriochloa barbinodis* (Lagasca) Herter *Hopia obtusa* (Kunth) Zuloaga & Morrone *Pleuraphis mutica* Buckley *Setaria* sp.	3	*Amaranthus palmeri* S. Watson *Dyssodia papposa* (Ventenat) Hitchcock *Solanum elaeagnifolium* Cavanilles	0		11
Wildlife reference plot S	1	9/23/2014	3	Brickellia californica (Torrey & Gray) Gray *Mimosa aculeaticarpa* Ortega var. *biuncifera* (Bentham) Barneby *Prosopis glandulosa* Torrey	5	*Aristida* sp. *Bothriochloa barbinodis* (Lagasca) Herter *Bouteloua curtipendula* (Michaux) Torrey *Hopia obtusa* (Kunth) Zuloaga & Morrone *Setaria* sp.	8	ified forbs -first block of the first sampling site so still getting	1	*Opuntia* sp.	17
Wildlife reference plot S	2	9/23/2014	3	Brickellia californica (Torrey & Gray) Gray *Mimosa aculeaticarpa* Ortega var. *biuncifera* (Bentham) Barneby *Prosopis glandulosa* Torrey	5	*Bothriochloa barbinodis* (Lagasca) Herter *Bouteloua curtipendula* (Michaux) Torrey *Hopia obtusa* (Kunth) Zuloaga & Morrone *Pleuraphis mutica* Buckley *Setaria* sp.	3	*Amaranthus palmeri* S. Watson *Solanum elaeagnifolium* Cavanilles *Sphaeralcea coccinea* (Nuttall) Rydberg	1	*Dasylirion wheeleri* S. Watson	12
Wildlife reference plot S	3	9/23/2014	2	Mimosa aculeaticarpa Ortega var. biuncifera (Bentham) Barneby Prosopis glandulosa Torrey (1) unknown Fabaceae	6	*Aristida adscensionis* Linnaeus *Aristida purpurea* Nuttall *Bothriochloa barbinodis* (Lagasca) Herter *Bouteloua curtipendula* (Michaux) Torrey *Pleuraphis mutica* Buckley *Setaria* sp.	4	*Amaranthus palmeri* S. Watson *Solanum elaeagnifolium* Cavanilles *Sphaeralcea coccinea* (Nuttall) Rydberg (1) unknown forb	1	*Cylindropuntia* sp. -- Cholla	13
Wildlife reference plot S	4	9/23/2014	3	Brickellia californica (Torrey & Gray) Gray *Mimosa aculeaticarpa* Ortega var. *biuncifera* (Bentham) Barneby *Prosopis glandulosa* Torrey	6	*Aristida adscensionis* Linnaeus *Aristida purpurea* Nuttall *Bothriochloa barbinodis* (Lagasca) Herter *Bouteloua curtipendula* (Michaux) Torrey *Hopia obtusa* (Kunth) Zuloaga & Morrone *Setaria* sp.	6	*Amaranthus palmeri* S. Watson *Physaria* sp. *Solanum elaeagnifolium* Cavanilles *Sphaeralcea coccinea* (Nuttall) Rydberg (2) unknown forbs	0		15
Wildlife reference plot S	5	9/23/2014	3	Brickellia californica (Torrey & Gray) Gray *Mimosa aculeaticarpa* Ortega var. *biuncifera* (Bentham) Barneby *Prosopis glandulosa* Torrey	6	*Aristida adscensionis* Linnaeus *Aristida purpurea* Nuttall *Bothriochloa barbinodis* (Lagasca) Herter *Hopia obtusa* (Kunth) Zuloaga & Morrone *Pleuraphis mutica* Buckley (1) unknown Poaceae	5	*Amaranthus palmeri* S. Watson *Solanum elaeagnifolium* Cavanilles *Sphaeralcea coccinea* (Nuttall) Rydberg *Tragia ramosa* Torrey (1) unknown forb	0		14

Notes:

* = All species identifications used nomenclature in Flora Neomexicana (2012) except where noted (identified by Matt Schulz of NMED)

Table F-4. Data for Community Analysis

Freeport-McMoran Chino Mines Company
Vanadium, New Mexico
Smelter/Tailing Soils IU Phytotoxicity and Vegetation Community Study

Site ID	Site Type	Latitude	Longitude	Percent Cover Unadjusted	Species Richness	OAT Score	NDVI 2011	NDVI 2014	Month and Year Soil Sampled	Year Vegetation Sampled in September	Cover Adjusted to 2011 Conditions	Conductivity Sat. Paste (mmhos/cm)	Total Copper (mg/kg)	pH (sat. paste)	Calculated pCu	Measured pCu	pre-FS RAC (1= below)	Soil Category	Aspect	Slope (degrees)	Bedrock (%)	Soil Complex	Ecotype	Vegetation Alliance
STS-RWU-2011-1	Site	32.7124	-108.1083	6	1	12	14%	13%	July 2013	2011	6	0.526	338	5.2	5.48	4.86	1	bedrock	South	4.46	88	63, Santana-Rock outcrop complex, 1 to 25%	Hills	mtn mahogany/shrub
STS-RWU-2011-2	Site	32.7045	-108.1050	8	0.4	8	6%	7%	July 2013	2011	8	1.39	381	4.1	4.32	3.62	1	bedrock	South	14.57	90	63, Santana-Rock outcrop complex, 1 to 25%	Hills	mtn mahogany/shrub
STS-RWU-2011-3	Site	32.7076	-108.1070	59	6.2	24	48%	58%	July 2013	2011	59	0.789	998	5.1	4.14	4.19	1	slope	South	8.35	0	2, Abrazo-Luzena complex, 15-45%	Hills	mtn mahogany/shrub
STS-RWU-2011-4	Site	32.7123	-108.1430	64	9.8	35	35%	18%	July 2013	2011	64	0.741	427	7.2	7.07	8.13	1	flat granular	South	3.06	0	47, Plack gravelly loam, 0-8%	Shallow	mix grama/herb
STS-RWU-2011-5	Site	32.7067	-108.0950	34	10	33	26%	23%	July 2013	2011	34	0.621	779	4.6	3.96	3.47	1	flat granular	South	6.10	0	13, Encierro-Rock outcrop complex, 15-35%	Hills	mesq/mix grama
STS-RWU-2011-6	Site	32.7085	-108.1209	25	8	16	31%	17%	July 2013	2011	25	0.64	1300	7.3	5.88	6.72	1	slope	North	16.41	0	39, Oro Grande-Rock outcrop complex, 5-15%	Gravelly	mtn mahogany/shrub
STS-RWU-2011-7	Site	32.6972	-108.1060	11	1.8	9	7%	6%	July 2013	2011	11	0.388	529	4.9	4.69	3.19	1	flat rocky	South	1.70	0	63, Santana-Rock outcrop complex, 1 to 25%	Hills	mesq/mix grama
STS-RWU-2011-8	Site	32.7103	-108.0939	45	21.6	37	53%	46%	July 2013	2011	45	0.42	287	5.6	6.04	5.71	0	slope	North	12.11	0	37, Muzzler-Rock outcrop association, 25-45%	Hills	juniper-oak
STS-RWU-2011-9	Site	32.6959	-108.1000	3	0.8	11	6%	7%	July 2013	2011	3	0.614	560	4.4	4.15	3.09	1	bedrock	North	5.15	95	63, Santana-Rock outcrop complex, 1 to 25%	Hills	mtn mahogany/shrub
STS-RWU-2011-10	Site	32.6748	-108.0840	24	10	16	16%	21%	July/Oct 2013[a]	2011	24	0.874/0.2	96/234	4.6/4.5	6.37/5.25	4.76	1	flat granular	South	1.92	0	13, Encierro-Rock outcrop complex, 15-35%	Hills	mesq/mix grama
STS-RWU-2011-11	Site	32.6747	-108.0920	4	1.6	6	5%	6%	July 2013	2011	4	0.567	216	4.3	5.16	3.64	0	bedrock	South	1.76	93	63, Santana-Rock outcrop complex, 1 to 25%	Hills	mtn mahogany/shrub
STS-RWU-2011-12	Site	32.6642	-108.0870	9	2	10	NA	NA	July/Oct 2013	2011	9	1.35/1	316/152	3.9/3.7	5.00	3.89	1	flat rocky	North	2.00	0	63, Santana-Rock outcrop complex, 1 to 25%	Hills	mesq/mix grama
STS-RWU-2011-13	Site	32.6768	-108.0940	26	3.6	8	12%	11%	July 2013	2011	26	1.08	305	5.6	5.97	6.14	0	flat granular	South	5.25	0	2, Abrazo-Luzena complex, 15-45%	Hills	mesq/mix grama
STS-RWU-2011-14	Site	32.7081	-108.1150	27	8	26	34%	32%	July/Oct 2013	2014	28	0.675/0.4	1640[a]/153	5.3/5.1	6.30	4.12	1	slope	North	32.12	0	2, Abrazo-Luzena complex, 15-45%	Hills	mtn mahogany/shrub
STS-RWU-2011-15	Site	32.7092	-108.1180	18	7.4	14	16%	13%	July 2013	2011	18	1.06	1640	5.7	4.13	4.14	1	flat granular	South	4.06	0	39, Oro Grande-Rock outcrop complex, 5-15%	Gravelly	mesq/mix grama
STS-RWU-2011-16	Site	32.7048	-108.0850	22	13	23	21%	22%	July 2013	2011	22	0.471	395	4.9	5.02	3.89	1	flat granular	North	13.54	0	54, Rock outcrop-Muzzler association, 25-65%	Hills	mtn mahogany/shrub
STS-RWU-2011-17	Site	32.6762	-108.0960	36	5.4	10	11%	10%	July 2013	2011	36	1.13	654	4.6	4.16	4.06	1	flat rocky	South	3.04	0	25, Lonti gravelly loam 15-35%	Breaks	mesq/mix grama
WILDLIFE REFERENCE PLOT NORTH	Reference	32.6840	-108.0677	30	10/13.2		19%	20%	July 2013	2011/2014	30	0.681	213	5.9	6.66	5.67	0	flat granular	North	3.06	0	37, Muzzler-Rock outcrop association, 25-45%	Hills	mesq/mix grama
WILDLIFE REFERENCE PLOT SOUTH	De Minimus	32.6748	-108.0601	20/37	11/14.2		12%	22%	July/Oct 2013	2011/2014	20	0.608/0.3	288/164	4.6/4.6	5.11/5.75	3.70	1	flat granular	South	1.36	0	37, Muzzler-Rock outcrop association, 25-45%	Hills	mesq/mix grama
STS-PT-2013-1	Site	32.689013	-108.106386	32	3.2	12	26%	16%	October 2013	2014	50	0.75	1030	4.5	3.55	3.73	1	flat rocky	North	2.95	0	25, Lonti gravelly loam 15-35%	Breaks	mesq/mix grama
STS-PT-2013-2	Site	32.685045	-108.104709	31	5.2	9	29%	12%	October 2013	2014	74	1.8	809	6.7	5.87	6.45	1	flat rocky	South	8.60	0	26, Lonti gravelly loam 0-8%	Loamy	mesq/mix grama
STS-PT-2013-5	Site	32.705641	-108.113509	38	8.6	27	33%	22%	October 2013	2014	55	1.3	632	6.1	5.60	6.63	1	slope	South	27.07	25	2, Abrazo-Luzena complex, 15-45%	Hills	mtn mahogany/shrub
STS-PT-2013-9	Site	32.697826	-108.106861	5	1.8	7	8%	8%	October 2013	2014	6	0.4	1350	4.3	3.05	2.93	1	bedrock	South	2.89	60	63, Santana-Rock outcrop complex, 1 to 25%	Hills	mesq/mix grama
STS-PT-2013-12	Site	32.669984	-108.051091	20	7.2	17	11%	9%	October 2013	2014	24	0.7	449	6.5	6.36	7.27	1	bedrock	South	8.74	85	13, Encierro-Rock outcrop complex, 15-35%	Hills	mtn mahogany/shrub
STS-PT-2013-17	Site	32.6897	-108.1040	19	5.8	19	12%	11%	October 2013	2014	20	0.6	1120	7.6	6.33	7.46	1	flat rocky	North	2.29	0	13, Encierro-Rock outcrop complex, 15-35%	Hills	mesq/mix grama
STS-PT-2013-19	Site	32.6925	-108.1046	5	4.4	15	10%	10%	October 2013	2014	5	0.4	714	4.6	4.06	3.68	1	flat rocky	North	2.76	59	63, Santana-Rock outcrop complex, 1 to 25%	Hills	mesq/mix grama
STS-PT-2013-20	Site	32.6892	-108.1566	24	12.8	30	36%	12%	October 2013	2014	76	0.5	131	7.5	8.71	8.45	0	flat granular	South	0.98	0	47, Plack gravelly loam, 0-8%	Shallow	mix grama/herb
STS-RWU-2012-B1	De Minimus	32.6714	-108.0445	18	3.4	17	7%	3%	July/Oct 2013	2012	18	0.38/0.2	182/61	4.6/4.2	5.63/6.52	4.00	1	bedrock	South	5.99	75	54, Rock outcrop-Muzzler association, 25-65%	Hills	mtn mahogany/shrub
STS-RWU-2012-B2	De Minimus	32.6714	-108.0423	3	5	11	7%	7%	July/Oct 2013	2012	3	0.395/2.7	344/248	4.7/3.9	4.25/4.63	3.94	1	bedrock	South	4.90	85	54, Rock outcrop-Muzzler association, 25-65%	Hills	mtn mahogany/shrub
STS-RWU-2012-B3	De Minimus	32.6738	-108.0449	3	2.6	15	12%	6%	July/Oct 2013	2012	3	0.401/0.4	161/253	4.7/4.4	5.87/5.07	4.46	1	bedrock	North	19.76	93	54, Rock outcrop-Muzzler association, 25-65%	Hills	mtn mahogany/shrub
STS-PT-2013-26	Reference	32.6394	-108.0500	37	15.8	20	22%	16%	October 2013	2014	51	0.4	109	7.6	9.01	8.31	0	flat granular	South	4.61	0	33, Manzano loam, 1 to 3 %	Loamy	fluvial forest/shrub
STS-PT-2013-33	Site	32.6928	-108.1220	0	0		1%	1%	October 2013	2014	30	12.8	95300	4.3	-1.85	1.98	1	flat granular	South	2.70	0	47, Plack gravelly loam, 0-8%	Shallow	Mine facilities/urban

*When soil was sampled in July and October, the October value (number after the slash) was used in the analyses.

[a] This 1640 mg/kg concentration is the same as STS-RWU-2011-15 copper concentration and is probably an error. The October value of 153 that was used was not an outlier in any analyses.

Notes:

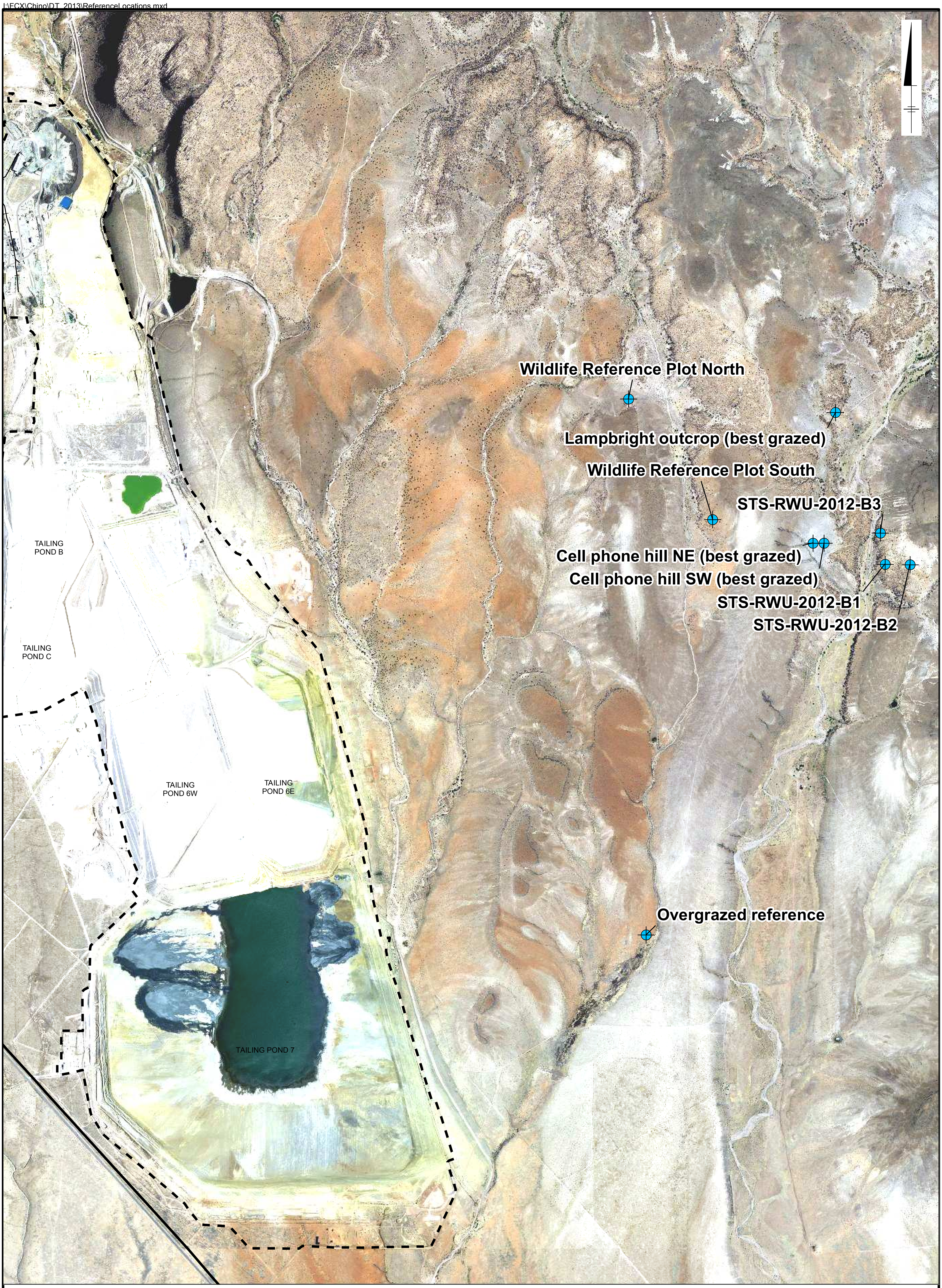
NA = not available due to too much cloud cover.

The 2011 data (adjusted if sampled in 2014) was used in all analyses

Calculated pCu is based on total copper and pH using upland with reference equation

Measured pCu is estimated with an ion-selective electrode.

OFFICE: LAKEWOOD DB: MLM TM: MB PM: AT
PROJECT# B0063543.0000
I:\FCX\Chino\DT_2013\ReferenceLocations.mxd



Legend

- ⊕ Reference Soil Locations
- ▭ Operations Boundary
- ┼ Railroad
- — Town Roads
- ━ Major Roads
- ▢ City Limits

Notes: The Wildlife Reference North and South and 3 bedrock locations were de minimus locations. The Cell phone hill and Lampbright outcrop locations were used to calibrate the OAT score to good conditions and overgrazed reference to a poor rating each year.

0 2,500 5,000 Feet
GRAPHIC SCALE

Service Layer Credits: APFO

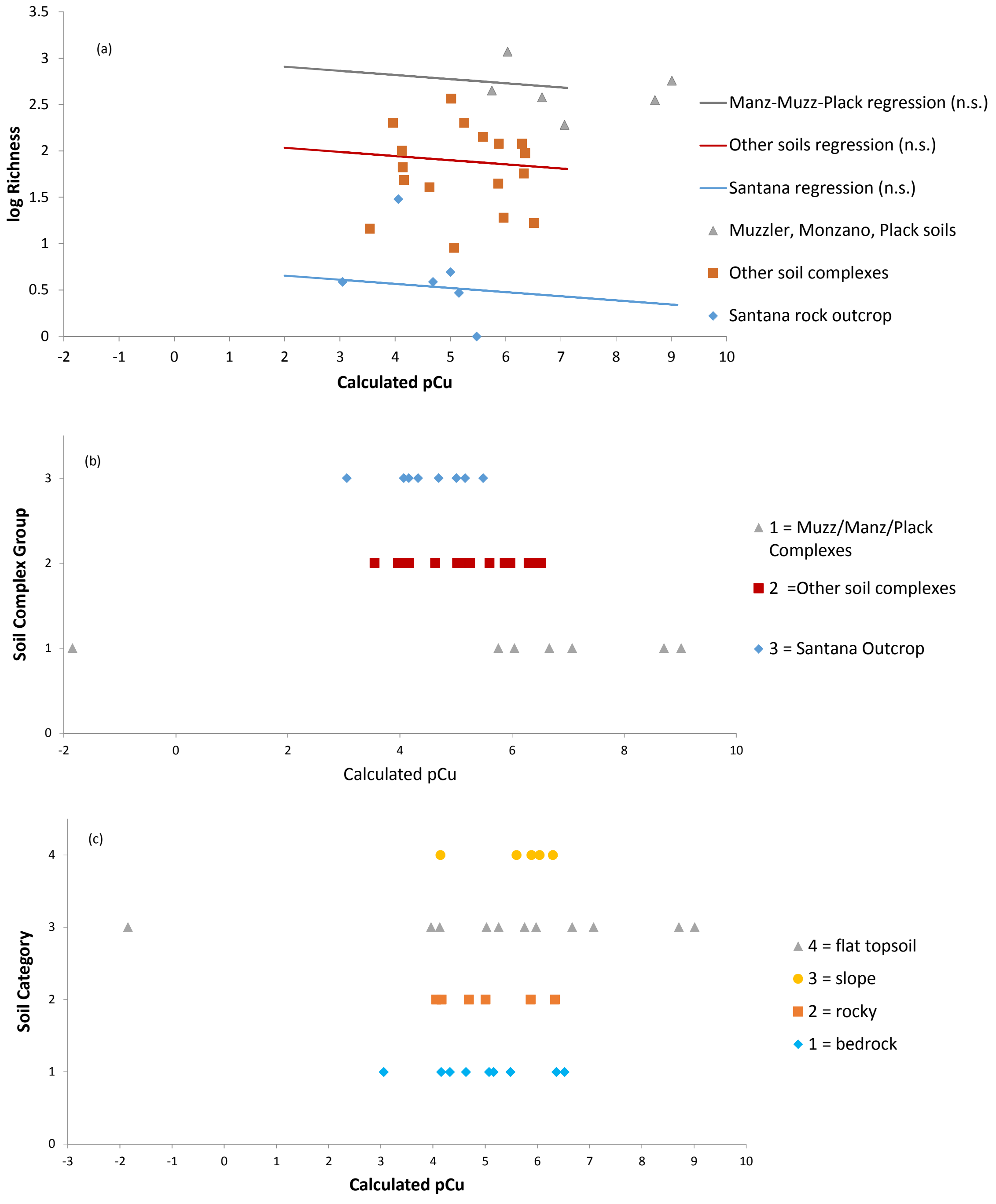
FREEPORT-MCMORAN CHINO MINES COMPANY
VANADIUM, NEW MEXICO

SMELTER TAILINGS IU PHYTOTOXICITY STUDY

VEGETATION COMMUNITY REFERENCE LOCATIONS

ARCADIS

FIGURE
F-2



Notes:

(a) Independent of pCu, richness separates by soil complex group, with lowest richness in the Santana rock outcrop. The pCu is not significantly (n.s.) contributing to variation in richness in (a) because soil complex is correlated to pCu (b) and thus is not a valid covariate in regression models. Soil complexes named in the graph are Muzzler-Rock outcrop association, 25-45% slopes, NRCS code 37; Manzano loam, 1 to 3 % slopes, NRCS code 33; Plack gravelly loam, 0-8% slopes, NRCS code 47; Santana-Rock outcrop complex, 1 to 25% slopes, NRCS code 63. (c) Unlike soil complex, soil category is unrelated to pCu and thus is a valid covariate. Only b and c have an outlier location with negative pCu included.

FREEPORT-MCMORAN CHINO MINES COMPANY
VANADIUM, NEW MEXICO

PHYTOTOXICITY AND VEGETATION COMMUNITY STUDY

Relationship between pCu and Soil Complex or Soil Category, which can modify Richness

ARCADIS

FIGURE
F-3

Notes: Numbers represent Natural Resource Conservation Service (NRCS) Soil Complex identification numbers from NRCS soil web site map.

13, Encierro-Rock outcrop complex, 15-35%
54, Rock outcrop-Muzzler association, 25-65%
63, Santana-Rock outcrop complex, 1 to 25%
26, Lonti gravelly loam 0-8%
47, Plack gravelly loam, 0-8%
2, Abrazo-Luzena complex, 15-45%
54, Rock outcrop-Muzzler association, 25-65%
37, Muzzler-Rock outcrop association, 25-45%
39, Oro Grande-Rock outcrop complex, 5-15%
33, Manzano loam, 1 to 3 %
25, Lonti gravelly loam 15-35%

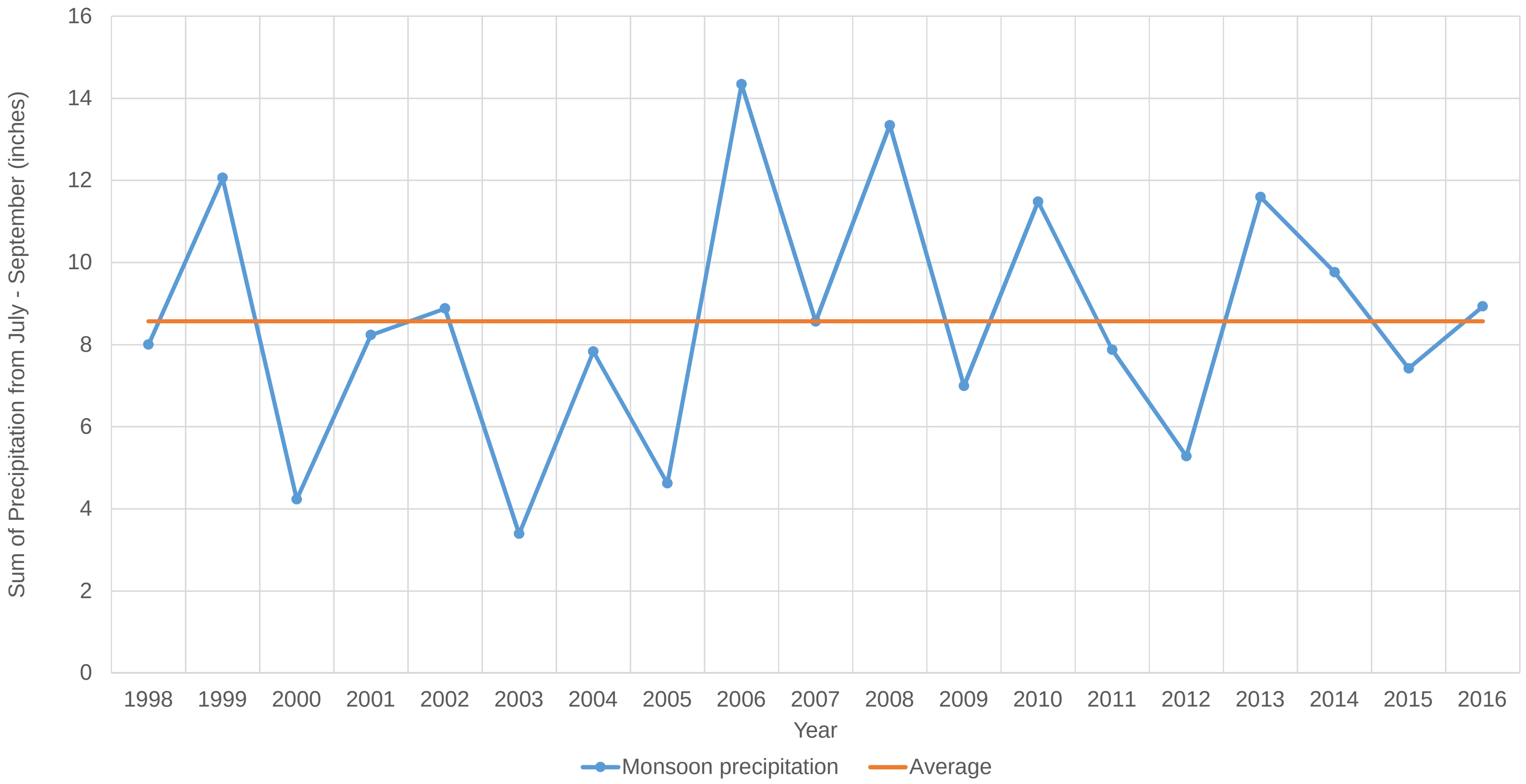
FREEPORT-MCMORAN CHINO MINES COMPANY
VANADIUM, NEW MEXICO

PHYTOTOXICITY AND VEGETATION COMMUNITY STUDY

Map of Soil Complexes by NRCS Code

ARCADIS

FIGURE
F-4



FREEPORT-MCMORAN CHINO MINES COMPANY
VANADIUM, NEW MEXICO

PHYTOTOXICITY AND VEGETATION COMMUNITY STUDY

Precipitation of Monsoon Months at Hurley, NM

ARCADIS

FIGURE
F-5

APPENDIX G

Greenhouse Phytotoxicity Dose-Response Models

Freeport-McMoRan Chino Mines Company

GREENHOUSE PHYTOTOXICITY DOSE-RESPONSE MODELS WITH AND WITHOUT COVARIATES

September 2018

GREENHOUSE PHYTOTOXICITY DOSE-RESPONSE MODELS WITH AND WITHOUT COVARIATES

Prepared for:

Freeport-McMoRan Chino Mines Company
Vanadium, New Mexico

Prepared by:

Arcadis U.S., Inc.
1687 Cole Blvd.
Suite 200
Lakewood
Colorado 80401
Tel +1 303 231 9115
Fax +1 303 231 9571

Our Ref.:

B0063543.0014

Date:

July 2017

CONTENTS

TABLES

FIGURES

ACRONYMS AND ABBREVIATIONS

AICc	corrected Akaike information criterion
DEL	de minimus effects level
pCu	cupric ion activity
PEL	probable effects level

1 INTRODUCTION

The purpose of this appendix is to provide additional details relating to the greenhouse phytotoxicity dose-response models, both with and without covariates. The main report discusses the methods by which non-linear, S-shaped dose-response curves were fit to data using SAS statistical software to determine if plant endpoint values of each site, *de minimus*, and reference soil are related to the soil's pCu. This appendix presents the details of the models resulting from that analysis. To account for potential confounding factors in the test soils that might have affected plant growth, this appendix also discusses covariates identified to include in the dose-response curves and presents the methods and results for the covariate analysis.

2 FIVE AND THREE-SEED DOSE-RESPONSE MODELS

Tables G-1 and G-2 present the non-linear statistical models evaluated in SAS for the five- and three-seed models. The three-seed models omit tansyaster field and nursery seeds because of their poor performance in control soils. However, the resulting dose-response curves are almost the same, and the five seed model is most complete and presented in the main report.

The statistical models presented show the number of parameters modeled in the final best models (based on lowest AICc) to predict the various vegetation endpoints based on pCu. Also presented in **Tables G-1** and **G-2** are the sample sizes, fit of the model in terms of pseudo R^2[1] which can typically range from 0 to 1 (poor to very good, Nagelkerke 1991), and coefficients for the parameters that are used in the non-linear equation (equation 1 in main report) to plot the curves shown in Figures 6 and 7 of the main report. If parameters (slope, Rmax, EC50) are not significantly different when compared with another seed type, the parameter is represented by one value (e.g., one slope or one EC50). If it does change, the parameter is represented by a value for each seed type that differs (e.g., a separate slope for alfalfa and a separate slope for field sideoats, etc.). If all 5 seed types had separate values for all 3 parameters, the model would be a 15 parameter model (without adding covariates discussed below, which increase the number of parameters further). The large number of combinations of models tested for each of the five endpoints to find the one with the lowest AICc are not presented in this appendix to assist the reader in seeing the final

---

[1] Pseudo R^2 (calculated as 1-SSE/corrected total SS, where SS = sum of squares and SSE = sum of squares of error term) is reported as a global fit measure appropriate for use with non-linear models, but it should not be used for selecting the best model. This goodness-of-fit measure is called "pseudo" because it may exceed 1.0 when applied to non-linear regression (Spiess and Neumeyer 2010).

results important to the interpretation of the study[2]. The AICc is also not presented because it is only meaningful when compared for the same dataset (same sample size) to select the final model. It is not used to compare the final models. The fit of the final model can best be evaluated by visually examining how well the curves in the graphs in Figure 6 and 7 fit the data points, as well as the final pseudo R^2.

3 COVARIATE METHODS

To account for potential confounding factors in the test soils that might have affected plant growth, the best covariates were identified to include in the dose-response curve. Too many variables and parameters in a model can reduce power to detect trends. To meet the assumptions of non-linear regression (e.g., no multicollinearity) and reduce the variable list to the best candidate covariates to avoid reducing model power, the following steps were followed (Belsley et al. 1980, Hosmer and Lemeshow 2000):

(1) To prevent multicollinearity[3], the pairs of independent variables (physical and chemical parameters in soil including pCu) that were highly correlated with each other at $r > 0.7$ using either Pearson Product Moment and Spearman Rank correlation statistics were identified. The variable in each correlated pair that was least correlated to the dependent variables (alfalfa plant endpoints) was removed from further analysis. The exception to this removal was if the pair of variables was hypothesized to have opposite effects on the plant endpoint when combined with pCu (e.g., the micronutrient iron is hypothesized to be protective but aluminum, not a nutrient, is hypothesized to be toxic, and both were retained, though never included in the same model).

(2) The remaining independent variables were screened for a simple correlation (Pearson or Spearman[4]) with the dependent variable (plant endpoints) with $p < 0.25$. Those with no such relationship were removed from further analysis as unlikely to contribute to the dose-response curve when modeled as a non-linear S-shaped curve (Hosmer and Lemeshow 2000).

(3) The remaining independent variables were retained as potential covariates. Principal component analysis was used to combine these variables to assess if principal components as potential covariates are more predictive of endpoints than the individual variables.

All potential covariates and principal components were added to the dose-response equation one at a time using the following equation (terms defined in main text):

---

[2] Data are provided, however, allowing one to recreate them.

[3] Multicollinearity is tested between two variables because one must be able to distinguish between a unit change in one covariate and a unit change in the other. If the two variables are linearly related then a unit change in one coincides with k units increase in the other variable, where k is some constant, and then one cannot determine the separate effects of both variables. With multicollinearity in a model, the coefficients become unstable (Neter et al. 1990).

[4] Pearson product moment correlation is a linear, parametric correlation. Spearman correlation is a non-parametric rank correlation measure that looks for monotonically increasing or decreasing relationships that the Pearson correlation may miss.

$$R = \left(\frac{R_{max}}{1 + 10^{slope(-pCu + EC50 + (alpha\ x\ covariate))}} \right)$$ (Equation 1)

Where R is the endpoint, alpha, slope, and EC50 are coefficients estimated to fit the data to a dose-response curve as described in the main text. Alpha is a new coefficient added to the equation to model the effect of the covariate. The data for the endpoint (R), pCu, and covariate are used to develop the model.

If one covariate improved the model, the next best covariate that also improved the model was added to the equation shown below to evaluate if two covariates improved the model. The model with the lowest AICc was selected as the best, most parsimonious model.

$$R = \left(\frac{R_{max}}{1 + 10^{slope(-pCu + EC50 + (alpha1\ x\ covariate1) + (alpha2\ x\ covariate2))}} \right)$$ (Equation 2)

Confidence intervals were calculated in the same manner discussed in the main text[5]. The pCu for any endpoint value (e.g., EC10) on the dose-response curve can be calculated with covariates using the following equation:

$$pCu = (EC50 + (alpha\ x\ covariate)) - \left(\frac{log10\left(\frac{R_{max}}{R} - 1\right)}{slope} \right)$$ (Equation 3)

Equation 2 was used to calculate EC10, EC20 and minimum reference-based DEL and PEL pCu values. For example, the endpoint value, R, at 10% reduction from the maximum (R_{max}) entered into this equation provided the EC10 pCu. If more than one covariate is in the equation (true for shoot weight and shoot height), the equation is as follows:

$$pCu = (EC50 + (alpha1\ x\ covariate1) + (alpha2\ x\ covariate2)) - \left(\frac{log10\left(\frac{R_{max}}{R} - 1\right)}{slope} \right)$$

(Equation 4)

The EC50 in the equation with covariates no longer represents the EC50 of the curve with the covariate included. To calculate the EC50 with the covariates, the following equation must be used (two covariate equation shown):

---

[5] Using Equation 3 in main text except term in parenthesis after slope includes addition of alpha x covariate.

$$EC50_{covariate} = \left(EC50_{model} + (alpha1\ x\ covariate1) + (alpha2\ x\ covariate2)\right)$$

The $EC50_{model}$ is the EC50 when the covariate in the equation is assigned a value of zero (or the reference group[6] for categorical variables). Because the covariate data are influencing the structure of the model,

4 COVARIATE RESULTS

To account for potential confounding factors in the test soils that might also have affected plant viability and growth, the independent variables not screened out in **Table G-3** were evaluated for significance in the dose-response curves (significant if they lowered the AICc). None of the principal components significantly improved model fit, but several individual variables did. The significant covariates added to the five-seed models for each of the five endpoints were: granular soil present in relatively level areas, extractable iron, and percent clay. Dose-response curves for all endpoints and seed types with different levels of the covariate(s) are presented in **Figure G-1**. The effects of these covariates on the endpoints are as follows:

- **Emergence**: Granular soil present in flat areas is “protective” (i.e., lowers the DEL and PEL), possibly due to higher granular structure in which the seed can germinate. In support, roads ripped to increase granularity increased grass growth (Arcadis 2017a).

- **Survival**: Extractable iron is protective, possibly due to the ferrous or ferric ion competing with the cupric ion during plant uptake. Copper toxicity creates iron deficiency in plants, which is offset by more plant-available iron (Patsikka et al. 2002).

- **Root length:** High clay amount is detrimental (i.e., increases the DEL and PEL), possibly due to the difficulty of the roots growing through dense clay.

- **Shoot height:** High clay amount is detrimental, but granular soil present in flat areas is protective. If high clay content reduces root growth, then reduced shoot height should follow, which is observed.

- **Shoot weight**: High clay amount is detrimental, but granular soil present in flat areas is protective. If high clay content reduces root growth, then reduced shoot weight should follow, which is observed.

Modelled dose-response curves are shown in Figure G-1. The DELs and PELs based on the five-seed models with the categorical or minimum, mean, and maximum values observed of the covariates on Site included (see **Appendix A** for raw data) are presented in **Tables G-4 and G-5**, respectively. For the categorical variable of flat granular, DELs and PELs are shown for soils that are and are not flat granular.

---

[6] Categorical variables are represented by a “dummy” variable, where the reference category is assigned a value of 0. For flat granular, the “not flat granular” category is the reference category.

The minimum and maximum values are the extremes for the Site and not necessarily representative of locations that may be considered for remediation. Site-specific soil data on clay content, soil category of the location, and extractable iron concentrations can be entered into the dose-response equation 3 (if the endpoint's model has one covariate [emergence, survival, root length]) or equation 4 (if the endpoint's model has two covariates [shoot weight and height]) along with pCu (using the estimates of the equation parameters provided in **Table G-4**) in this Appendix to predict the DEL for a location for an endpoint. If a soil is in the flat, granular category, it gets a covariate value of 1, a value of 0 if not. If the pCu value for the EC50 is desired, then R is 0.5. If the pCu for the EC10 is desired, then R is 0.9[7]. If the minimum reference-based DEL is desired, the minimum of the endpoint for the reference dataset is entered into the equation as R. If the PEL using this minimum method is desired, the minimum of the endpoint for the reference dataset is divided by 2 and then entered into the equation as R.

As an example, evaluating only emergence (the most ecologically relevant greenhouse endpoint, see main text) for the flat granular soil category, the results in Table G-5 show the DEL ranges from 3.0 to 5.3 across seed types, while the PEL ranges from 2.3 to 4.0 across seed types (including tansyaster). The non-flat granular category ranges are higher at 4.5 to 6.8 for the DEL and 3.7 to 5.5 for the PEL. Without tansyaster, the flat granular soil category ranges are 3.0 to 5.2 for the DEL and 2.3 to 3.7 for the PEL. Without tansyaster, the non-flat granular soil category ranges are 4.5 to 6.6 for the DEL and 3.7 to 5.2 for the PEL (Table G-5).

The covariates associated with the endpoints in Figure G-1 are those that were significant with that endpoint. Covariates such as flat, granular soil are significant only for emergence, shoot weight, and shoot height, and therefore, different PELs and DELs can be estimated for that soil category only for those endpoints.

---

[7] To obtain the EC50, a shortcut is to add the alpha x covariate product to the EC50 provided in Table G-4 and shown in Equation 5.

TABLES

Table G-1. Five-Seed Model Results

Freeport-McMoran Chino Mines Company
Vanadium, New Mexico
Smelter/Tailing Soils IU Phytotoxicity and Vegetation Community Study

Endpoint	n	SSE	Parameters	Pseudo R^2	SAS Formulation	Seed Type	Slope				Rmax				EC50				EC20				EC10			
							Estimate	S.E.	95 LCL	95UCL	Estimate	S.E.	95 LCL	95UCL	Estimate	S.E.	95 LCL	95UCL	Estimate	S.E.	95 LCL	95UCL	Estimate	S.E.	95 LCL	95UCL
Emergence																										
Emergence	165	5.884	10	0.83	if seed = 'Alfalfa' then mod = Rmax_a/(1+10**(slope_a*(-measured_pcu + ec50_a))); if seed = 'Side Oats (Field)' then mod = Rmax_fso/(1+10**(slope*(-measured_pcu + ec50_so))); if seed = 'Side Oats (Nursery)' then mod = Rmax_nso/(1+10**(slope*(-measured_pcu + ec50_so))); if seed = 'Tansyaster (Field)' then mod = Rmax_ftan/(1+10**(slope*(-measured_pcu + ec50_tan))); if seed = 'Tansyaster (Nursery)' then mod = Rmax_ntan/(1+10**(slope*(-measured_pcu + ec50_tan))); model Emergence_Std =mod;	Alfalfa	1.747	0.717	0.331	3.164	0.812	0.046	0.721	0.903	3.787	0.106	3.577	3.996	4.131	0.164	3.808	4.454	4.333	0.233	3.872	4.793
						Field Sideoats Grama	0.592	0.081	0.433	0.752	1.111	0.068	0.976	1.246	5.109	0.133	4.846	5.372	6.125	0.241	5.649	6.601	6.720	0.315	6.097	7.343
						Nursery Sideoats Grama	0.592	0.081	0.433	0.752	1.454	0.076	1.303	1.605	5.109	0.133	4.846	5.372	6.125	0.241	5.649	6.601	6.720	0.315	6.097	7.343
						Field Tansyaster	0.592	0.081	0.433	0.752	0.171	0.061	0.050	0.292	5.303	0.475	4.366	6.241	6.320	0.517	5.298	7.341	6.914	0.557	5.814	8.014
						Nursery Tansyaster	0.592	0.081	0.433	0.752	0.390	0.070	0.253	0.527	5.303	0.475	4.366	6.241	6.320	0.517	5.298	7.341	6.914	0.557	5.814	8.014
Survival																										
Survival	127	14.687	12	0.86	if seed = 'Alfalfa' then mod = Rmax_a/(1+10**(slope_a*(-measured_pcu + ec50_a))); if seed = 'Side Oats (Field)' then mod = Rmax_fso/(1+10**(slope_so*(-measured_pcu + ec50_so))); if seed = 'Side Oats (Nursery)' then mod = Rmax_nso/(1+10**(slope_so*(-measured_pcu + ec50_so))); if seed = 'Tansyaster (Field)' then mod = Rmax_ftan/(1+10**(slope_tan*(-measured_pcu + ec50_ftan))); if seed = 'Tansyaster (Nursery)' then mod = Rmax_ntan/(1+10**(slope_tan*(-measured_pcu + ec50_ntan))); model Survival_Std =mod;	Alfalfa	14.105	22.771	-31.000	59.211	0.943	0.069	0.808	1.079	3.682	0.034	3.615	3.749	3.725	0.062	3.601	3.848	3.750	0.099	3.553	3.946
						Field Sideoats Grama	0.579	0.180	0.224	0.935	1.244	0.141	0.965	1.522	5.115	0.277	4.565	5.664	6.154	0.528	5.109	7.199	6.762	0.702	5.372	8.152
						Nursery Sideoats Grama	0.579	0.180	0.224	0.935	1.121	0.134	0.857	1.386	5.115	0.277	4.565	5.664	6.154	0.528	5.109	7.199	6.762	0.702	5.372	8.152
						Field Tansyaster	8.911	2.837	3.292	14.531	2.922	0.102	2.720	3.124	5.231	0.051	5.130	5.333	5.299	0.061	5.179	5.419	5.338	0.069	5.202	5.474
						Nursery Tansyaster	8.911	2.837	3.292	14.531	2.436	0.096	2.247	2.626	4.915	0.037	4.843	4.988	4.983	0.044	4.896	5.070	5.022	0.052	4.919	5.125
Root Length																										
Root Length	114	1.801	8	0.87	if seed = 'Alfalfa' then mod = Rmax_a/(1+10**(slope*(-measured_pcu + ec50_a))); if seed = 'Side Oats (Field)' then mod = Rmax_fso/(1+10**(slope*(-measured_pcu + ec50_so))); if seed = 'Side Oats (Nursery)' then mod = Rmax_nso/(1+10**(slope*(-measured_pcu + ec50_so))); if seed = 'Tansyaster (Field)' then mod = Rmax_tan/(1+10**(slope*(-measured_pcu + ec50_tan))); if seed = 'Tansyaster (Nursery)' then mod = Rmax_tan/(1+10**(slope*(-measured_pcu + ec50_tan))); model Rootlength_Std =mod;	Alfalfa	0.974	0.144	0.688	1.260	0.705	0.058	0.591	0.820	6.456	0.182	6.096	6.816	7.074	0.224	6.631	7.518	7.436	0.261	6.919	7.953
						Field Sideoats Grama	0.974	0.144	0.688	1.260	0.926	0.050	0.827	1.026	6.121	0.085	5.952	6.291	6.739	0.149	6.445	7.034	7.101	0.196	6.712	7.490
						Nursery Sideoats Grama	0.974	0.144	0.688	1.260	1.106	0.053	1.002	1.210	6.121	0.085	5.952	6.291	6.739	0.149	6.445	7.034	7.101	0.196	6.712	7.490
						Field & Nursery Tansyaster	0.974	0.144	0.688	1.260	0.223	0.031	0.163	0.284	5.091	0.441	4.218	5.965	5.709	0.446	4.825	6.594	6.071	0.458	5.163	6.979
Shoot Weight																										
Shoot Weight	114	0.741	7	0.74	if seed = 'Alfalfa' then mod = Rmax_a/(1+10**(slope*(-measured_pcu + ec50_a))); if seed = 'Side Oats (Field)' then mod = Rmax_so/(1+10**(slope*(-measured_pcu + ec50_so))); if seed = 'Side Oats (Nursery)' then mod = Rmax_so/(1+10**(slope*(-measured_pcu + ec50_so))); if seed = 'Tansyaster (Field)' then mod = Rmax_tan/(1+10**(slope*(-measured_pcu + ec50_tan))); if seed = 'Tansyaster (Nursery)' then mod = Rmax_tan/(1+10**(slope*(-measured_pcu + ec50_tan))); model Dryweight_Std =mod;	Alfalfa	0.459	0.086	0.289	0.628	0.307	0.037	0.234	0.380	5.103	0.383	4.343	5.862	6.416	0.527	5.371	7.460	7.184	0.640	5.914	8.453
						Field & Nursery Sideoats Grama	0.459	0.086	0.289	0.628	0.490	0.040	0.410	0.570	5.662	0.251	5.165	6.159	6.975	0.456	6.072	7.878	7.743	0.590	6.574	8.912
						Field & Nursery Tansyaster	0.459	0.086	0.289	0.628	0.089	0.042	0.007	0.171	6.994	1.627	3.770	10.218	8.306	1.678	4.979	11.634	9.074	1.724	5.656	12.493
Shoot Height																										
Shoot Height	114	1.956	5	0.74	if seed = 'Alfalfa' then mod = Rmax_a/(1+10**(slope*(-measured_pcu + ec50))); if seed = 'Side Oats (Field)' then mod = Rmax_so/(1+10**(slope*(-measured_pcu + ec50))); if seed = 'Side Oats (Nursery)' then mod = Rmax_so/(1+10**(slope*(-measured_pcu + ec50))); if seed = 'Tansyaster (Field)' then mod = Rmax_tan/(1+10**(slope*(-measured_pcu + ec50))); if seed = 'Tansyaster (Nursery)' then mod = Rmax_tan/(1+10**(slope*(-measured_pcu + ec50))); model Height_Std =mod;	Alfalfa	0.518	0.087	0.345	0.690	0.581	0.057	0.468	0.694	5.857	0.197	5.467	6.247	7.021	0.361	6.305	7.737	7.701	0.469	6.772	8.630
						Field & Nursery Sideoats Grama	0.518	0.087	0.345	0.690	0.803	0.058	0.689	0.917	5.857	0.197	5.467	6.247	7.021	0.361	6.305	7.737	7.701	0.469	6.772	8.630
						Field & Nursery Tansyaster	0.518	0.087	0.345	0.690	0.266	0.035	0.197	0.336	5.857	0.197	5.467	6.247	7.021	0.361	6.305	7.737	7.701	0.469	6.772	8.630
Shoot Height, Outlier Excluded	113	1.232	5	0.79	if seed = 'Alfalfa' then mod = Rmax_a/(1+10**(slope*(-measured_pcu + ec50))); if seed = 'Side Oats (Field)' then mod = Rmax_so/(1+10**(slope*(-measured_pcu + ec50))); if seed = 'Side Oats (Nursery)' then mod = Rmax_so/(1+10**(slope*(-measured_pcu + ec50))); if seed = 'Tansyaster (Field)' then mod = Rmax_tan/(1+10**(slope*(-measured_pcu + ec50))); if seed = 'Tansyaster (Nursery)' then mod = Rmax_tan/(1+10**(slope*(-measured_pcu + ec50))); model Height_Std =mod;	Alfalfa	0.570	0.079	0.414	0.725	0.553	0.041	0.472	0.634	5.673	0.139	5.397	5.949	6.730	0.256	6.223	7.237	7.348	0.335	6.685	8.011
						Field & Nursery Sideoats Grama	0.570	0.079	0.414	0.725	0.717	0.039	0.639	0.794	5.673	0.139	5.397	5.949	6.730	0.256	6.223	7.237	7.348	0.335	6.685	8.011
						Field & Nursery Tansyaster	0.570	0.079	0.414	0.725	0.256	0.026	0.204	0.309	5.673	0.139	5.397	5.949	6.730	0.256	6.223	7.237	7.348	0.335	6.685	8.011

Notes:
SE = standard error, using Wald statistic in SAS for non-linear regression.
LCL = lower confidence limit
UCL = upper confidence limit
Rmax = upper endpoint threshold of S-shaped dose-response curve (where curve plateaus)
Slope = slope of S-shaped curve
ECx = effects concentration (in pCu units) at x% of the endpoint below Rmax
a = alfalfa, so = sideoats grama, nso = nursery seed sideoats grama, fso = field seed sideoats grama, tan = tansyaster, ftan = field seed tansyaster, ntan = nursery seed tansyasters

Table G-2. Three-Seed Model Results

Freeport-McMoran Chino Mines Company
Vanadium, New Mexico
Smelter/Tailing Soils IU Phytotoxicity and Vegetation Community Study

Endpoint	n	SSE	Parameters	Pseudo R^2	SAS Formulation	Seed Type	Slope				Rmax				EC50				EC20				EC10			
							Estimate	S.E.	95 LCL	95UCL	Estimate	S.E.	95 LCL	95UCL	Estimate	S.E.	95 LCL	95UCL	Estimate	SE	95 LCL	95UCL	Estimate	SE	95 LCL	95UCL
Emergence																										
Emergence	99	5.348	7	0.74	if seed = 'Alfalfa' then mod = Rmax_a/(1+10**(slope_a*(-measured_pcu + ec50_a))); if seed = 'Side Oats (Field)' then mod = Rmax_fso/(1+10**(slope_so*(-measured_pcu + ec50_so))); if seed = 'Side Oats (Nursery)' then mod = Rmax_nso/(1+10**(slope_so*(-measured_pcu + ec50_so)));	Alfalfa	1.747	0.887	-0.015	3.510	0.812	0.057	0.698	0.925	3.787	0.131	3.526	4.047	4.131	0.202	3.729	4.533	4.333	0.288	3.760	4.906
						Field Sideoats Grama	0.562	0.098	0.368	0.756	1.125	0.088	0.951	1.300	5.147	0.176	4.797	5.497	6.218	0.324	5.574	6.862	6.845	0.425	6.001	7.689
						Nursery Sideoats Grama	0.562	0.098	0.368	0.756	1.472	0.099	1.275	1.669	5.147	0.176	4.797	5.497	6.218	0.324	5.574	6.862	6.845	0.425	6.001	7.689
Survival																										
Survival	90	2.550	7	0.80	if seed = 'Alfalfa' then mod = Rmax_a/(1+10**(slope_a*(-measured_pcu + ec50_a))); if seed = 'Side Oats (Field)' then mod = Rmax_fso/(1+10**(slope_so*(-measured_pcu + ec50_so))); if seed = 'Side Oats (Nursery)' then mod = Rmax_nso/(1+10**(slope_so*(-measured_pcu + ec50_so)));	Alfalfa	14.102	11.167	-8.108	36.312	0.943	0.034	0.876	1.010	3.682	0.017	3.649	3.715	3.725	0.031	3.664	3.785	3.750	0.049	3.653	3.847
						Field Sideoats Grama	0.579	0.088	0.404	0.755	1.244	0.069	1.107	1.381	5.115	0.136	4.844	5.385	6.154	0.259	5.639	6.669	6.762	0.344	6.077	7.447
						Nursery Sideoats Grama	0.579	0.088	0.404	0.755	1.121	0.066	0.991	1.252	5.115	0.136	4.844	5.385	6.154	0.259	5.639	6.669	6.762	0.344	6.077	7.447
Root Length																										
Root Length	84	1.213	6	0.90	if seed = 'Alfalfa' then mod = Rmax_a/(1+10**(slope*(-measured_pcu + ec50_a))); if seed = 'Side Oats (Field)' then mod = Rmax_fso/(1+10**(slope*(-measured_pcu + ec50_so))); if seed = 'Side Oats (Nursery)' then mod = Rmax_nso/(1+10**(slope*(-measured_pcu + ec50_so)));	Alfalfa	0.976	0.140	0.698	1.255	0.705	0.055	0.595	0.815	6.456	0.173	6.111	6.801	7.072	0.214	6.646	7.499	7.433	0.250	6.935	7.931
						Field Sideoats Grama	0.976	0.140	0.698	1.255	0.926	0.048	0.830	1.022	6.120	0.082	5.958	6.283	6.737	0.143	6.453	7.021	7.098	0.189	6.722	7.474
						Nursery Sideoats Grama	0.976	0.140	0.698	1.255	1.106	0.050	1.006	1.206	6.120	0.082	5.958	6.283	6.737	0.143	6.453	7.021	7.098	0.189	6.722	7.474
Shoot Weight																										
Shoot Weight	84	0.635	5	0.70	if seed = 'Alfalfa' then mod = Rmax_a/(1+10**(slope*(-measured_pcu + ec50_a))); if seed = 'Side Oats (Field)' then mod = Rmax_so/(1+10**(slope*(-measured_pcu + ec50_so))); if seed = 'Side Oats (Nursery)' then mod = Rmax_so/(1+10**(slope*(-measured_pcu + ec50_so)));	Alfalfa	0.467	0.094	0.280	0.653	0.305	0.039	0.228	0.383	5.089	0.405	4.282	5.895	6.379	0.556	5.273	7.486	7.134	0.675	5.790	8.478
						Field & Nursery Sideoats Grama	0.467	0.094	0.280	0.653	0.488	0.042	0.404	0.572	5.647	0.262	5.125	6.170	6.938	0.478	5.987	7.889	7.693	0.620	6.460	8.926
Shoot Height																										
Shoot Height	84	1.471	5	0.77	if seed = 'Alfalfa' then mod = Rmax_a/(1+10**(slope*(-measured_pcu + ec50_a))); if seed = 'Side Oats (Field)' then mod = Rmax_so/(1+10**(slope*(-measured_pcu + ec50_so))); if seed = 'Side Oats (Nursery)' then mod = Rmax_so/(1+10**(slope*(-measured_pcu + ec50_so)));	Alfalfa	0.532	0.093	0.348	0.717	0.534	0.061	0.412	0.656	5.486	0.336	4.817	6.154	6.617	0.450	5.720	7.513	7.278	0.540	6.204	8.353
						Field & Nursery Sideoats Grama	0.532	0.093	0.348	0.717	0.817	0.063	0.693	0.942	5.944	0.216	5.515	6.374	7.075	0.376	6.326	7.824	7.737	0.483	6.776	8.698
Shoot Height, Outlier Excluded	83	0.764	5	0.84	if seed = 'Alfalfa' then mod = Rmax_a/(1+10**(slope*(-measured_pcu + ec50_a))); if seed = 'Side Oats (Field)' then mod = Rmax_so/(1+10**(slope*(-measured_pcu + ec50_so))); if seed = 'Side Oats (Nursery)' then mod = Rmax_so/(1+10**(slope*(-measured_pcu + ec50_so)));	Alfalfa	0.586	0.076	0.434	0.738	0.524	0.042	0.441	0.606	5.435	0.224	4.989	5.881	6.462	0.299	5.867	7.057	7.063	0.359	6.348	7.778
						Field & Nursery Sideoats Grama	0.586	0.076	0.434	0.738	0.724	0.038	0.648	0.800	5.728	0.142	5.445	6.010	6.755	0.243	6.271	7.239	7.356	0.314	6.731	7.981

Notes:
Three seed models exclude tansyaster seeds (both field and nursery seeds)
SE = standard error, using Wald statistic in SAS for non-linear regression.
LCL = lower confidence limit
UCL = upper confidence limit
Rmax = upper endpoint threshold of S-shaped dose-response curve (where curve plateaus)
Slope = slope of S-shaped curve
ECx = effects concentration (in pCu units) at x% of the endpoint below Rmax
a = alfalfa, so = sideoats grama, nso = nursery seed sideoats grama, fso = field seed sideoats grama

Table G-3. Covariates Considered and Eliminated from Greenhouse Phytotoxicity Data Analysis

Freeport-McMoran Chino Mines Company
Vanadium, New Mexico
Smelter/Tailing Soils IU Phytotoxicity and Vegetation Community Study

Parameter	Units	Remaining after multicollinearity test[a]	Remaining if $p < 0.25$ with an endpoint[b]
Lime as $CaCO_3$	%		
Organic Matter, LOI	%		
Soil category (bedrock, flat rocky, slope, flat granular)	indicator variable[d]	X	X
Soil texture (% clay, silt, sand)	%	X	X
Calcium, Extractable, NH_4OAc	meq/100g	X	X
Magnesium, Extractable, NH_4OAc	meq/100g		
Potassium, Extractable, NH_4OAc	meq/100g		
Sodium, Extractable, NH_4OAc	meq/100g	X	X
Alkalinity, Saturated Paste	meq/L		
Bicarbonate, Saturated Paste	meq/L		
Calcium, Saturated Paste	meq/L	X	X
Chloride, Saturated Paste	meq/L		
Sulfate, Saturated Paste	meq/L		
Aluminum, DTPA extraction	mg/kg	X	X
Calcium, NH_4OAc	mg/kg		
Iron, DTPA extraction	mg/kg	X[c]	X
Magnesium, NH_4OAc	mg/kg		
Manganese, DTPA extraction	mg/kg	X	X
Nitrate + nitrite	mg/kg	X	
Organic Carbon, Dissolved (DOC)	mg/kg	X	X
Phosphate	mg/kg	X	
Phosphorus, Olsen-Bray	mg/kg	X	X
Potassium, NH_4OAc	mg/kg	X	X
Sodium, NH_4OAc	mg/kg		
Fluoride	mg/L		
Conductivity, Saturated Paste	mmhos/cm		
pCu, Measured in $CaCl_2$	s.u.	X	X

Acronyms/Abbreviations:

$CaCl_2$ = calcium chloride
$CaCO_3$ = calcium carbonate
DOC = dissolved organic carbon
DTPA = diethylenetriaminepentaacetic acid
LOI = loss on ignition
meq/100 g = millequivalents per 100 grams
meq/L = millequivalents per liter
mg/kg = milligrams per kilogram
mg/L = milligrams per liter
mmhos/cm = millimhos per centimeter
NH_4OAc = ammonium acetate
s.u. = standard units

Notes:

a. Multicollinearity test involved retaining variable if not correlated (< 0.7) to another independent covariate (including pCu), and if correlated, only one of a pair of correlated variables is retained.

b. Variable was retained if significantly correlated to any of the greenhouse endpoints at $p < 0.25$.

c. Iron was correlated (>0.7) with aluminum, but retained because iron has opposite effect on plants than aluminum and could reduce iron deficiency that copper causes.

d. An indicator variable for four categories is coded by (1,0,0), (0,1,0), (0,0,1), and (0,0,0) where slope is the all 0 reference category.

Correlations were by Pearson and Spearman methods.

Table G-4. Five-Seed Model Results with Covariates

Freeport-McMoRan Chino Mines Company
Vanadium, New Mexico
Smelter/Tailing Soils IU Phytotoxicity and Vegetation Community Study

Endpoint (Covariate)	n	SSE	Parameters	Pseudo R^2	SAS Formulation	Seed Type	Slope				Rmax				$EC50_{model}$				Alpha				Alpha 2			
							Estimate	S.E.	95 LCL	95UCL	Estimate	S.E.	95 LCL	95UCL	Estimate	S.E.	95 LCL	95UCL	Estimate	S.E.	95 LCL	95UCL	Estimate	S.E.	95 LCL	95UCL
Emergence																										
Emergence (Flat Granular/Not Flat Granular)	165	4.363	11	0.87	if seed = 'Alfalfa' then mod = Rmax_a/(1+10**(slope_a*(-measured_pcu + ec50_a+(alpha*&covar)))); if seed = 'Side Oats (Field)' then mod = Rmax_fso/(1+10**(slope*(-measured_pcu + ec50_so+(alpha*&covar)))); if seed = 'Side Oats (Nursery)' then mod = Rmax_nso/(1+10**(slope*(-measured_pcu + ec50_so+(alpha*&covar)))); if seed = 'Tansyaster (Field)' then mod = Rmax_ftan/(1+10**(slope*(-measured_pcu + ec50_tan+(alpha*&covar)))); if seed = 'Tansyaster (Nursery)' then mod = Rmax_ntan/(1+10**(slope*(-measured_pcu + ec50_tan+(alpha*&covar)))); model Emergence_Std =mod;	Alfalfa	1.406	0.486	0.446	2.366	0.817	0.040	0.739	0.895	3.806	0.108	3.594	4.018	-1.438	0.233	-1.897	-0.978	NA	NA	NA	NA
						Field Sideoats Grama	0.737	0.089	0.562	0.912	1.072	0.051	0.971	1.173	5.155	0.096	4.965	5.345	-1.438	0.233	-1.897	-0.978	NA	NA	NA	NA
						Nursery Sideoats Grama	0.737	0.089	0.562	0.912	1.398	0.055	1.289	1.507	5.155	0.096	4.965	5.345	-1.438	0.233	-1.897	-0.978	NA	NA	NA	NA
						Field Tansyaster	0.737	0.089	0.562	0.912	0.164	0.050	0.064	0.263	5.473	0.393	4.696	6.250	-1.438	0.233	-1.897	-0.978	NA	NA	NA	NA
						Nursery Tansyaster	0.737	0.089	0.562	0.912	0.376	0.056	0.267	0.486	5.473	0.393	4.696	6.250	-1.438	0.233	-1.897	-0.978	NA	NA	NA	NA
Survival																										
Survival (Iron)	127	7.460	13	0.93	if seed = 'Alfalfa' then mod = Rmax_a/(1+10**(slope_a*(-measured_pcu + ec50_a+(alpha*&covar)))); if seed = 'Side Oats (Field)' then mod = Rmax_fso/(1+10**(slope_so*(-measured_pcu + ec50_so+(alpha*&covar)))); if seed = 'Side Oats (Nursery)' then mod = Rmax_nso/(1+10**(slope_so*(-measured_pcu + ec50_so+(alpha*&covar)))); if seed = 'Tansyaster (Field)' then mod = Rmax_ftan/(1+10**(slope_tan*(-measured_pcu + ec50_ftan+(alpha*&covar)))); if seed = 'Tansyaster (Nursery)' then mod = Rmax_ntan/(1+10**(slope_tan*(-measured_pcu + ec50_ntan+(alpha*&covar)))); model Survival_Std =mod;	Alfalfa	4.421	3.947	-3.399	12.241	0.948	0.050	0.850	1.047	3.751	0.082	3.589	3.913	-0.00448	0.00171	-0.00787	-0.00109	NA	NA	NA	NA
						Field Sideoats Grama	0.634	0.143	0.352	0.917	1.253	0.100	1.055	1.451	5.372	0.209	4.957	5.786	-0.00448	0.00171	-0.00787	-0.00109	NA	NA	NA	NA
						Nursery Sideoats Grama	0.634	0.143	0.352	0.917	1.119	0.095	0.930	1.307	5.372	0.209	4.957	5.786	-0.00448	0.00171	-0.00787	-0.00109	NA	NA	NA	NA
						Field Tansyaster	6.968	1.693	3.614	10.322	2.925	0.074	2.778	3.071	5.419	0.088	5.246	5.593	-0.00448	0.00171	-0.00787	-0.00109	NA	NA	NA	NA
						Nursery Tansyaster	6.968	1.693	3.614	10.322	2.455	0.067	2.323	2.587	5.047	0.061	4.926	5.168	-0.00448	0.00171	-0.00787	-0.00109	NA	NA	NA	NA
Root Length																										
Root Length (Clay)	114	1.506	9	0.89	if seed = 'Alfalfa' then mod = Rmax_a/(1+10**(slope*(-measured_pcu + ec50_a+(alpha*&covar)))); if seed = 'Side Oats (Field)' then mod = Rmax_fso/(1+10**(slope*(-measured_pcu + ec50_so+(alpha*&covar)))); if seed = 'Side Oats (Nursery)' then mod = Rmax_nso/(1+10**(slope*(-measured_pcu + ec50_so+(alpha*&covar)))); if seed = 'Tansyaster (Field)' then mod = Rmax_tan/(1+10**(slope*(-measured_pcu + ec50_tan+(alpha*&covar)))); if seed = 'Tansyaster (Nursery)' then mod = Rmax_tan/(1+10**(slope*(-measured_pcu + ec50_tan+(alpha*&covar)))); model Rootlength_Std =mod;	Alfalfa	0.968	0.120	0.730	1.206	0.700	0.051	0.599	0.802	5.725	0.227	5.274	6.176	0.0238	0.00510	0.0137	0.0339	NA	NA	NA	NA
						Field Sideoats Grama	0.968	0.120	0.730	1.206	0.935	0.045	0.845	1.025	5.374	0.177	5.024	5.724	0.0238	0.00510	0.0137	0.0339	NA	NA	NA	NA
						Nursery Sideoats Grama	0.968	0.120	0.730	1.206	1.110	0.047	1.017	1.202	5.374	0.177	5.024	5.724	0.0238	0.00510	0.0137	0.0339	NA	NA	NA	NA
						Field & Nursery Tansyaster	0.968	0.120	0.730	1.206	0.231	0.028	0.174	0.287	4.492	0.392	3.715	5.269	0.0238	0.00510	0.0137	0.0339	NA	NA	NA	NA
Shoot Weight																										
Shoot Weight (Clay [alpha] and Flat Granular [alpha2])	114	0.642	9	0.78	if seed = 'Alfalfa' then mod = Rmax_a/(1+10**(slope*(-measured_pcu + ec50_a+(alpha*&covar)+(alpha2*&covar2)))); if seed = 'Side Oats (Field)' then mod = Rmax_so/(1+10**(slope*(-measured_pcu + ec50_so+(alpha*&covar)+(alpha2*&covar2)))); if seed = 'Side Oats (Nursery)' then mod = Rmax_so/(1+10**(slope*(-measured_pcu + ec50_so+(alpha*&covar)+(alpha2*&covar2)))); if seed = 'Tansyaster (Field)' then mod = Rmax_tan/(1+10**(slope*(-measured_pcu + ec50_tan+(alpha*&covar)+(alpha2*&covar2)))); if seed = 'Tansyaster (Nursery)' then mod = Rmax_tan/(1+10**(slope*(-measured_pcu + ec50_tan+(alpha*&covar)+(alpha2*&covar2)))); model Dryweight_Std =mod;	Alfalfa	0.658	0.118	0.424	0.891	0.289	0.028	0.234	0.343	4.409	0.312	3.792	5.027	0.0244	0.00773	0.0091	0.0397	-0.492	0.243	-0.974	-0.00932
						Field & Nursery Sideoats Grama	0.658	0.118	0.424	0.891	0.463	0.024	0.415	0.510	4.874	0.286	4.307	5.442	0.0244	0.00773	0.0091	0.0397	-0.492	0.243	-0.974	-0.00932
						Field & Nursery Tansyaster	0.658	0.118	0.424	0.891	0.075	0.023	0.029	0.122	5.755	1.157	3.462	8.049	0.0244	0.00773	0.0091	0.0397	-0.492	0.243	-0.974	-0.00932
Shoot Height																										
Shoot Height (Clay [alpha] and Flat Granular [alpha2])	114	1.724	7	0.77	if seed = 'Alfalfa' then mod = Rmax_a/(1+10**(slope*(-measured_pcu + ec50+(alpha*&covar)+(alpha2*&covar2)))); if seed = 'Side Oats (Field)' then mod = Rmax_so/(1+10**(slope*(-measured_pcu + ec50+(alpha*&covar)+(alpha2*&covar2)))); if seed = 'Side Oats (Nursery)' then mod = Rmax_so/(1+10**(slope*(-measured_pcu + ec50+(alpha*&covar)+(alpha2*&covar2)))); if seed = 'Tansyaster (Field)' then mod = Rmax_tan/(1+10**(slope*(-measured_pcu + ec50+(alpha*&covar)+(alpha2*&covar2)))); if seed = 'Tansyaster (Nursery)' then mod = Rmax_tan/(1+10**(slope*(-measured_pcu + ec50+(alpha*&covar)+(alpha2*&covar2)))); model Height_Std =mod;	Alfalfa	0.621	0.099	0.424	0.817	0.549	0.045	0.459	0.639	5.273	0.313	4.653	5.894	0.0185	0.008380	0.001890	0.0351	-0.576	0.255	-1.082	-0.0696
						Field & Nursery Sideoats Grama	0.621	0.099	0.424	0.817	0.769	0.040	0.691	0.848	5.273	0.313	4.653	5.894	0.0185	0.008380	0.001890	0.0351	-0.576	0.255	-1.082	-0.0696
						Field & Nursery Tansyaster	0.621	0.099	0.424	0.817	0.258	0.031	0.198	0.319	5.273	0.313	4.653	5.894	0.0185	0.008380	0.001890	0.0351	-0.576	0.255	-1.082	-0.0696
Shoot Height, Outlier Excluded (Clay [alpha] and Flat Granular [alpha2])	113	0.997	7	0.83	if seed = 'Alfalfa' then mod = Rmax_a/(1+10**(slope*(-measured_pcu + ec50+(alpha*&covar)+(alpha2*&covar2)))); if seed = 'Side Oats (Field)' then mod = Rmax_so/(1+10**(slope*(-measured_pcu + ec50+(alpha*&covar)+(alpha2*&covar2)))); if seed = 'Side Oats (Nursery)' then mod = Rmax_so/(1+10**(slope*(-measured_pcu + ec50+(alpha*&covar)+(alpha2*&covar2)))); if seed = 'Tansyaster (Field)' then mod = Rmax_tan/(1+10**(slope*(-measured_pcu + ec50+(alpha*&covar)+(alpha2*&covar2)))); if seed = 'Tansyaster (Nursery)' then mod = Rmax_tan/(1+10**(slope*(-measured_pcu + ec50+(alpha*&covar)+(alpha2*&covar2)))); model Height_Std =mod;	Alfalfa	0.800	0.108	0.587	1.013	0.519	0.032	0.456	0.582	4.933	0.208	4.521	5.345	0.0226	0.00577	0.0111	0.0340	-0.501	0.176	-0.850	-0.153
						Field & Nursery Sideoats Grama	0.800	0.108	0.587	1.013	0.683	0.027	0.630	0.737	4.933	0.208	4.521	5.345	0.0226	0.00577	0.0111	0.0340	-0.501	0.176	-0.850	-0.153
						Field & Nursery Tansyaster	0.800	0.108	0.587	1.013	0.247	0.022	0.203	0.291	4.933	0.208	4.521	5.345	0.0226	0.00577	0.0111	0.0340	-0.501	0.176	-0.850	-0.153

Note: The EC50 in this table is a coefficient estimated in the model, assuming covariate values are zero, which differs from EC50 calculated in Table G-5.

Table G-5. DEL and PEL Based on Five-Seed Models with Various Combinations of the Covariates

Freeport-McMoran Chino Mines Company
Vanadium, New Mexico
Smelter/Tailing Soils IU Phytotoxicity and Vegetation Community Study

Species	Emergence, not on Flat Granular	Emergence, on Flat Granular	Survival, Minimum Iron	Survival, Mean Iron	Survival, Maximum Iron	Shoot Weight, not on Flat Granular, Minimum Clay	Shoot Weight, not on Flat Granular, Mean Clay	Shoot Weight, not on Flat Granular, Maximum Clay	Shoot Weight, on Flat Granular, Minimum Clay	Shoot Weight, on Flat Granular, Mean Clay	Shoot Weight, on Flat Granular, Maximum Clay	Shoot Height, not on Flat Granular, Minimum Clay	Shoot Height, not on Flat Granular, Mean Clay	Shoot Height, not on Flat Granular, Maximum Clay	Shoot Height, on Flat Granular, Minimum Clay	Shoot Height, on Flat Granular, Mean Clay	Shoot Height, on Flat Granular, Maximum Clay	Root Length, Minimum Clay	Root Length, Mean Clay	Root Length, Maximum Clay
Alfalfa																				
EC10 (DEL)	4.48	3.05	3.95	3.77	2.56	6.06	6.41	6.98	5.56	5.92	6.49	6.31	6.63	7.17	5.81	6.13	6.66	6.90	7.25	7.81
EC50 (PEL)	3.81	2.37	3.74	3.55	2.34	4.60	4.96	5.53	4.11	4.47	5.04	5.11	5.44	5.97	4.61	4.94	5.47	5.92	6.26	6.82
DEL based on minimum of reference	4.46	3.02	4.64	4.45	3.24	6.54	6.90	7.47	6.05	6.40	6.98	6.21	6.54	7.07	5.71	6.04	6.57	7.26	7.60	8.16
PEL based on minimum of reference	3.74	2.30	3.75	3.56	2.36	4.54	4.89	5.46	4.05	4.40	4.97	4.99	5.31	5.85	4.49	4.81	5.34	5.87	6.22	6.78
Field Sideoats																				
EC10 (DEL)	6.45	5.01	6.86	6.68	5.47	6.52	6.87	7.45	6.03	6.38	6.96	6.31	6.63	7.17	5.81	6.13	6.66	6.55	6.90	7.45
EC50 (PEL)	5.15	3.72	5.36	5.17	3.96	5.07	5.42	6.00	4.58	4.93	5.50	5.11	5.44	5.97	4.61	4.94	5.47	5.56	5.91	6.47
DEL based on minimum of reference	5.84	4.41	6.77	6.59	5.38	5.88	6.23	6.80	5.38	5.74	6.31	5.87	6.20	6.73	5.37	5.70	6.23	7.24	7.58	8.14
PEL based on minimum of reference	4.87	3.43	5.20	5.02	3.81	4.76	5.12	5.69	4.27	4.63	5.20	4.89	5.22	5.75	4.39	4.72	5.25	5.54	5.89	6.45
Nursery Sideoats																				
EC10 (DEL)	6.45	5.01	6.86	6.68	5.47	6.52	6.87	7.45	6.03	6.38	6.96	6.31	6.63	7.17	5.81	6.13	6.66	6.55	6.90	7.45
EC50 (PEL)	5.15	3.72	5.36	5.17	3.96	5.07	5.42	6.00	4.58	4.93	5.50	5.11	5.44	5.97	4.61	4.94	5.47	5.56	5.91	6.47
DEL based on minimum of reference	6.60	5.17	7.27	7.08	5.87	6.04	6.39	6.96	5.55	5.90	6.47	5.90	6.22	6.75	5.39	5.72	6.25	6.61	6.96	7.52
PEL based on minimum of reference	5.06	3.62	5.28	5.09	3.89	4.82	5.17	5.75	4.33	4.68	5.25	4.90	5.23	5.76	4.40	4.73	5.26	5.48	5.83	6.39
Field Tansyaster																				
EC10 (DEL)	6.77	5.33	5.54	5.36	4.15	7.40	7.76	8.33	6.91	7.26	7.84	6.31	6.63	7.17	5.81	6.13	6.66	5.67	6.01	6.57
EC50 (PEL)	5.47	4.04	5.41	5.22	4.01	5.95	6.30	6.88	5.46	5.81	6.39	5.11	5.44	5.97	4.61	4.94	5.47	4.68	5.03	5.59
DEL based on minimum of reference	5.16	3.72	5.51	5.32	4.12	5.57	5.92	6.50	5.08	5.43	6.00	5.59	5.92	6.45	5.09	5.41	5.94	4.19	4.53	5.09
PEL based on minimum of reference	4.60	3.16	5.39	5.20	3.99	4.95	5.30	5.88	4.46	4.81	5.38	4.78	5.11	5.64	4.28	4.61	5.14	3.81	4.15	4.71
Nursery Tansyaster																				
EC10 (DEL)	6.77	5.33	5.17	4.98	3.78	7.40	7.76	8.33	6.91	7.26	7.84	6.31	6.63	7.17	5.81	6.13	6.66	5.67	6.01	6.57
EC50 (PEL)	5.47	4.04	5.03	4.85	3.64	5.95	6.30	6.88	5.46	5.81	6.39	5.11	5.44	5.97	4.61	4.94	5.47	4.68	5.03	5.59
DEL based on minimum of reference	5.57	4.13	5.21	5.02	3.82	5.26	5.62	6.19	4.77	5.13	5.70	5.06	5.39	5.92	4.56	4.89	5.42	4.69	5.04	5.59
PEL based on minimum of reference	4.89	3.45	5.03	4.84	3.63	4.70	5.05	5.63	4.21	4.56	5.13	4.48	4.81	5.34	3.98	4.31	4.84	4.19	4.54	5.10

Notes:

DEL = *de minimus* effect level in pCu units

PEL = probable effect level in pCu units

ECx = Effect concentration of x%, which is pCu when endpoint is reduced by x% from the modeled no effect threshold, R_{max}

When minimum reference was >Rmax, Rmax was the endpoint value for the DEL (the case for alfalfa survival)

EC50 in this table include the effect of the covariate at the level indicated (either minimum, mean, or maximum value of the covariate).

Table G-6. EC20 on Five-Seed Models with Various Combinations of the Covariates

Freeport-McMoran Chino Mines Company
Vanadium, New Mexico
Smelter/Tailing Soils IU Phytotoxicity and Vegetation Community Study

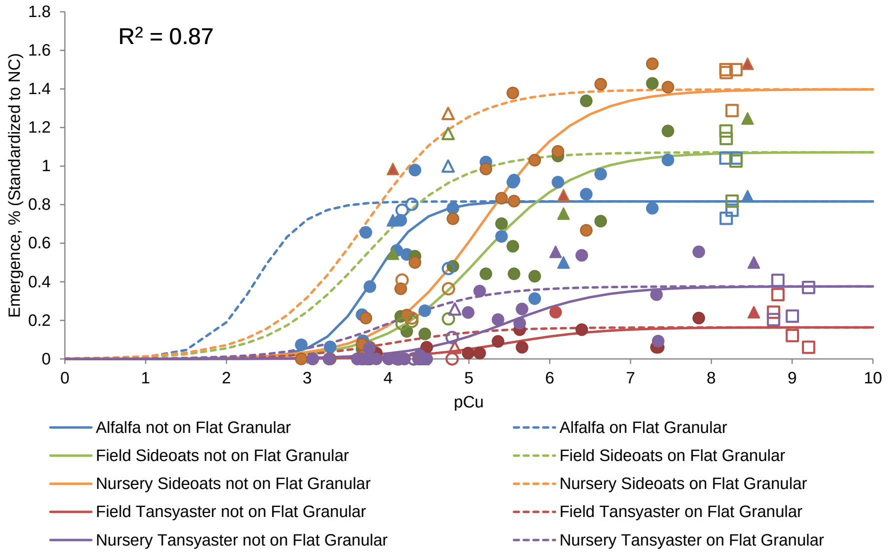
Species	Emergence, not on Flat Granular	Emergence, on Flat Granular	Survival, Minimum Iron	Survival, Mean Iron	Survival, Maximum Iron	Shoot Weight, not on Flat Granular, Minimum Clay	Shoot Weight, not on Flat Granular, Mean Clay	Shoot Weight, not on Flat Granular, Maximum Clay	Shoot Weight, on Flat Granular, Minimum Clay	Shoot Weight, on Flat Granular, Mean Clay	Shoot Weight, on Flat Granular, Maximum Clay	Shoot Height, not on Flat Granular, Minimum Clay	Shoot Height, not on Flat Granular, Mean Clay	Shoot Height, not on Flat Granular, Maximum Clay	Shoot Height, on Flat Granular, Minimum Clay	Shoot Height, on Flat Granular, Mean Clay	Shoot Height, on Flat Granular, Maximum Clay	Root Length, Minimum Clay	Root Length, Mean Clay	Root Length, Maximum Clay
Alfalfa																				
EC20	4.23	2.80	3.87	3.69	2.48	5.52	5.87	6.45	5.03	5.38	5.96	5.87	6.19	6.73	5.37	5.69	6.22	6.54	6.88	7.44
Field Sideoats																				
EC20	5.97	4.53	6.31	6.12	4.91	5.98	6.34	6.91	5.49	5.85	6.42	5.87	6.19	6.73	5.37	5.69	6.22	6.19	6.53	7.09
Nursery Sideoats																				
EC20	5.97	4.53	6.31	6.12	4.91	5.98	6.34	6.91	5.49	5.85	6.42	5.87	6.19	6.73	5.37	5.69	6.22	6.19	6.53	7.09
Field Tansyaster																				
EC20	6.29	4.85	5.49	5.30	4.10	6.87	7.22	7.79	6.37	6.73	7.30	5.87	6.19	6.73	5.37	5.69	6.22	5.30	5.65	6.21
Nursery Tansyaster																				
EC20	6.29	4.85	5.12	4.93	3.73	6.87	7.22	7.79	6.37	6.73	7.30	5.87	6.19	6.73	5.37	5.69	6.22	5.30	5.65	6.21

Notes:

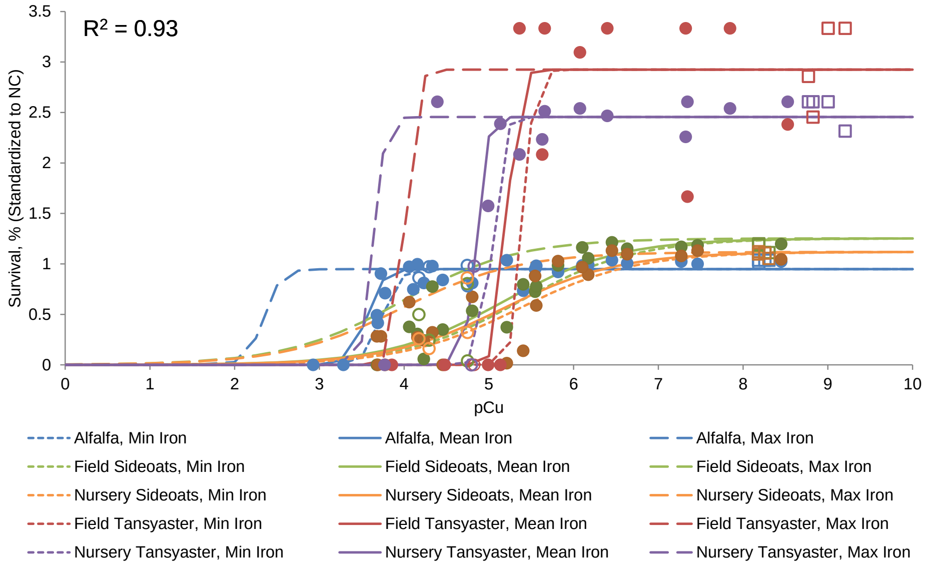
ECx = Effect concentration of x%, which is pCu when endpoint is reduced by x% from the modeled no effect threshold, R_{max}

NA = not available because minimum reference above the curve.

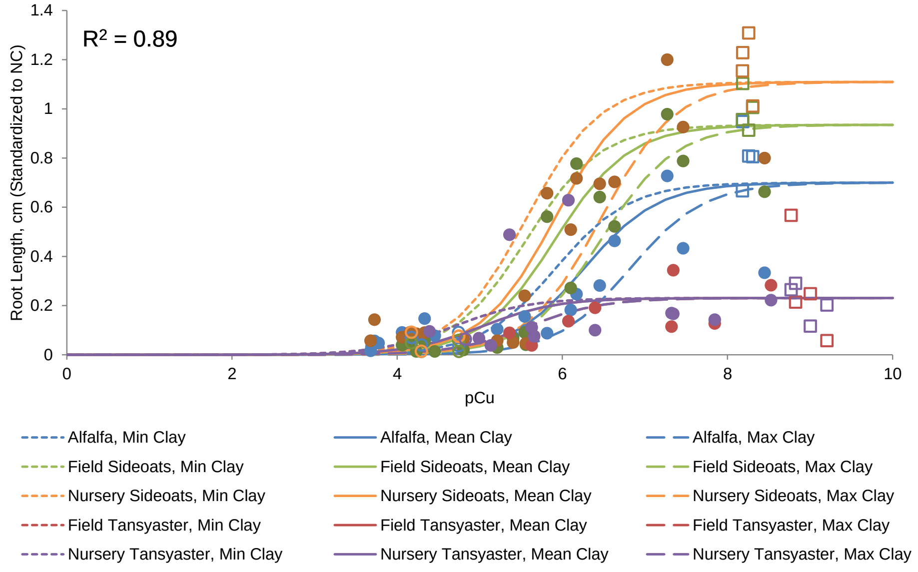
FIGURES



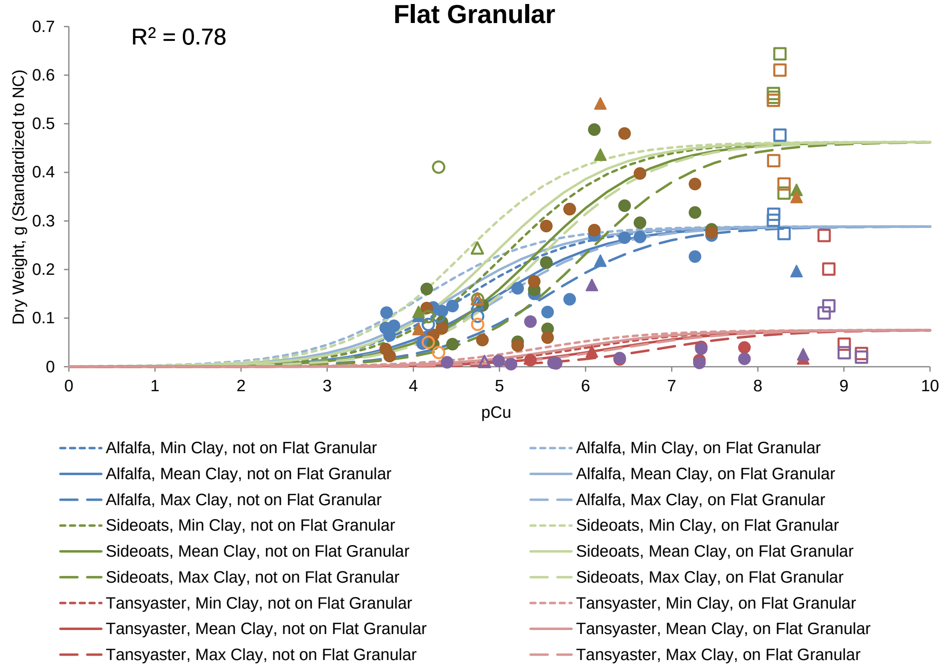
Emergence on Flat Granular and Not Flat Granular Soil



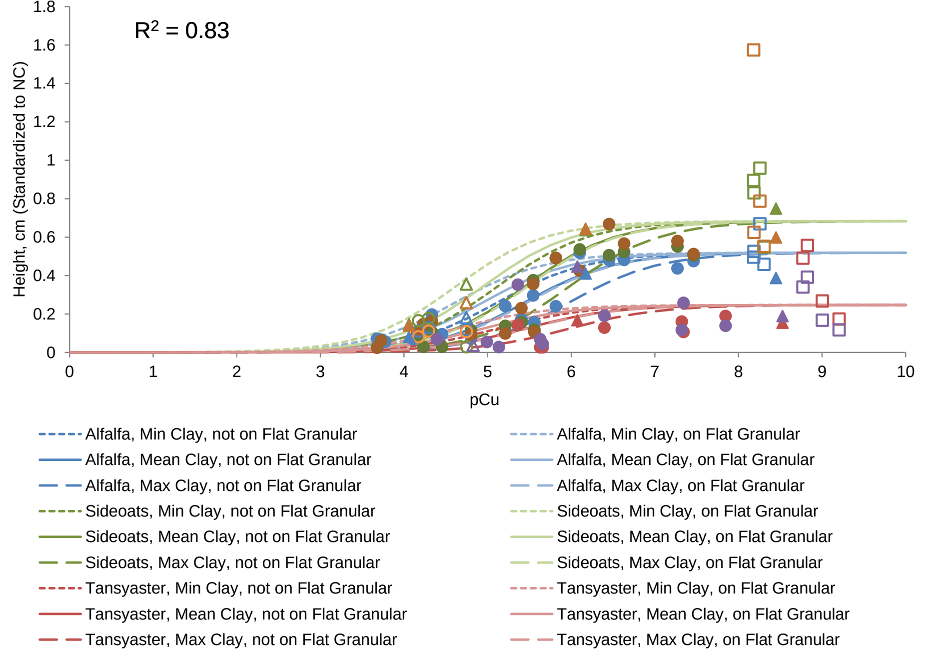
Survival with 3 Levels of Iron



Root Length with 3 Levels of Clay



Shoot Weight with 3 Levels of Clay on Flat Granular and Not Flat Granular



Shoot Height with 3 Levels of Clay on Flat Granular and Not Flat Granular

Notes:

R^2 is calculated as 1-SSE/corrected total SS, where SS = sum of squares and SSE = sum of squares of error term.

- ● Alfalfa
- ● Field Sideoats
- ● Nursery Sideoats
- ● Field Tansyaster
- ● Nursery Tansyaster

Dose-Response Curves without Flat Granular as Covariate:

- ● Site
- ○ De Minimus
- □ Reference

Dose-Response Curves with Flat Granular as Covariate:

- ● Site not on Flat Granular
- ▲ Site on Flat Granular
- ○ De Minimus not on Flat Granular
- △ De Minimus on Flat Granular
- □ Reference on Flat Granular

FREEPORT-MCMORAN CHINO MINES COMPANY
VANADIUM, NEW MEXICO

PHYTOTOXICITY AND VEGETATION COMMUNITY STUDY

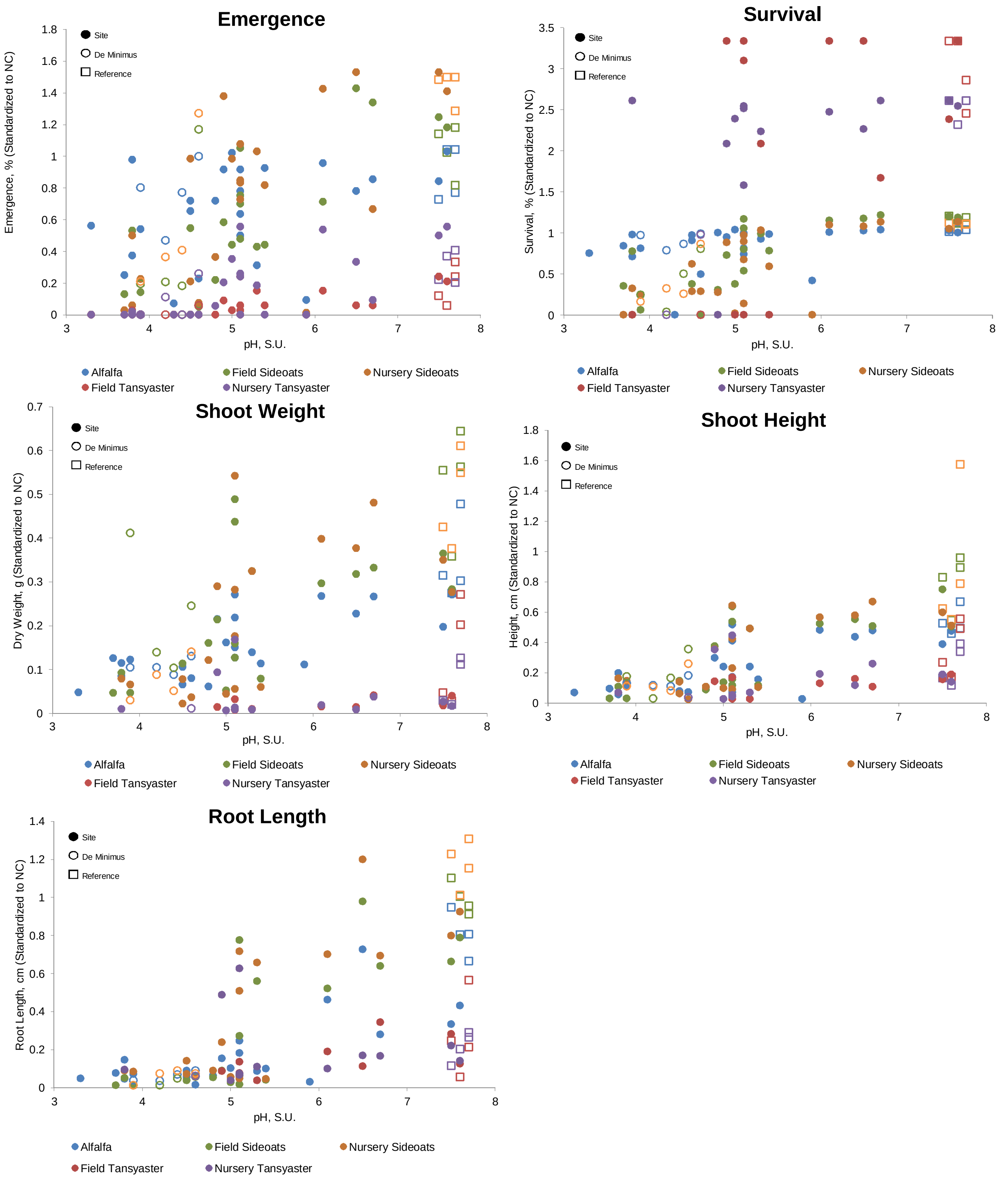
Five Seed Dose-Response Curves with Significant Soil Covariates from Greenhouse Study

ARCADIS

FIGURE
G-1

APPENDIX H

Copper and pH Plotted versus Greenhouse Study Endpoints



Notes: Emergence, growth, and survival are more related to pH than copper.

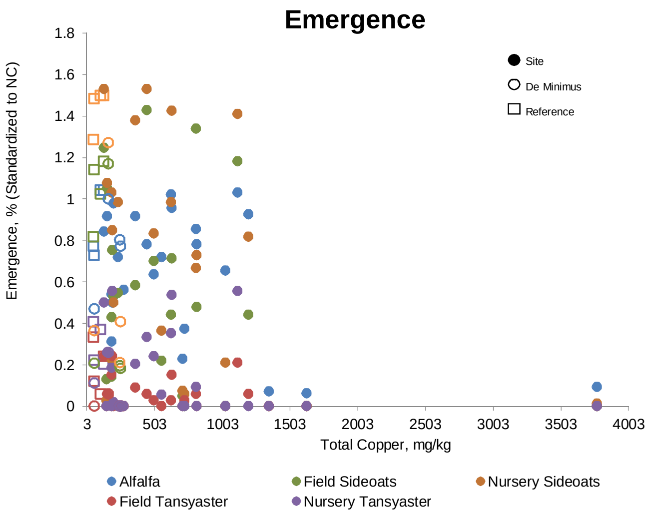
FREEPORT-MCMORAN CHINO MINES COMPANY
VANADIUM, NEW MEXICO

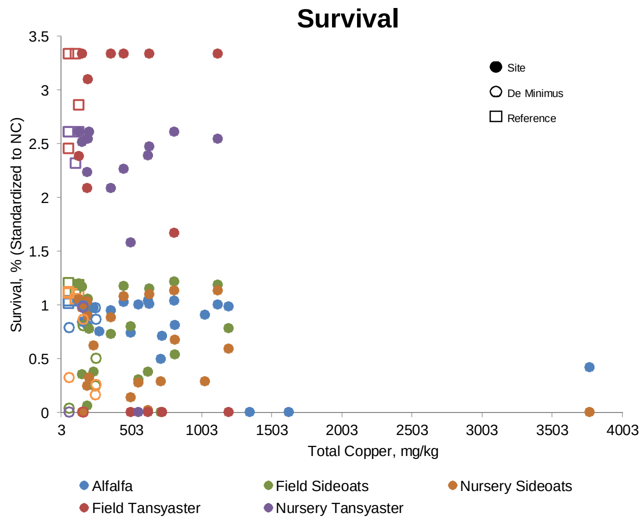
PHYTOTOXICITY AND VEGETATION COMMUNITY STUDY

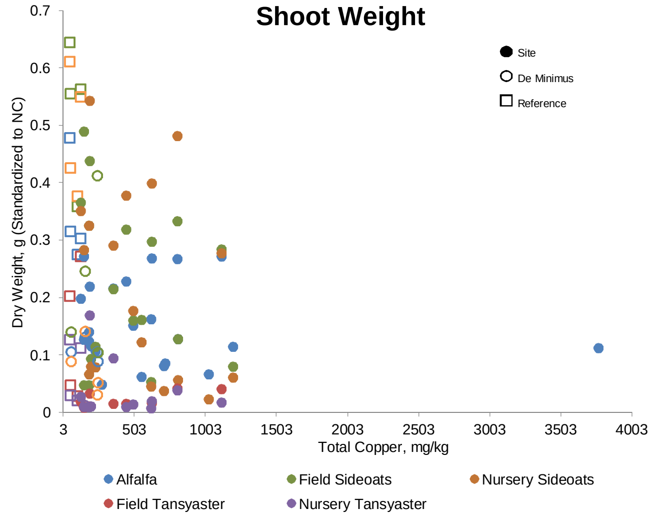
Relationship between pH and Greenhouse Study Endpoints

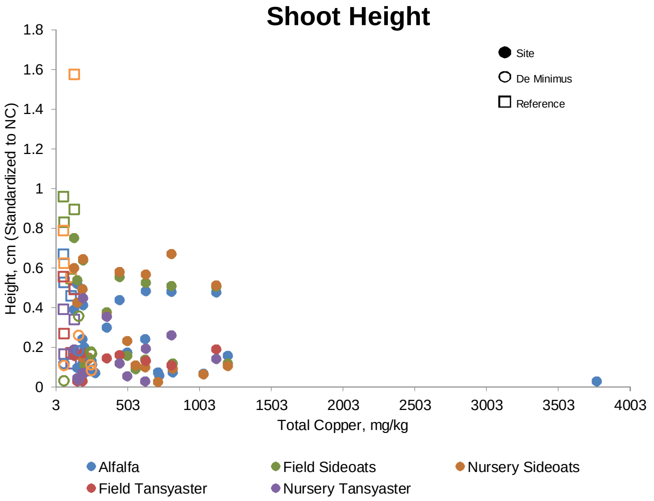
ARCADIS

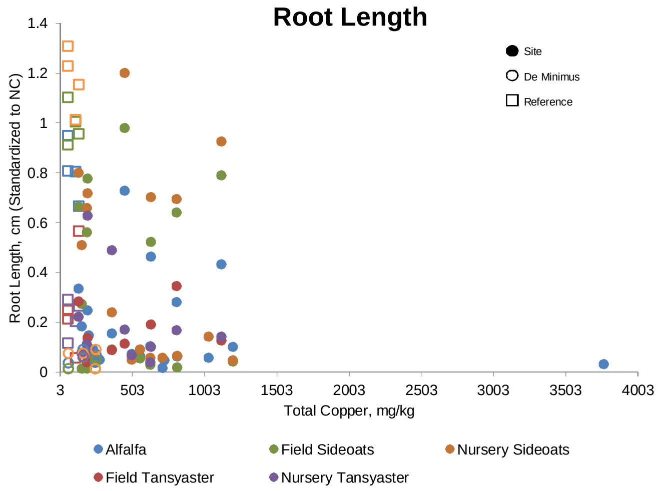
APPENDIX
H-1











Notes: Emergence, growth, and survival are more related to pH than copper.

FREEPORT-MCMORAN CHINO MINES COMPANY
VANADIUM, NEW MEXICO

PHYTOTOXICITY AND VEGETATION COMMUNITY STUDY

Relationship between Copper and Greenhouse Study Endpoints

ARCADIS

APPENDIX
H-2

APPENDIX I

Project Photographs

Appendix I. Phytotoxicity Study Photo Log

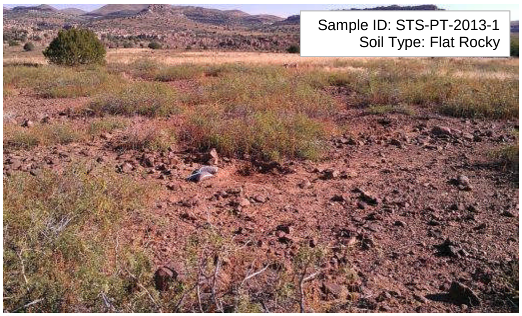
Freeport-McMoran Chino Mines Company
Vanadium, New Mexico
Smelter/Tailing Soils IU Phytotoxicity and Vegetation Community Study

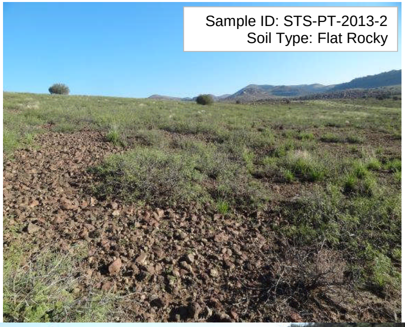
Phytotoxicity ID	Community ID	Original Location ID	Oriiginal Study	Longitude	Latitude	Soil Category
STS-PT-2013-1	STS-PT-2013-1	ERA02	Site-wide ERA	-108.106386	32.689013	Flat Rocky
STS-PT-2013-2	STS-PT-2013-2	ERA03	Site-wide ERA	-108.104709	32.685045	Flat Rocky
STS-PT-2013-3	NA	ERA04	Site-wide ERA	-108.092165	32.68906	Flat Rocky
STS-PT-2013-4	NA	ERA13	Site-wide ERA	-108.048915	32.682528	Flat Granular
STS-PT-2013-5	STS-PT-2013-5	FID 10	pH monitoring	-108.113509	32.705641	Slope
STS-PT-2013-6	NA	FID 101	pH monitoring	-108.090994	32.673182	Bedrock
STS-PT-2013-7	NA	FID 102	pH monitoring	-108.088698	32.662368	Bedrock
STS-PT-2013-8	NA	FID 105	pH monitoring	-108.10331	32.6873	Flat Rocky
STS-PT-2013-9	STS-PT-2013-9	FID 15	pH monitoring	-108.106861	32.697826	Bedrock
STS-PT-2013-10	NA	FID 16	pH monitoring	-108.1071	32.696038	Bedrock
STS-PT-2013-11	NA	FID 18	pH monitoring	-108.091822	32.674019	Bedrock
STS-PT-2013-12	STS-PT-2013-12	FID 28	pH monitoring	-108.051091	32.669984	Bedrock
STS-PT-2013-13	NA	FID 7	pH monitoring	-108.067478	32.678551	Flat Rocky
STS-PT-2013-14	NA	FID 8	pH monitoring	-108.092	32.66682	Flat Rocky
STS-PT-2013-15	NA	Reference #2 (North)	pH monitoring	-108.129671	32.713011	Flat Rocky
STS-PT-2013-16	NA	Reference #3 (Northeast)	pH monitoring	-108.111134	32.703831	Slope
STS-PT-2013-17	STS-PT-2013-17	Reference #4 (East)	pH monitoring	-108.103955	32.68969	Flat Rocky
STS-PT-2013-18*	NA	STS-PCUG-2011-17	STSIU FS	-108.102457	32.704557	Bedrock
STS-PT-2013-19	STS-PT-2013-19	STS-PCUG-2011-19	STSIU FS	-108.104566	32.692459	Flat Rocky
STS-PT-2013-20	STS-PT-2013-20	U04-1034	STSIU ERA	-108.156611	32.68923	Flat Granular
STS-PT-2013-21	STS-RWU-2012-B1	STS-RWU-2012-B1	STSIU FS	-108.044492	32.67139	Bedrock
STS-PT-2013-22	STS-RWU-2012-B2	STS-RWU-2012-B2	STSIU FS	-108.04225	32.67136	Bedrock
STS-PT-2013-23	STS-RWU-2012-B3	STS-RWU-2012-B3	STSIU FS	-108.044928	32.67379	Bedrock
STS-PT-2013-24	NA	Reference #1 (West)	pH monitoring	-108.223	32.670765	Flat Granular
STS-PT-2013-25	NA	Reference 4 (new)		-108.046	32.6192	Flat Granular
STS-PT-2013-26	STS-PT-2013-26	Reference 5 (new)		-108.05	32.6394	Flat Granular
STS-PT-2013-27	Wildlife Reference Plot South	Wildlife reference plot S	STSIU FS	-108.060065	32.674796	Flat Granular
STS-PT-2013-28	NA	Reference 6 (new)		-108.05275	32.603	Flat Granular
STS-PT-2013-29	STS-RWU-2011-10	STS-RWU-2011-10	STSIU FS	-108.084	32.6748	Flat Granular
STS-PT-2013-30	STS-RWU-2011-12	STS-RWU-2011-12	STSIU FS	-108.087	32.6642	Flat Rocky
STS-PT-2013-31	STS-RWU-2011-14	STS-RWU-2011-14	STSIU FS	-108.115	32.7081	Slope
STS-PT-2013-32	NA	new site		-108.118	32.70905	Flat Rocky
STS-PT-2013-33*[a]	NA	new site		-108.122	32.69284	Flat Granular[a]
STS-PT-2013-34*	NA	new site		-108.109	32.70495	Flat Rocky
STS-PT-2013-35	NA	new site		-108.108	32.69484	Flat Rocky
STS-PT-2013-36	NA	new site		-108.115	32.6978	Flat Rocky

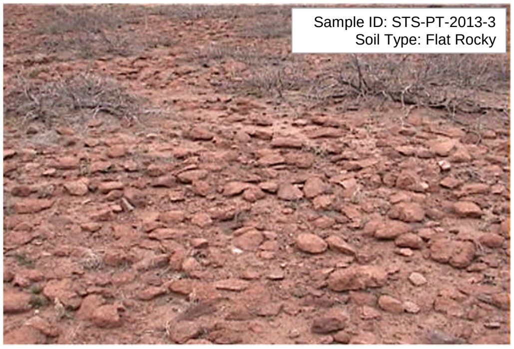
*Not used in greenhouse study

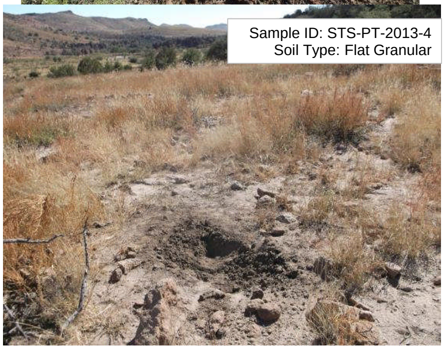
[a] Soil had copper concentrate

NA = not applicable


Sample ID: STS-PT-2013-1
Soil Type: Flat Rocky


Sample ID: STS-PT-2013-2
Soil Type: Flat Rocky


Sample ID: STS-PT-2013-3
Soil Type: Flat Rocky


Sample ID: STS-PT-2013-4
Soil Type: Flat Granular


Sample ID: STS-PT-2013-5
Soil Type: Slope


Sample ID: STS-PT-2013-6
Soil Type: Bedrock


Sample ID: STS-PT-2013-7
Soil Type: Bedrock


Sample ID: STS-PT-2013-8
Soil Type: Flat Rocky

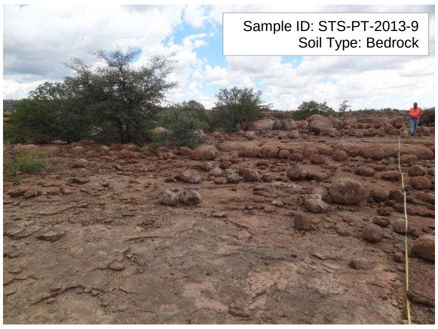
FREEPORT-MCMORAN CHINO MINES COMPANY
VANADIUM, NEW MEXICO

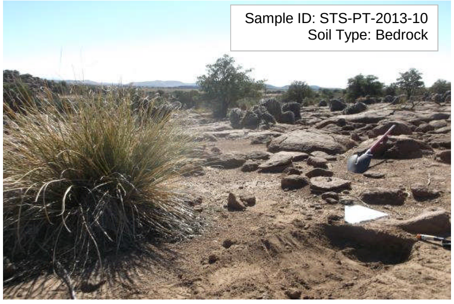
PHYTOTOXICITY AND VEGETATION COMMUNITY STUDY

PHYTOTOXICITY STUDY PHOTO LOG

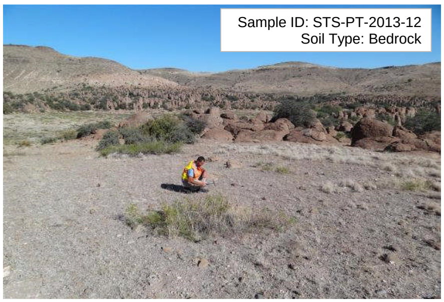
ARCADIS

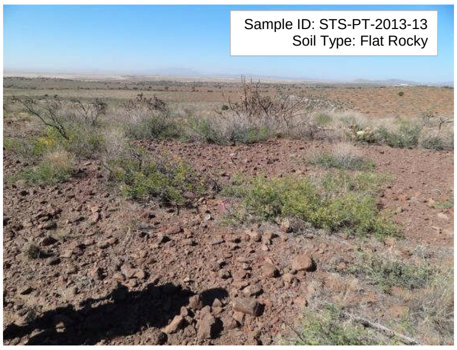
APPENDIX I

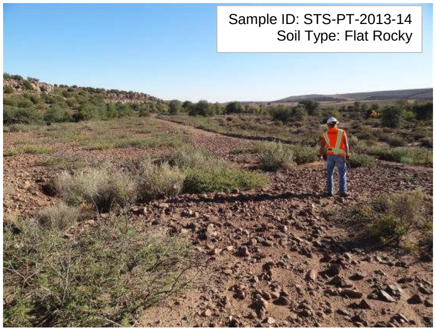

Sample ID: STS-PT-2013-9
Soil Type: Bedrock

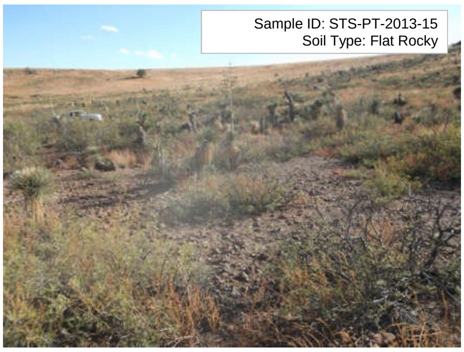

Sample ID: STS-PT-2013-10
Soil Type: Bedrock

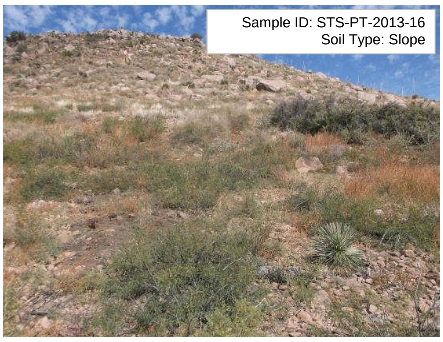

Sample ID: STS-PT-2013-11
Soil Type: Bedrock


Sample ID: STS-PT-2013-12
Soil Type: Bedrock


Sample ID: STS-PT-2013-13
Soil Type: Flat Rocky


Sample ID: STS-PT-2013-14
Soil Type: Flat Rocky


Sample ID: STS-PT-2013-15
Soil Type: Flat Rocky


Sample ID: STS-PT-2013-16
Soil Type: Slope

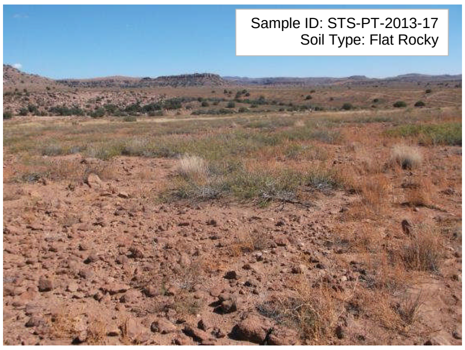
FREEPORT-MCMORAN CHINO MINES COMPANY
VANADIUM, NEW MEXICO

PHYTOTOXICITY AND VEGETATION COMMUNITY STUDY

PHYTOTOXICITY STUDY PHOTO LOG

ARCADIS

APPENDIX I

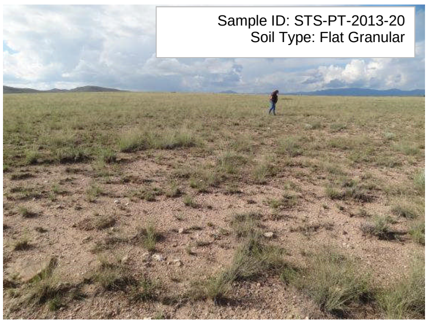

Sample ID: STS-PT-2013-17
Soil Type: Flat Rocky

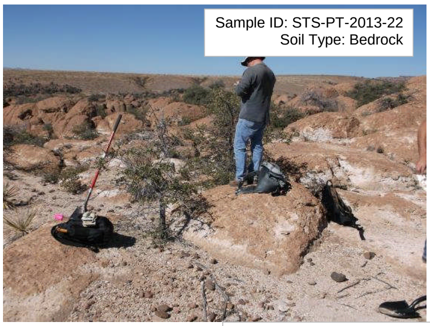

Sample ID: STS-PT-2013-19
Soil Type: Flat Rocky

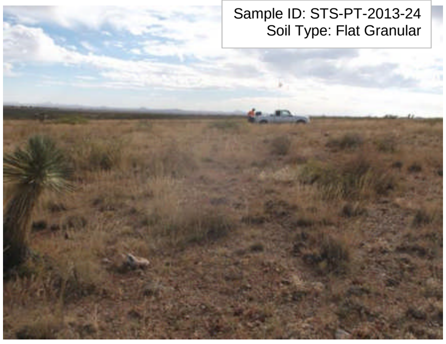

Sample ID: STS-PT-2013-21
Soil Type: Bedrock


Sample ID: STS-PT-2013-23
Soil Type: Bedrock


Sample ID: STS-PT-2013-18
Soil Type: Bedrock


Sample ID: STS-PT-2013-20
Soil Type: Flat Granular


Sample ID: STS-PT-2013-22
Soil Type: Bedrock


Sample ID: STS-PT-2013-24
Soil Type: Flat Granular

FREEPORT-MCMORAN CHINO MINES COMPANY
VANADIUM, NEW MEXICO

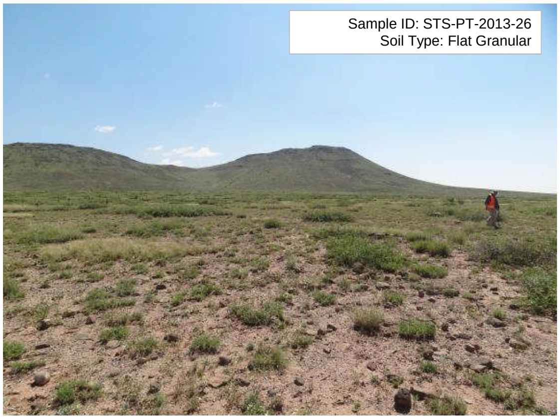
PHYTOTOXICITY AND VEGETATION COMMUNITY STUDY

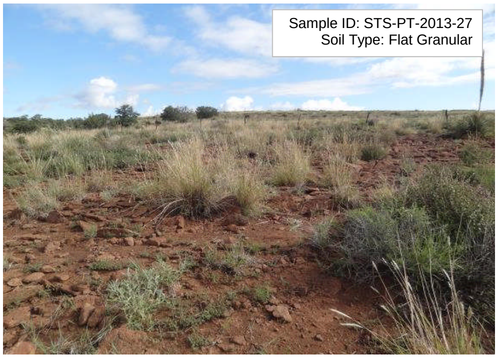
PHYTOTOXICITY STUDY PHOTO LOG

ARCADIS

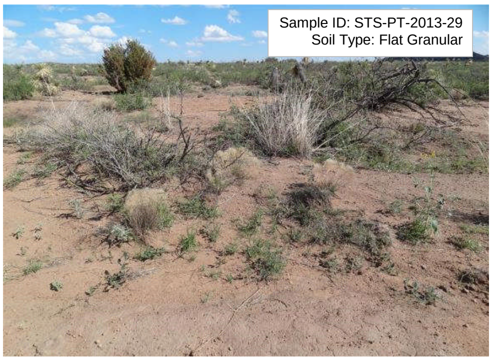
APPENDIX I

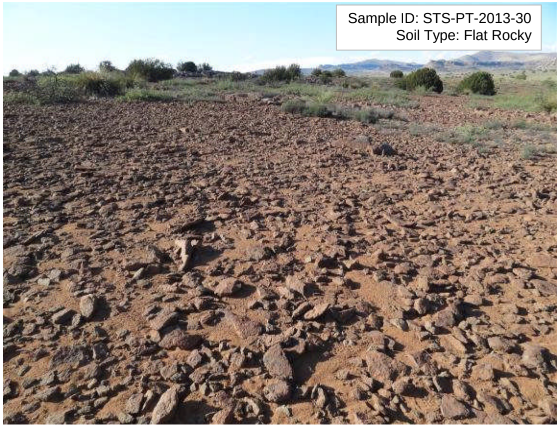

Sample ID: STS-PT-2013-25
Soil Type: Flat Granular


Sample ID: STS-PT-2013-26
Soil Type: Flat Granular


Sample ID: STS-PT-2013-27
Soil Type: Flat Granular


Sample ID :STS-PT-2013-28
Soil Type: Flat Granular


Sample ID: STS-PT-2013-29
Soil Type: Flat Granular


Sample ID: STS-PT-2013-30
Soil Type: Flat Rocky


Sample ID: STS-PT-2013-31
Soil Type: Slope

FREEPORT-MCMORAN CHINO MINES COMPANY
VANADIUM, NEW MEXICO

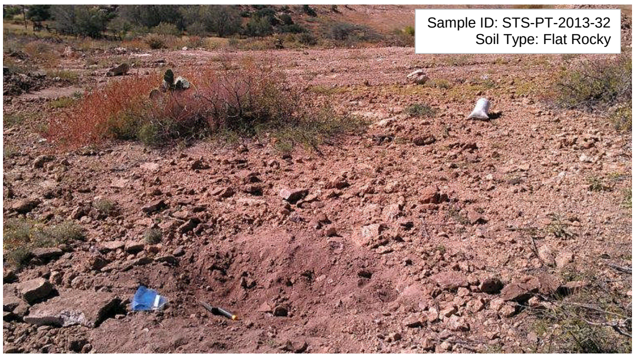
PHYTOTOXICITY AND VEGETATION COMMUNITY STUDY

PHYTOTOXICITY STUDY PHOTO LOG

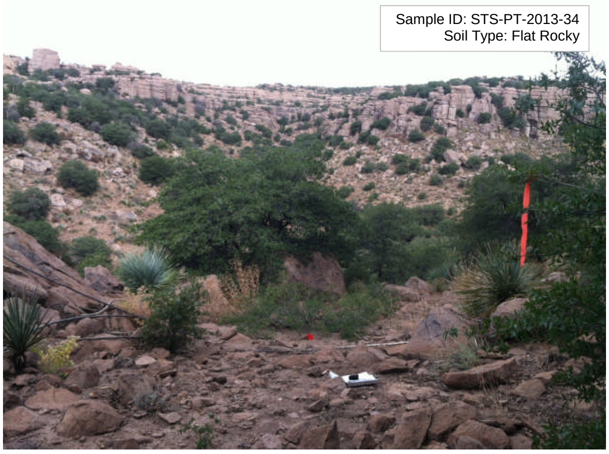
ARCADIS

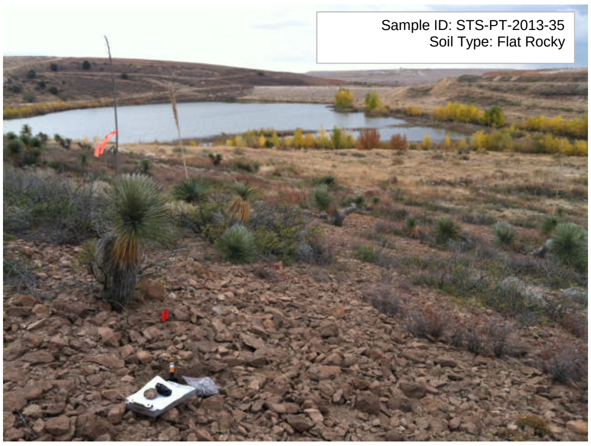
APPENDIX I

Page 4


Sample ID: STS-PT-2013-32
Soil Type: Flat Rocky


Sample ID: STS-PT-2013-33
Soil Type: Flat Granular


Sample ID: STS-PT-2013-34
Soil Type: Flat Rocky


Sample ID: STS-PT-2013-35
Soil Type: Flat Rocky


Sample ID: STS-PT-2013-36
Soil Type: Flat Rocky

FREEPORT-MCMORAN CHINO MINES COMPANY
VANADIUM, NEW MEXICO

PHYTOTOXICITY AND VEGETATION COMMUNITY STUDY

PHYTOTOXICITY STUDY PHOTO LOG

ARCADIS

APPENDIX I

Community Study Photo Log

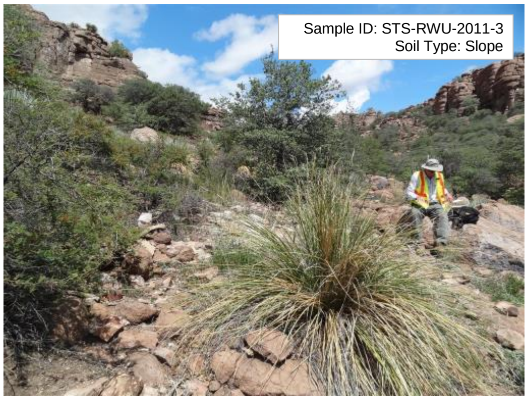
Freeport-McMoran Chino Mines Company
Vanadium, New Mexico
Smelter/Tailing Soils IU Phytotoxicity and Vegetation Community Study

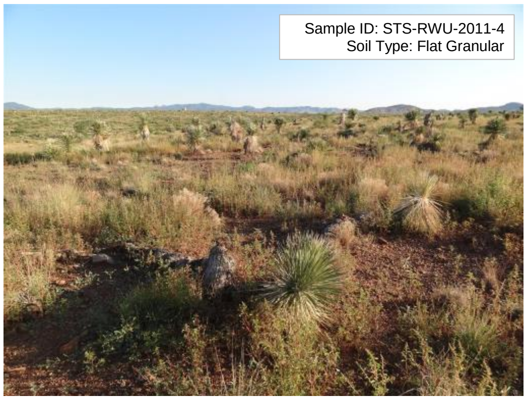
Community LocID	Phytotoxity ID	Longitude	Latitude	Soil Category
STS-RWU-2011-1	NA	-108.108342	32.71238401	Bedrock
STS-RWU-2011-2	NA	-108.105	32.7045	Bedrock
STS-RWU-2011-3	NA	-108.107	32.7076	Slope
STS-RWU-2011-4	NA	-108.143	32.7123	Flat Granular
STS-RWU-2011-5	NA	-108.095	32.7067	Flat Granular
STS-RWU-2011-6	NA	-108.120902	32.70849497	Slope
STS-RWU-2011-7	NA	-108.106	32.6972	Flat Rocky
STS-RWU-2011-8	NA	-108.093895	32.71029498	Slope
STS-RWU-2011-9	NA	-108.1	32.6959	Bedrock
STS-RWU-2011-10	STS-PT-2013-29	-108.084	32.6748	Flat Granular
STS-RWU-2011-11	NA	-108.092	32.6747	Bedrock
STS-RWU-2011-12	STS-PT-2013-30	-108.087	32.6642	Flat Rocky
STS-RWU-2011-13	NA	-108.094	32.6768	Flat Granular
STS-RWU-2011-14	STS-PT-2013-31	-108.115	32.7081	Slope
STS-RWU-2011-15	NA	-108.118	32.7092	Flat Granular
STS-RWU-2011-16	NA	-108.085	32.7048	Flat Granular
STS-RWU-2011-17	NA	-108.096	32.6762	Flat Rocky
STS-RWU-2012-B1	STS-PT-2013-21	-108.044492	32.67139	Bedrock
STS-RWU-2012-B2	STS-PT-2013-22	-108.04225	32.67136	Bedrock
STS-RWU-2012-B3	STS-PT-2013-23	-108.044928	32.67379	Bedrock
Wildlife Reference Plot North	NA	-108.067687	32.68399199	Flat Granular
Wildlife Reference Plot South	STS-PT-2013-27	-108.060065	32.674796	Flat Granular
STS-PT-2013-1	STS-PT-2013-1	-108.106386	32.689013	Flat Rocky
STS-PT-2013-2	STS-PT-2013-2	-108.104709	32.685045	Flat Rocky
STS-PT-2013-5	STS-PT-2013-5	-108.113509	32.705641	Slope
STS-PT-2013-9	STS-PT-2013-9	-108.106861	32.697826	Bedrock
STS-PT-2013-12	STS-PT-2013-12	-108.051091	32.669984	Bedrock
STS-PT-2013-17	STS-PT-2013-17	-108.103955	32.68969	Flat Rocky
STS-PT-2013-19	STS-PT-2013-19	-108.104566	32.692459	Flat Rocky
STS-PT-2013-20	STS-PT-2013-20	-108.156611	32.68923	Flat Granular
STS-PT-2013-26	STS-PT-2013-26	-108.05	32.6394	Flat Granular
STS-PT-2013-33[a]	STS-PT-2013-33	-108.122	32.69284	Flat Granular

[a] Soil had copper concentrate


Sample ID: STS-RWU-2011-1
Soil Type: Bedrock


Sample ID: STS-RWU-2011-2
Soil Type: Bedrock


Sample ID: STS-RWU-2011-3
Soil Type: Slope


Sample ID: STS-RWU-2011-4
Soil Type: Flat Granular


Sample ID: STS-RWU-2011-5
Soil Type: Flat Granular


Sample ID: STS-RWU-2011-6
Soil Type: Slope

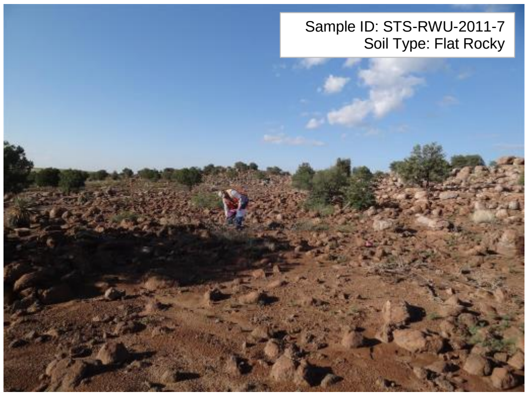
FREEPORT-MCMORAN CHINO MINES COMPANY
VANADIUM, NEW MEXICO

PHYTOTOXICITY AND VEGETATION COMMUNITY STUDY

COMMUNITY STUDY PHOTO LOG

ARCADIS

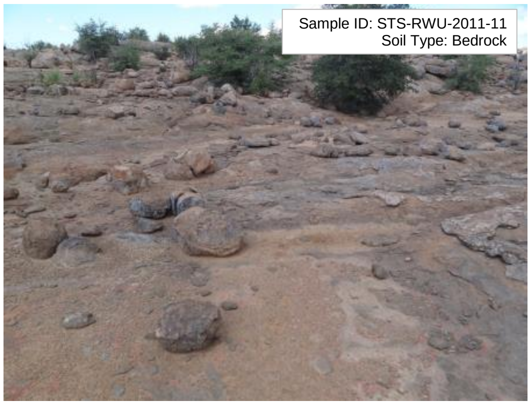
APPENDIX I


Sample ID: STS-RWU-2011-7
Soil Type: Flat Rocky


Sample ID: STS-RWU-2011-8
Soil Type: Slope


Sample ID: STS-RWU-2011-9
Soil Type: Bedrock


Sample ID: STS-RWU-2011-10
Soil Type: Flat Granular


Sample ID: STS-RWU-2011-11
Soil Type: Bedrock


Sample ID: STS-RWU-2011-12
Soil Type: Flat Rocky

FREEPORT-MCMORAN CHINO MINES COMPANY
VANADIUM, NEW MEXICO

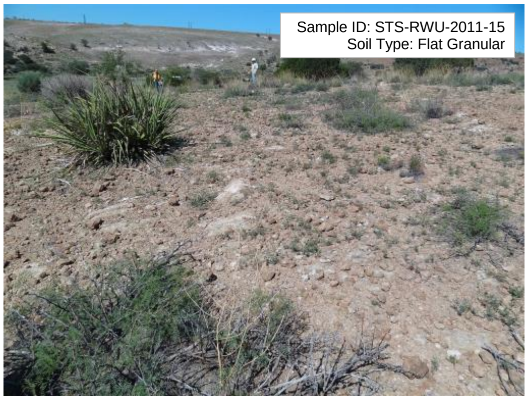
PHYTOTOXICITY AND VEGETATION COMMUNITY STUDY

COMMUNITY STUDY PHOTO LOG

ARCADIS

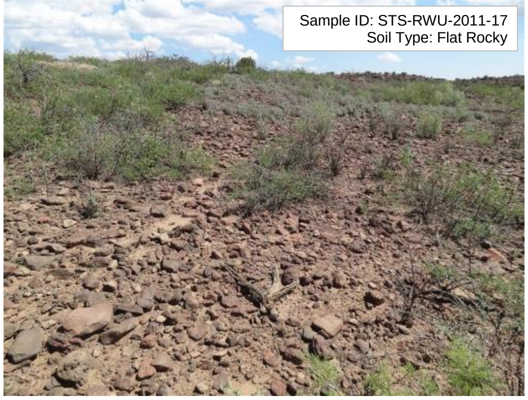
Sample ID: STS-RWU-2011-13
Soil Type: Flat Granular

Sample ID: STS-RWU-2011-14
Soil Type: Slope



Sample ID: STS-RWU-2011-15
Soil Type: Flat Granular

Sample ID: STS-RWU-2011-16
Soil Type: Flat Granular



Sample ID: STS-RWU-2011-17
Soil Type: Flat Rocky

Sample ID: STS-RWU-2012-B1
Soil Type: Bedrock

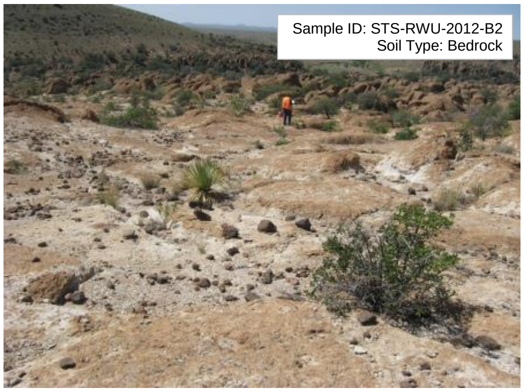
FREEPORT-MCMORAN CHINO MINES COMPANY
VANADIUM, NEW MEXICO

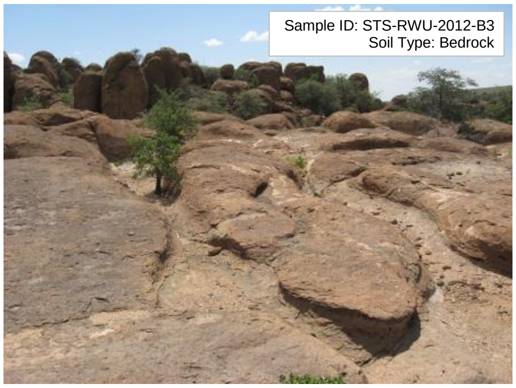
PHYTOTOXICITY AND VEGETATION COMMUNITY STUDY

COMMUNITY STUDY PHOTO LOG

ARCADIS

APPENDIX I


Sample ID: STS-RWU-2012-B2
Soil Type: Bedrock


Sample ID: STS-RWU-2012-B3
Soil Type: Bedrock


Sample ID: Wildlife Reference Plot North
Soil Type: Flat Granular


Sample ID: Wildlife Reference Plot South
Soil Type: Flat Granular


Sample ID: STS-PT-2013-1
Soil Type: Flat Granular


Sample ID: STS-PT-2013-2
Soil Type: Flat Rocky

FREEPORT-MCMORAN CHINO MINES COMPANY
VANADIUM, NEW MEXICO

PHYTOTOXICITY AND VEGETATION COMMUNITY STUDY

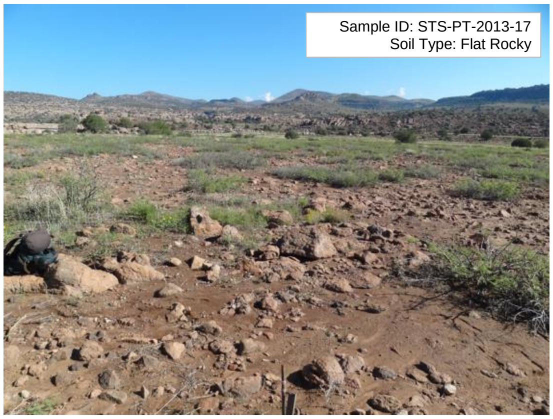
COMMUNITY STUDY PHOTO LOG

ARCADIS


Sample ID: STS-PT-2013-5
Soil Type: Slope


Sample ID: STS-PT-2013-9
Soil Type: Bedrock


Sample ID: STS-PT-2013-12
Soil Type: Bedrock


Sample ID: STS-PT-2013-17
Soil Type: Flat Rocky


Sample ID: STS-PT-2013-19
Soil Type: Flat Rocky


Sample ID: STS-PT-2013-20
Soil Type: Flat Granular


Sample ID: STS-PT-2013-26
Soil Type: Flat Granular


Sample ID: STS-PT-2013-33
Soil Type: Flat Granular

FREEPORT-MCMORAN CHINO MINES COMPANY
VANADIUM, NEW MEXICO

PHYTOTOXICITY AND VEGETATION COMMUNITY STUDY

COMMUNITY STUDY PHOTO LOG

ARCADIS

APPENDIX J

Measured versus Calculated pCu

Table J-1. Estimated Community DEL and PEL by Endpoint and Soil Category for Measured pCu

Freeport-McMoran Chino Mines Company
Vanadium, New Mexico
Smelter/Tailing Soils IU Phytotoxicity and Vegetation Community Study

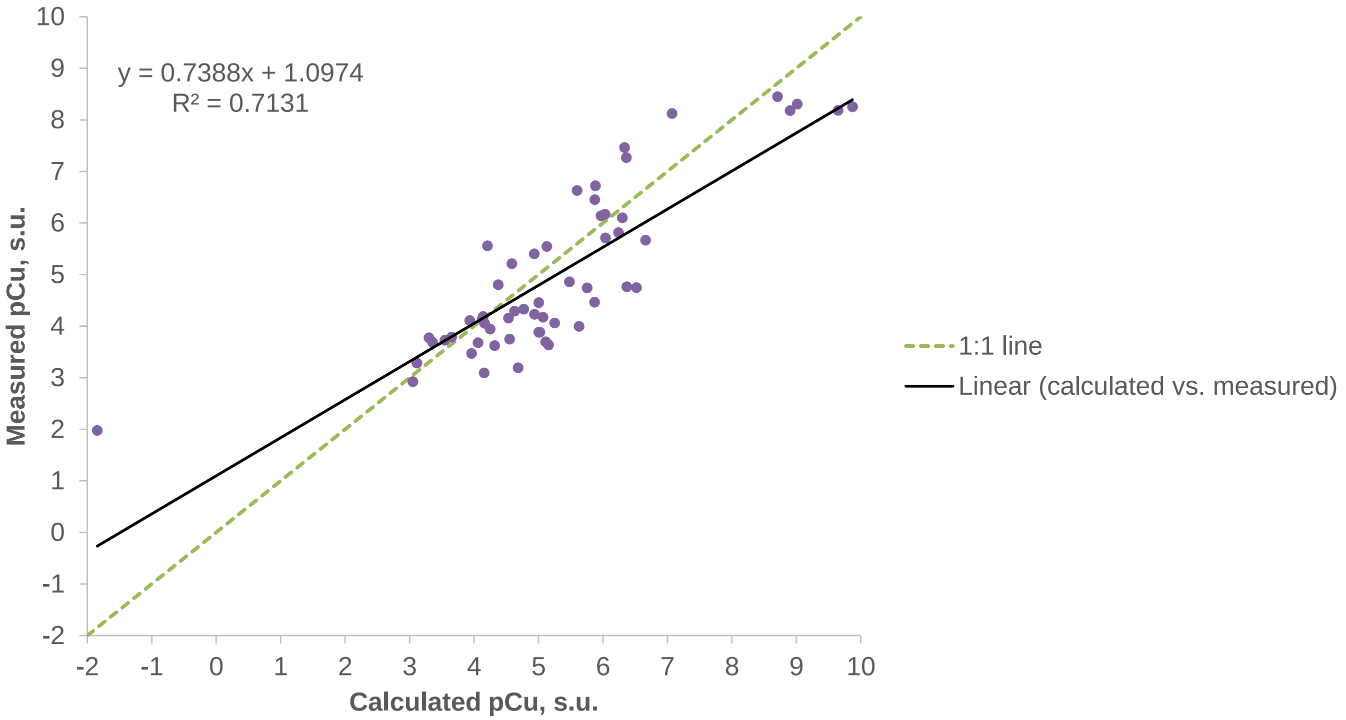
Soil Category	Richness		Cover		OAT	
	DEL	PEL	DEL	PEL	DEL	PEL
Bedrock	NA	NA	NA	NA	NA	NA
Flat Rocky	NA	NA	NR	NR	NR	NR
Slope	NA	NA	NR	NR	NR	NR
Flat Granular	7.82	1.25	5.51	3.61	NR	NR

Acronyms/Abbreviations:

DEL = *de minimus* effect level
NA = not available; no *de minimus* available and therefore no DEL or PEL calculated
NR = no relationship to pCu and therefore no DEL or PEL applies
PEL = probable effect level
OAT = observed apparent trend

Notes:

DEL is predicted pCu of minimum endpoint of reference locations.



Notes: Includes phytotoxicity and community samples

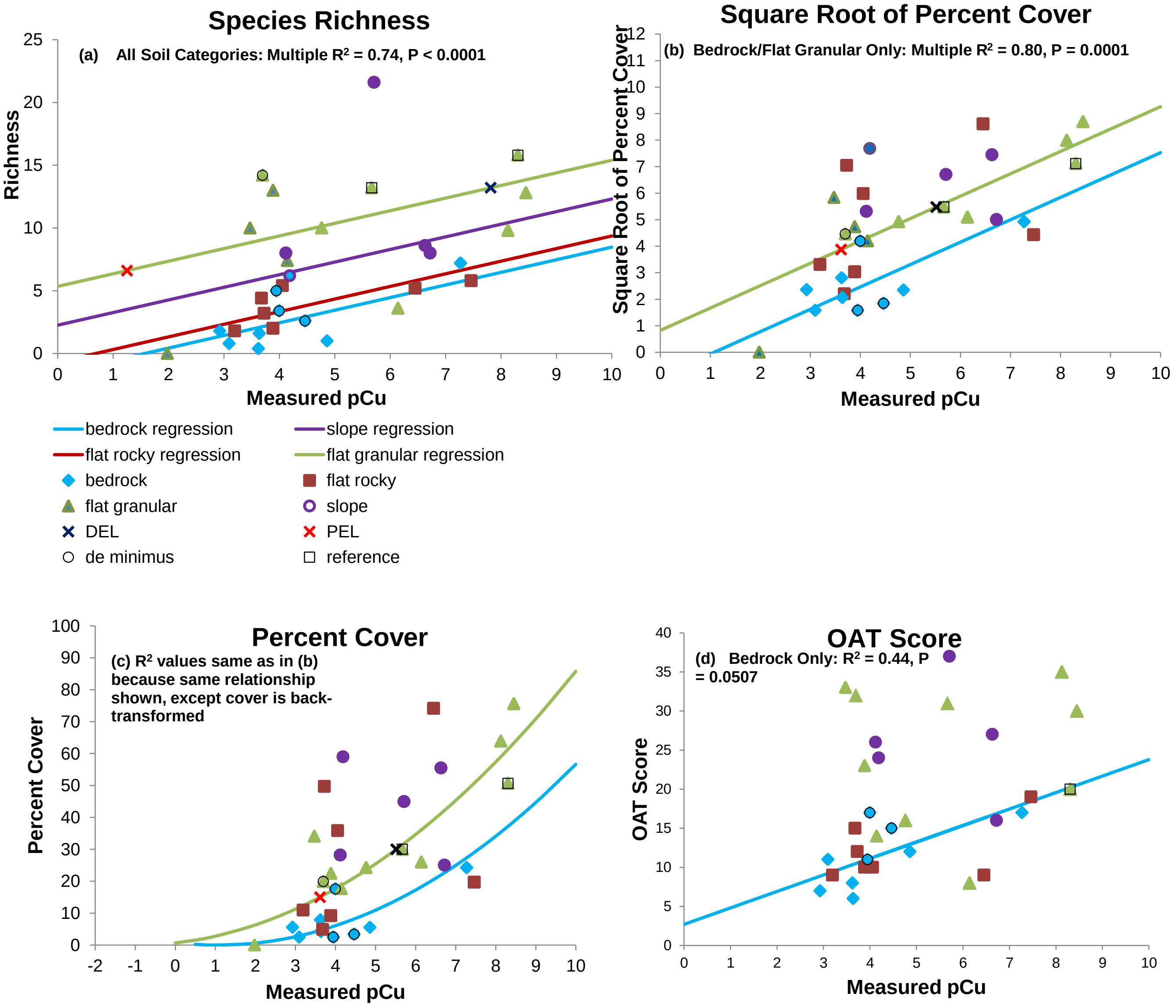
FREEPORT-MCMORAN CHINO MINES COMPANY
VANADIUM, NEW MEXICO

PHYTOTOXICITY AND VEGETATION COMMUNITY STUDY

Calculated pCu Prediction of Measured pCu

ARCADIS

FIGURE
J-1



Notes:
These graphs are similar to those in Figure 10, except they show results for measured pCu rather than calculated pCu.

FREEPORT-MCMORAN CHINO MINES COMPANY
VANADIUM, NEW MEXICO

PHYTOTOXICITY AND VEGETATION COMMUNITY STUDY

Relationship between Measured pCu and Community Endpoints with Soil Category Covariate

ARCADIS

FIGURE
J-2

APPENDIX K

Lab Reports

ANALYTICAL SUMMARY REPORT

December 18, 2013

Chino Mine Company
PO Box 10
Bayard, NM 88023

Workorder No.: H13110389

Project Name: Not Indicated

Energy Laboratories Inc Helena MT received the following 25 samples for Chino Mine Company on 11/8/2013 for analysis.

Sample ID	Client Sample ID	Collect Date	Receive Date	Matrix	Test
H13110389-001	STS-RWU-2011-4 0-6 [0-6]	07/15/13 10:15	11/08/13	Soil	Metals, Water Extractable Copper Activity CaCl2 Hot Water Soil Extraction Soil Preparation
H13110389-002	1# WEST 0-6 [0-6]	07/15/13 10:57	11/08/13	Soil	Metals, Water Extractable Copper Activity CaCl2 Hot Water Soil Extraction
H13110389-003	STS-RWU-2011-15 0-6 [0-6]	07/15/13 11:30	11/08/13	Soil	Same As Above
H13110389-004	STS-RWU-2011-6 0-6 [0-6]	07/15/13 11:57	11/08/13	Soil	Same As Above
H13110389-005	STS-RWU-2011-1 0-6 [0-6]	07/16/13 9:03	11/08/13	Soil	Same As Above
H13110389-006	STS-RWU-2011-3 0-6 [0-6]	07/16/13 8:13	11/08/13	Soil	Same As Above
H13110389-007	STS-RWU-2011-14 0-6 [0-6]	07/15/13 13:00	11/08/13	Soil	Same As Above
H13110389-008	STS-RWU-2011-2 0-6 [0-6]	07/16/13 10:15	11/08/13	Soil	Same As Above
H13110389-009	STS-RWU-2011-8 0-6 [0-6]	07/16/13 13:41	11/08/13	Soil	Same As Above
H13110389-010	STS-RWU-2011-5 0-6 [0-6]	07/16/13 12:59	11/08/13	Soil	Same As Above
H13110389-011	STS-RWU-2011-16 0-6 [0-6]	07/16/13 14:31	11/08/13	Soil	Same As Above
H13110389-012	STS-RWU-2011-7 0-6 [0-6]	07/15/13 17:27	11/08/13	Soil	Same As Above
H13110389-013	STS-RWU-2011-9 0-6 [0-6]	07/16/13 12:07	11/08/13	Soil	Same As Above
H13110389-014	STS-RWU-2011-10 0-6 [0-6]	07/16/13 18:01	11/08/13	Soil	Same As Above
H13110389-015	STS-RWU-2011-11 0-6 [0-6]	07/15/13 14:55	11/08/13	Soil	Same As Above
H13110389-016	STS-RWU-2011-12 0-6 [0-6]	07/15/13 16:30	11/08/13	Soil	Same As Above
H13110389-017	STS-RWU-2011-13 0-6 [0-6]	07/15/13 19:20	11/08/13	Soil	Same As Above
H13110389-018	STS-RWU-2011-17 0-6 [0-6]	07/15/13 14:05	11/08/13	Soil	Same As Above

ANALYTICAL SUMMARY REPORT

H13110389-019	STS-RWU-2012-B1 0-6 [0-6]	07/17/13 9:30	11/08/13	Soil	Same As Above
H13110389-020	STS-RWU-2012-B2 0-6 [0-6]	07/17/13 10:37	11/08/13	Soil	Same As Above
H13110389-021	STS-RWU-2012-B3 0-6 [0-6]	07/17/13 9:20	11/08/13	Soil	Same As Above
H13110389-022	WILDLIFE REF NORTH 0-6 [0-6]	07/16/13 17:14	11/08/13	Soil	Same As Above
H13110389-023	WILDLIFE REF SOUTH 0-6 [0-6]	07/16/13 16:40	11/08/13	Soil	Same As Above
H13110389-024	DUP #1 [0-6]	07/16/13 16:40	11/08/13	Soil	Same As Above
H13110389-025	DUP #2 [0-6]	07/16/13 16:40	11/08/13	Soil	Same As Above

The analyses presented in this report were performed by Energy Laboratories, Inc., 3161 E. Lyndale Ave., Helena, MT 59604, unless otherwise noted. Any exceptions or problems with the analyses are noted in the Laboratory Analytical Report, the QA/QC Summary Report, or the Case Narrative.

The results as reported relate only to the item(s) submitted for testing.

If you have any questions regarding these test results, please call.

Report Approved By: Jonathan D. Hager
Branch Manager - Helena, MT

Digitally signed by
Jonathan Hager
Date: 2013.12.18 12:25:51 -07:00

CLIENT: Chino Mine Company
Project: Not Indicated
Sample Delivery Group: H13110389

Report Date: 12/18/13

CASE NARRATIVE

Standard operating procedure submitted by Arcadis as "Standard Operating Procedures for Measurement of Cu2+ Activity in Soil by Ion-Selective Electrode" (ed. September 2013). Copper activity measured with a Combination Cupric Sure-Flow Ion Selective Electrode (Thermo Scientific, 9629BNWP) as per SOP. All samples and standards were filtered through 0.22µm membrane cellulose-acetate filters (Whatman, 10404112), prior to analysis. All analysis was performed under reduced light conditions.

LABORATORY ANALYTICAL REPORT

Prepared by Helena, MT Branch

Client: Chino Mine Company
Project: Not Indicated
Workorder: H13110389

Report Date: 12/18/13
Date Received: 11/08/13

		Analysis		Cu	Conductivity , CaCl2	Millivolts	pCu, Measured	ph, CaCl2
		Units		mg/kg	mmhos/cm	mV	s_u_	s_u_
Sample ID	**Client Sample ID**	**Up**	**Low**	**Results**	**Results**	**Results**	**Results**	**Results**
H13110389-001	STS-RWU-2011-4 0-6	0	6	0.1	2.1	-21	8.44	7.1
H13110389-002	1# WEST 0-6	0	6	< 0.1	2.2	-14	8.14	7.2
H13110389-003	STS-RWU-2011-15 0-6	0	6	6.7	2.2	87	3.84	5.3
H13110389-004	STS-RWU-2011-6 0-6	0	6	0.3	2.2	17	6.82	7.3
H13110389-005	STS-RWU-2011-1 0-6	0	6	1.5	2.1	67	4.67	4.5
H13110389-006	STS-RWU-2011-3 0-6	0	6	5.5	2.2	85	3.89	4.7
H13110389-007	STS-RWU-2011-14 0-6	0	6	5.6	2.2	87	3.81	5.0
H13110389-008	STS-RWU-2011-2 0-6	0	6	17.2	2.3	101	3.24	4.0
H13110389-009	STS-RWU-2011-8 0-6	0	6	0.3	2.2	44	5.65	5.4
H13110389-010	STS-RWU-2011-5 0-6	0	6	21.7	2.3	105	3.06	3.9
H13110389-011	STS-RWU-2011-16 0-6	0	6	7.9	2.2	94	3.54	4.1
H13110389-012	STS-RWU-2011-7 0-6	0	6	35.0	2.2	112	2.74	4.4
H13110389-013	STS-RWU-2011-9 0-6	0	6	55.8	2.2	115	2.63	3.9
H13110389-014	STS-RWU-2011-10 0-6	0	6	1.2	2.2	70	4.56	4.1
H13110389-015	STS-RWU-2011-11 0-6	0	6	14.9	2.2	100	3.25	3.8
H13110389-016	STS-RWU-2011-12 0-6	0	6	9.0	2.5	94	3.54	3.6
H13110389-017	STS-RWU-2011-13 0-6	0	6	0.1	2.3	33	6.15	6.2
H13110389-018	STS-RWU-2011-17 0-6	0	6	5.3	2.4	89	3.74	4.2
H13110389-019	STS-RWU-2012-B1 0-6	0	6	6.5	2.2	91	3.67	3.9
H13110389-020	STS-RWU-2012-B2 0-6	0	6	7.0	2.2	92	3.61	4.1
H13110389-021	STS-RWU-2012-B3 0-6	0	6	1.9	2.2	78	4.21	4.2
H13110389-022	WILDLIFE REF NORTH 0-6	0	6	0.2	2.2	46	5.60	5.2
H13110389-023	WILDLIFE REF SOUTH 0-6	0	6	10.3	2.2	99	3.23	3.9
H13110389-024	DUP #1	0	6	50.7	2.2	118	2.52	3.9
H13110389-025	DUP #2	0	6	0.2	2.2	50	5.40	5.3

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: Chino Mine Company **Report Date:** 12/18/13
Project: Not Indicated **Work Order:** H13110389

Method: **arcadis SOP** Analytical Run: MISC SOILS_131216B

Sample ID: **CCV_1_131211_1** Continuing Calibration Verification Standard 12/17/13 09:12

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Conductivity, CaCl2	1.42	mmhos/cm	0.10	100	90	110			
pCu, Measured	7.97	s.u.	0.010	106	90	110			
ph, CaCl2	7.02	s.u.	0.10	100	90	110			

Sample ID: **CCV1_1_131211_1** Continuing Calibration Verification Standard 12/17/13 09:12

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Conductivity, CaCl2	0.150	mmhos/cm	0.10	100	90	110			
pCu, Measured	12.3	s.u.	0.010		90	110			
ph, CaCl2	4.01	s.u.	0.10	100	90	110			

Sample ID: **ICV_1_131211_1** Initial Calibration Verification Standard 12/17/13 09:14

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
ph, CaCl2	7.03	s.u.	0.10	100	90	110			

Sample ID: **CCV_1_131216_1** Continuing Calibration Verification Standard 12/17/13 10:14

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Conductivity, CaCl2	1.42	mmhos/cm	0.10	100	90	110			
pCu, Measured	7.50	s.u.	0.010	100	90	110			
ph, CaCl2	7.04	s.u.	0.10	101	90	110			

Sample ID: **CCV1_1_131216_1** Continuing Calibration Verification Standard 12/17/13 10:15

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Conductivity, CaCl2	0.152	mmhos/cm	0.10	102	90	110			
pCu, Measured	12.5	s.u.	0.010		90	110			
ph, CaCl2	4.02	s.u.	0.10	100	90	110			

Sample ID: **CCV** Continuing Calibration Verification Standard 12/17/13 11:05

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Conductivity, CaCl2	1.41	mmhos/cm	0.10	100	90	110			
pCu, Measured	7.30	s.u.	0.010	97	90	110			
ph, CaCl2	6.99	s.u.	0.10	100	90	110			

Method: **arcadis SOP** Batch: 131216_1_PH-S-PASTE

Sample ID: **LCS-22839** Laboratory Control Sample Run: MISC SOILS_131216B 12/17/13 10:20

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Conductivity, CaCl2	2.86	mmhos/cm	0.10	109	70	130			
pCu, Measured	8.43	s.u.	0.010	97	70	130			
ph, CaCl2	7.36	s.u.	0.10	101	70	130			

Sample ID: **LCS-22754** Laboratory Control Sample Run: MISC SOILS_131216B 12/17/13 10:28

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Conductivity, CaCl2	2.96	mmhos/cm	0.10	113	70	130			
pCu, Measured	8.34	s.u.	0.010	96	70	130			
ph, CaCl2	7.37	s.u.	0.10	101	70	130			

Sample ID: **H13110389-010Adup** Sample Duplicate Run: MISC SOILS_131216B 12/17/13 10:42

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Conductivity, CaCl2	2.29	mmhos/cm	0.10						
Millivolts	105	mV							
pCu, Measured	3.05	s.u.	0.010						
ph, CaCl2	3.91	s.u.	0.10						

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: Chino Mine Company **Report Date:** 12/18/13

Project: Not Indicated **Work Order:** H13110389

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: **arcadis SOP**								Batch: 131216_1_PH-S-PASTE	
Sample ID: **H13110389-020Adup**	Sample Duplicate				Run: MISC SOILS_131216B			12/17/13 10:55	
Conductivity, CaCl2	2.19	mmhos/cm	0.10						
Millivolts	91.8	mV							
pCu, Measured	3.62	s.u.	0.010						
ph, CaCl2	4.17	s.u.	0.10						
Sample ID: **H13110389-025Adup**	Sample Duplicate				Run: MISC SOILS_131216B			12/17/13 11:02	
Conductivity, CaCl2	2.27	mmhos/cm	0.10						
Millivolts	48.3	mV							
pCu, Measured	5.48	s.u.	0.010						
ph, CaCl2	5.08	s.u.	0.10						

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: Chino Mine Company **Report Date:** 12/18/13
Project: Not Indicated **Work Order:** H13110389

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: **SW6020**									Analytical Run: ICPMS204-B_131216B
Sample ID: **ICV STD**	Initial Calibration Verification Standard								12/16/13 11:10
Copper	0.0607	mg/L	0.0010	101	90	110			
Sample ID: **ICV STD**	Initial Calibration Verification Standard								12/16/13 16:27
Copper	0.0610	mg/L	0.0010	102	90	110			
Method: **SW6020**									Batch: 22754
Sample ID: **MB-22754**	Method Blank				Run: ICPMS204-B_131216B				12/17/13 02:43
Copper	0.05	mg/kg	0.003						
Sample ID: **LFB-22754**	Laboratory Fortified Blank				Run: ICPMS204-B_131216B				12/17/13 02:52
Copper	5.19	mg/kg	0.10	103	80	120			
Sample ID: **H13110389-010Adup**	Sample Duplicate				Run: ICPMS204-B_131216B				12/17/13 04:04
Copper	22.9	mg/kg	0.10						
Sample ID: **H13110389-020Adup**	Sample Duplicate				Run: ICPMS204-B_131216B				12/17/13 05:20
Copper	6.91	mg/kg	0.10						
Method: **SW6020**									Analytical Run: ICPMS204-B_131217A
Sample ID: **ICV STD**	Initial Calibration Verification Standard								12/17/13 10:52
Copper	0.0597	mg/L	0.0010	99	90	110			

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

Workorder Receipt Checklist

Chino Mine Company H13110389

Login completed by: Skyler T. Pester
Reviewed by: BL2000\sdull
Reviewed Date: 12/2/2013

Date Received: 11/8/2013
Received by: TLL
Carrier name: UPS Ground

Shipping container/cooler in good condition?	Yes ☑	No ☐	Not Present ☐
Custody seals intact on all shipping container(s)/cooler(s)?	Yes ☐	No ☐	Not Present ☑
Custody seals intact on all sample bottles?	Yes ☐	No ☐	Not Present ☑
Chain of custody present?	Yes ☐	No ☑	
Chain of custody signed when relinquished and received?	Yes ☐	No ☑	
Chain of custody agrees with sample labels?	Yes ☐	No ☑	
Samples in proper container/bottle?	Yes ☑	No ☐	
Sample containers intact?	Yes ☑	No ☐	
Sufficient sample volume for indicated test?	Yes ☑	No ☐	
All samples received within holding time? (Exclude analyses that are considered field parameters such as pH, DO, Res Cl, Sulfite, Ferrous Iron, etc.)	Yes ☑	No ☐	
Temp Blank received in all shipping container(s)/cooler(s)?	Yes ☐	No ☑	Not Applicable ☐
Container/Temp Blank temperature:	10.9℃ No Ice		
Water - VOA vials have zero headspace?	Yes ☐	No ☐	No VOA vials submitted ☑
Water - pH acceptable upon receipt?	Yes ☐	No ☐	Not Applicable ☑

Standard Reporting Procedures:

Lab measurement of analytes considered field parameters that require analysis within 15 minutes of sampling such as pH, Dissolved Oxygen and Residual Chlorine, are qualified as being analyzed outside of recommended holding time.

Solid/soil samples are reported on a wet weight basis (as received) unless specifically indicated. If moisture corrected, data units are typically noted as –dry. For agricultural and mining soil parameters/characteristics, all samples are dried and ground prior to sample analysis.

Contact and Corrective Action Comments:

Received from ACZ labs. No COC received. No collection date/time on sample list - date/time taken from sample bags. No sample date/time for samples: Dup1 or Dup2 - collection date and time estimated in laboratory. Contacted client to ensure samples that were received match sample list. Client wants ELI-H to process "as received" samples rather than use processed soil from ACZ. 11/19/2013 STP.

Energy Laboratories Inc
3161 East Lyndale Avenue
Helena, MT 59601
(406) 442-0711

CHAIN-OF-CUSTODY RECORD

Page 1 of 1

WorkOrder: H13110389

Client:
Chino Mine Company
PO Box 10
Bayard, NM 88023

TEL:
FAX:
ProjectNo: Not Indicated
PO:

19-Nov-13

Sample ID	ClientSampID	Matrix	Collection Date	Bottle	Requested Tests						
					D10_20-S-CaCl	CU-ACTVTY-S	SOILREVIEW	WC REVIEW			
H13110389-001	STS-RWU-2011-4 0-6	Soil	7/15/2013 10:15:00 AM		A	A	A	A			
H13110389-002	1# WEST 0-6	Soil	7/15/2013 10:57:00 AM		A	A					
H13110389-003	STS-RWU-2011-15 0-6	Soil	7/15/2013 11:30:00 AM		A	A					
H13110389-004	STS-RWU-2011-6 0-6	Soil	7/15/2013 11:57:00 AM		A	A					
H13110389-005	STS-RWU-2011-1 0-6	Soil	7/16/2013 9:03:00 AM		A	A					
H13110389-006	STS-RWU-2011-3 0-6	Soil	7/16/2013 8:13:00 AM		A	A					
H13110389-007	STS-RWU-2011-14 0-6	Soil	7/15/2013 1:00:00 PM		A	A					
H13110389-008	STS-RWU-2011-2 0-6	Soil	7/16/2013 10:15:00 AM		A	A					
H13110389-009	STS-RWU-2011-8 0-6	Soil	7/16/2013 1:41:00 PM		A	A					
H13110389-010	STS-RWU-2011-5 0-6	Soil	7/16/2013 12:59:00 PM		A	A					
H13110389-011	STS-RWU-2011-16 0-6	Soil	7/16/2013 2:31:00 PM		A	A					
H13110389-012	STS-RWU-2011-7 0-6	Soil	7/15/2013 5:27:00 PM		A	A					
H13110389-013	STS-RWU-2011-9 0-6	Soil	7/16/2013 12:07:00 PM		A	A					
H13110389-014	STS-RWU-2011-10 0-6	Soil	7/16/2013 6:01:00 PM		A	A					
H13110389-015	STS-RWU-2011-11 0-6	Soil	7/15/2013 2:55:00 PM		A	A					
H13110389-016	STS-RWU-2011-12 0-6	Soil	7/15/2013 4:30:00 PM		A	A					

Comments: Part of Ammendment Study Samples (copper activity) project. No COC. No collection date/time on sample list, date/time taken from sample bags, no sample date/time for samples: Dup1 or Dup2, collection date and time estimated in laboratory 11/19/2013 STP.

	Date/Time		Date/Time
Relinquished by:		**Received by:**	
Relinquished by:		**Received by:**	
Relinquished by:		**Received by:**	11-8-13 9:37AM

NOTE: Samples are discarded 60 days after results are reported unless other arrangements are made. Hazardous samples will be returned to client or disposed of at client expense.

Bottle Type: L-Liter V-Voa S-Soil Jar O-Orbo T-Tedlar B-Brass P-Plastic OT-Other

Energy Laboratories Inc
3161 East Lyndale Avenue
Helena, MT 59601
(406) 442-0711

CHAIN-OF-CUSTODY RECORD

Page 1 of 1

WorkOrder: H13110389

Client:
Chino Mine Company
PO Box 10
Bayard, NM 88023

TEL:
FAX:
ProjectNo: Not Indicated
PO:

19-Nov-13

					Requested Tests						
Sample ID	**ClientSampID**	**Matrix**	**Collection Date**	**Bottle**	**010_20-S-CaC**	**CU-ACTVTY-S**	**SOILREVIEW**	**WC REVIEW**			
H13110389-017	STS-RWU-2011-13 0-6	Soil	7/15/2013 7:20:00 PM		A	A					
H13110389-018	STS-RWU-2011-17 0-6	Soil	7/15/2013 2:05:00 PM		A	A					
H13110389-019	STS-RWU-2012-B1 0-6	Soil	7/17/2013 9:30:00 AM		A	A					
H13110389-020	STS-RWU-2012-B2 0-6	Soil	7/17/2013 10:37:00 AM		A	A					
H13110389-021	STS-RWU-2012-B3 0-6	Soil	7/17/2013 9:20:00 AM		A	A					
H13110389-022	WILDLIFE REF NORTH 0-	Soil	7/16/2013 5:14:00 PM		A	A					
H13110389-023	WILDLIFE REF SOUTH 0-	Soil	7/16/2013 4:40:00 PM		A	A					
H13110389-024	DUP #1	Soil	7/16/2013 4:40:00 PM		A	A					
H13110389-025	DUP #2	Soil	7/16/2013 4:40:00 PM		A	A					

Comments: Part of Ammendment Study Samples (copper activity) project. No COC, No collection date/time on sample list, date/time taken from sample bags, no sample date/time for samples: Dup1 or Dup2, collection date and time estimated in laboratory 11/19/2013 STP.

	Date/Time		**Date/Time**
Relinquished by:		**Received by:**	
Relinquished by:		**Received by:**	
Relinquished by:		**Received by:**	11-8-13 9:37 AM

NOTE: Samples are discarded 60 days after results are reported unless other arrangements are made. Hazardous samples will be returned to client or disposed of at client expense.

Bottle Type: L-Liter V-Voa S-Soil Jar O-Orbo T-Tedlar B-Brass P-Plastic OT-Other

ANALYTICAL SUMMARY REPORT

December 20, 2013

Chino Mine Company
PO Box 10
Bayard, NM 88023

Workorder No.: H13110098

Project Name: Phytotoxicity Soil Samples

Energy Laboratories Inc Helena MT received the following 36 samples for Chino Mine Company on 11/1/2013 for analysis.

Sample ID	Client Sample ID	Collect Date	Receive Date	Matrix	Test
H13110098-001	STS-PT-2013-1	10/24/13 10:00	11/01/13	Soil	Metals by ICP/ICPMS, Total Metals, Water Extractable DPTA extractable metals Metals, NH4Ac Metals, Saturated Paste Alkalinity, Water Extractable Carbon, Dissolved Organic Conductivity, Saturated Paste Extract Copper Activity Exchangeable Cations Anions by Ion Chromatography Lime as CaCO3 Moisture Nitrate as N, CaCL2 Extract Organic Carbon/Matter Walkley-Black Phosphorus-Bray pH, Saturated Paste Soluble Phosphate Digestion, Total Metals CaCl2 Hot Water Soil Extraction Water extraction DTPA extraction for metals Preparation, Dissolved Filtration Lime Percentage NaHCO3 Soil Extract NH4AC Soil Extraction Total Organic Matter Prep Particle Size Analysis / Texture Prep Saturated Paste Extraction Particle Size Analysis / Texture Saturation Percentage Soil Preparation

ANALYTICAL SUMMARY REPORT

H13110098-002	STS-PT-2013-2	10/23/13 16:45	11/01/13	Soil	Metals by ICP/ICPMS, Total Metals, Water Extractable DPTA extractable metals Metals, NH4Ac Metals, Saturated Paste Alkalinity, Water Extractable Carbon, Dissolved Organic Conductivity, Saturated Paste Extract Copper Activity Exchangeable Cations Anions by Ion Chromatography Lime as CaCO3 Moisture Nitrate as N, CaCL2 Extract Organic Carbon/Matter Walkley-Black pH, Saturated Paste Soluble Phosphate Phosphorus-Olsen Digestion, Total Metals CaCl2 Hot Water Soil Extraction Water extraction DTPA extraction for metals Preparation, Dissolved Filtration Lime Percentage NaHCO3 Soil Extract NH4AC Soil Extraction Total Organic Matter Prep Particle Size Analysis / Texture Prep Saturated Paste Extraction Particle Size Analysis / Texture Saturation Percentage
H13110098-003	STS-PT-2013-3	10/24/13 16:30	11/01/13	Soil	Metals by ICP/ICPMS, Total Metals, Water Extractable DPTA extractable metals Metals, NH4Ac Metals, Saturated Paste Alkalinity, Water Extractable Carbon, Dissolved Organic Conductivity, Saturated Paste Extract Copper Activity Exchangeable Cations Anions by Ion Chromatography Lime as CaCO3 Moisture Nitrate as N, CaCL2 Extract Organic Carbon/Matter Walkley-Black Phosphorus-Bray pH, Saturated Paste Soluble Phosphate Digestion, Total Metals CaCl2 Hot Water Soil Extraction Water extraction DTPA extraction for metals Preparation, Dissolved Filtration Lime Percentage NaHCO3 Soil Extract NH4AC Soil Extraction Total Organic Matter Prep Particle Size Analysis / Texture Prep Saturated Paste Extraction Particle Size Analysis / Texture Saturation Percentage

ANALYTICAL SUMMARY REPORT

H13110098-004	STS-PT-2013-4	10/22/13 14:00	11/01/13	Soil	Same As Above
H13110098-005	STS-PT-2013-5	10/23/13 14:45	11/01/13	Soil	Same As Above
H13110098-006	STS-PT-2013-6	10/24/13 14:25	11/01/13	Soil	Same As Above
H13110098-007	STS-PT-2013-7	10/24/13 13:00	11/01/13	Soil	Same As Above
H13110098-008	STS-PT-2013-8	10/23/13 17:45	11/01/13	Soil	Same As Above
H13110098-009	STS-PT-2013-9	10/23/13 10:45	11/01/13	Soil	Same As Above
H13110098-010	STS-PT-2013-10	10/23/13 11:15	11/01/13	Soil	Same As Above
H13110098-011	STS-PT-2013-11	10/24/13 15:30	11/01/13	Soil	Same As Above
H13110098-012	STS-PT-2013-12	10/22/13 9:40	11/01/13	Soil	Metals by ICP/ICPMS, Total Metals, Water Extractable DPTA extractable metals Metals, NH4Ac Metals, Saturated Paste Alkalinity, Water Extractable Carbon, Dissolved Organic Conductivity, Saturated Paste Extract Copper Activity Exchangeable Cations Anions by Ion Chromatography Lime as CaCO3 Moisture Nitrate as N, CaCL2 Extract Organic Carbon/Matter Walkley-Black pH, Saturated Paste Soluble Phosphate Phosphorus-Olsen Digestion, Total Metals CaCl2 Hot Water Soil Extraction Water extraction DTPA extraction for metals Preparation, Dissolved Filtration Lime Percentage NaHCO3 Soil Extract NH4AC Soil Extraction Total Organic Matter Prep Particle Size Analysis / Texture Prep Saturated Paste Extraction Particle Size Analysis / Texture Saturation Percentage

ANALYTICAL SUMMARY REPORT

H13110098-013	STS-PT-2013-13	10/25/13 12:10	11/01/13	Soil	Metals by ICP/ICPMS, Total Metals, Water Extractable DPTA extractable metals Metals, NH4Ac Metals, Saturated Paste Alkalinity, Water Extractable Carbon, Dissolved Organic Conductivity, Saturated Paste Extract Copper Activity Exchangeable Cations Anions by Ion Chromatography Lime as CaCO3 Moisture Nitrate as N, CaCL2 Extract Organic Carbon/Matter Walkley-Black Phosphorus-Bray pH, Saturated Paste Soluble Phosphate Digestion, Total Metals CaCl2 Hot Water Soil Extraction Water extraction DTPA extraction for metals Preparation, Dissolved Filtration Lime Percentage NaHCO3 Soil Extract NH4AC Soil Extraction Total Organic Matter Prep Particle Size Analysis / Texture Prep Saturated Paste Extraction Particle Size Analysis / Texture Saturation Percentage
H13110098-014	STS-PT-2013-14	10/24/13 10:50	11/01/13	Soil	Same As Above
H13110098-015	STS-PT-2013-15	10/25/13 16:00	11/01/13	Soil	Same As Above
H13110098-016	STS-PT-2013-16	10/23/13 17:50	11/01/13	Soil	Same As Above

H13110098-017	STS-PT-2013-17	10/25/13 12:30	11/01/13	Soil	Metals by ICP/ICPMS, Total Metals, Water Extractable DPTA extractable metals Metals, NH4Ac Metals, Saturated Paste Alkalinity, Water Extractable Carbon, Dissolved Organic Conductivity, Saturated Paste Extract Copper Activity Exchangeable Cations Anions by Ion Chromatography Lime as CaCO3 Moisture Nitrate as N, CaCL2 Extract Organic Carbon/Matter Walkley-Black pH, Saturated Paste Soluble Phosphate Phosphorus-Olsen Digestion, Total Metals CaCl2 Hot Water Soil Extraction Water extraction DTPA extraction for metals Preparation, Dissolved Filtration Lime Percentage NaHCO3 Soil Extract NH4AC Soil Extraction Total Organic Matter Prep Particle Size Analysis / Texture Prep Saturated Paste Extraction Particle Size Analysis / Texture Saturation Percentage
H13110098-018	STS-PT-2013-18	10/23/13 9:45	11/01/13	Soil	Metals by ICP/ICPMS, Total Metals, Water Extractable DPTA extractable metals Metals, NH4Ac Metals, Saturated Paste Alkalinity, Water Extractable Carbon, Dissolved Organic Conductivity, Saturated Paste Extract Copper Activity Exchangeable Cations Anions by Ion Chromatography Lime as CaCO3 Moisture Nitrate as N, CaCL2 Extract Organic Carbon/Matter Walkley-Black Phosphorus-Bray pH, Saturated Paste Soluble Phosphate Digestion, Total Metals CaCl2 Hot Water Soil Extraction Water extraction DTPA extraction for metals Preparation, Dissolved Filtration Lime Percentage NaHCO3 Soil Extract NH4AC Soil Extraction Total Organic Matter Prep Particle Size Analysis / Texture Prep Saturated Paste Extraction Particle Size Analysis / Texture Saturation Percentage

ANALYTICAL SUMMARY REPORT

H13110098-019	STS-PT-2013-19	10/24/13 9:00	11/01/13	Soil	Same As Above
H13110098-020	STS-PT-2013-20	10/25/13 10:45	11/01/13	Soil	Metals by ICP/ICPMS, Total Metals, Water Extractable DPTA extractable metals Metals, NH4Ac Metals, Saturated Paste Alkalinity, Water Extractable Carbon, Dissolved Organic Conductivity, Saturated Paste Extract Copper Activity Exchangeable Cations Anions by Ion Chromatography Lime as CaCO3 Moisture Nitrate as N, CaCL2 Extract Organic Carbon/Matter Walkley-Black pH, Saturated Paste Soluble Phosphate Phosphorus-Olsen Digestion, Total Metals CaCl2 Hot Water Soil Extraction Water extraction DTPA extraction for metals Preparation, Dissolved Filtration Lime Percentage NaHCO3 Soil Extract NH4AC Soil Extraction Total Organic Matter Prep Particle Size Analysis / Texture Prep Saturated Paste Extraction Particle Size Analysis / Texture Saturation Percentage

ANALYTICAL SUMMARY REPORT

H13110098-021	STS-PT-2013-21	10/22/13 11:00	11/01/13	Soil	Metals by ICP/ICPMS, Total Metals, Water Extractable DPTA extractable metals Metals, NH4Ac Metals, Saturated Paste Alkalinity, Water Extractable Carbon, Dissolved Organic Conductivity, Saturated Paste Extract Copper Activity Exchangeable Cations Anions by Ion Chromatography Lime as CaCO3 Moisture Nitrate as N, CaCL2 Extract Organic Carbon/Matter Walkley-Black Phosphorus-Bray pH, Saturated Paste Soluble Phosphate Digestion, Total Metals CaCl2 Hot Water Soil Extraction Water extraction DTPA extraction for metals Preparation, Dissolved Filtration Lime Percentage NaHCO3 Soil Extract NH4AC Soil Extraction Total Organic Matter Prep Particle Size Analysis / Texture Prep Saturated Paste Extraction Particle Size Analysis / Texture Saturation Percentage
H13110098-022	STS-PT-2013-22	10/22/13 11:35	11/01/13	Soil	Same As Above
H13110098-023	STS-PT-2013-23	10/22/13 10:30	11/01/13	Soil	Same As Above

ANALYTICAL SUMMARY REPORT

H13110098-024	STS-PT-2013-24	10/24/13 18:30	11/01/13	Soil	Metals by ICP/ICPMS, Total Metals, Water Extractable DPTA extractable metals Metals, NH4Ac Metals, Saturated Paste Alkalinity, Water Extractable Carbon, Dissolved Organic Conductivity, Saturated Paste Extract Copper Activity Exchangeable Cations Anions by Ion Chromatography Lime as CaCO3 Moisture Nitrate as N, CaCL2 Extract Organic Carbon/Matter Walkley-Black pH, Saturated Paste Soluble Phosphate Phosphorus-Olsen Digestion, Total Metals CaCl2 Hot Water Soil Extraction Water extraction DTPA extraction for metals Preparation, Dissolved Filtration Lime Percentage NaHCO3 Soil Extract NH4AC Soil Extraction Total Organic Matter Prep Particle Size Analysis / Texture Prep Saturated Paste Extraction Particle Size Analysis / Texture Saturation Percentage
H13110098-025	STS-PT-2013-25	10/22/13 16:00	11/01/13	Soil	Same As Above
H13110098-026	STS-PT-2013-26	10/22/13 15:15	11/01/13	Soil	Same As Above

ANALYTICAL SUMMARY REPORT

H13110098-027	STS-PT-2013-27	10/25/13 14:15	11/01/13	Soil	Metals by ICP/ICPMS, Total Metals, Water Extractable DPTA extractable metals Metals, NH4Ac Metals, Saturated Paste Alkalinity, Water Extractable Carbon, Dissolved Organic Conductivity, Saturated Paste Extract Copper Activity Exchangeable Cations Anions by Ion Chromatography Lime as CaCO3 Moisture Nitrate as N, CaCL2 Extract Organic Carbon/Matter Walkley-Black Phosphorus-Bray pH, Saturated Paste Soluble Phosphate Digestion, Total Metals CaCl2 Hot Water Soil Extraction Water extraction DTPA extraction for metals Preparation, Dissolved Filtration Lime Percentage NaHCO3 Soil Extract NH4AC Soil Extraction Total Organic Matter Prep Particle Size Analysis / Texture Prep Saturated Paste Extraction Particle Size Analysis / Texture Saturation Percentage
H13110098-028	STS-PT-2013-28	10/22/13 17:15	11/01/13	Soil	Metals by ICP/ICPMS, Total Metals, Water Extractable DPTA extractable metals Metals, NH4Ac Metals, Saturated Paste Alkalinity, Water Extractable Carbon, Dissolved Organic Conductivity, Saturated Paste Extract Copper Activity Exchangeable Cations Anions by Ion Chromatography Lime as CaCO3 Moisture Nitrate as N, CaCL2 Extract Organic Carbon/Matter Walkley-Black pH, Saturated Paste Soluble Phosphate Phosphorus-Olsen Digestion, Total Metals CaCl2 Hot Water Soil Extraction Water extraction DTPA extraction for metals Preparation, Dissolved Filtration Lime Percentage NaHCO3 Soil Extract NH4AC Soil Extraction Total Organic Matter Prep Particle Size Analysis / Texture Prep Saturated Paste Extraction Particle Size Analysis / Texture Saturation Percentage

ANALYTICAL SUMMARY REPORT

H13110098-029	STS-PT-2013-29	10/25/13 16:00	11/01/13	Soil	Metals by ICP/ICPMS, Total Metals, Water Extractable DPTA extractable metals Metals, NH4Ac Metals, Saturated Paste Alkalinity, Water Extractable Carbon, Dissolved Organic Conductivity, Saturated Paste Extract Copper Activity Exchangeable Cations Anions by Ion Chromatography Lime as CaCO3 Moisture Nitrate as N, CaCL2 Extract Organic Carbon/Matter Walkley-Black Phosphorus-Bray pH, Saturated Paste Soluble Phosphate Digestion, Total Metals CaCl2 Hot Water Soil Extraction Water extraction DTPA extraction for metals Preparation, Dissolved Filtration Lime Percentage NaHCO3 Soil Extract NH4AC Soil Extraction Total Organic Matter Prep Particle Size Analysis / Texture Prep Saturated Paste Extraction Particle Size Analysis / Texture Saturation Percentage
H13110098-030	STS-PT-2013-30	10/24/13 12:40	11/01/13	Soil	Same As Above
H13110098-031	STS-PT-2013-31	10/23/13 14:00	11/01/13	Soil	Same As Above
H13110098-032	STS-PT-2013-32	10/23/13 12:55	11/01/13	Soil	Same As Above
H13110098-033	STS-PT-2013-33	10/25/13 9:20	11/01/13	Soil	Same As Above
H13110098-034	Dup1	10/23/13 17:00	11/01/13	Soil	Same As Above
H13110098-035	Dup2	10/23/13 17:00	11/01/13	Soil	Same As Above

ANALYTICAL SUMMARY REPORT

H13110098-036	Dup3	10/23/13 17:00	11/01/13	Soil	Metals by ICP/ICPMS, Total Metals, Water Extractable DPTA extractable metals Metals, NH4Ac Metals, Saturated Paste Alkalinity, Water Extractable Carbon, Dissolved Organic Conductivity, Saturated Paste Extract Copper Activity Exchangeable Cations Anions by Ion Chromatography Lime as CaCO3 Moisture Nitrate as N, CaCL2 Extract Organic Carbon/Matter Walkley-Black pH, Saturated Paste Soluble Phosphate Phosphorus-Olsen Digestion, Total Metals CaCl2 Hot Water Soil Extraction Water extraction DTPA extraction for metals Preparation, Dissolved Filtration Lime Percentage NaHCO3 Soil Extract NH4AC Soil Extraction Total Organic Matter Prep Particle Size Analysis / Texture Prep Saturated Paste Extraction Particle Size Analysis / Texture Saturation Percentage

The analyses presented in this report were performed by Energy Laboratories, Inc., 3161 E. Lyndale Ave., Helena, MT 59604, unless otherwise noted. Any exceptions or problems with the analyses are noted in the Laboratory Analytical Report, the QA/QC Summary Report, or the Case Narrative.

The results as reported relate only to the item(s) submitted for testing.

If you have any questions regarding these test results, please call.

Report Approved By: Jonathan D. Hager
Branch Manager - Helena, MT

Digitally signed by
Jonathan Hager
Date: 2013.12.20 16:22:13 -07:00

CLIENT: Chino Mine Company
Project: Phytotoxicity Soil Samples
Sample Delivery Group: H13110098

Revised Date: 12/20/13
Report Date: 12/18/13

CASE NARRATIVE

Tests associated with analyst identified as ELI-CA were subcontracted to Energy Laboratories, 2393 Salt Creek Hwy., Casper, WY, EPA Number WY00002 and WY00937.

Standard operating procedure submitted by Arcadis as "Standard Operating Procedures for Measurement of Cu2+ Activity in Soil by Ion-Selective Electrode" (ed. September 2013). Copper activity measured with a Combination Cupric Sure-Flow Ion Selective Electrode (Thermo Scientific, 9629BNWP) as per SOP. All samples and standards were filtered through 0.22µm membrane cellulose-acetate filters (Whatman, 10404112), prior to analysis. All analysis was performed under reduced light conditions.

Report corrected to properly calculate Exchangeable Copper, calculation was incorrect for the initial report and was revised 12/20/2013 by STP to report exchangeable copper in units of meq/100g.

LABORATORY ANALYTICAL REPORT

Prepared by Helena, MT Branch

Client: Chino Mine Company
Project: Phytotoxicity Soil Samples
Workorder: H13110098

Revised Date: 12/20/13
Report Date: 12/18/13
Date Received: 11/01/13

		Analysis		Moisture (As	Sand	Silt	Clay	Texture	Percent Sat	pH-SatPst	COND	Ca-SatPst	Mg-SatPst	K-SatPst
		Units		wt%	%	%	%	%	%	s_u_	mmhos/cm	meq/L	meq/L	meq/L
Sample ID	**Client Sample ID**	**Up**	**Low**	**Results**	**Results**	**Results**	**Results**	**Results**	**Results**	**Results**	**Results**	**Results**	**Results**	**Results**
H13110098-001	STS-PT-2013-1	0	0	4.3	51	31	18	L	30.2	4.5	0.7	4.14	1.19	0.24
H13110098-002	STS-PT-2013-2	0	0	5.5	48	28	24	L	41.7	6.7	1.8	16.8	2.74	0.24
H13110098-003	STS-PT-2013-3	0	0	2.2	54	24	22	SCL	30.5	5.3	0.7	3.46	1.46	0.42
H13110098-004	STS-PT-2013-4	0	0	4.2	60	18	22	SCL	32.3	5.1	1.5	7.77	3.59	0.69
H13110098-005	STS-PT-2013-5	0	0	7.4	34	20	46	C	67.8	6.1	1.3	8.21	2.62	0.21
H13110098-006	STS-PT-2013-6	0	0	2.5	52	40	8	L	38.0	3.8	0.4	1.72	0.34	0.26
H13110098-007	STS-PT-2013-7	0	0	1.9	48	42	10	L	45.4	3.3	3.0	25.1	4.08	0.10
H13110098-008	STS-PT-2013-8	0	0	8.3	28	30	42	C	46.2	5.0	0.4	1.16	0.50	0.15
H13110098-009	STS-PT-2013-9	0	0	3.5	52	26	22	SCL	26.1	4.3	0.4	1.45	0.40	0.17
H13110098-010	STS-PT-2013-10	0	0	3.5	73	17	10	SL	25.0	4.8	0.6	2.86	0.70	0.18
H13110098-011	STS-PT-2013-11	0	0	3.1	64	24	12	SL	29.6	3.9	0.3	0.94	0.18	0.14
H13110098-012	STS-PT-2013-12	0	0	2.3	60	26	14	SL	27.9	6.5	0.7	4.51	0.76	0.14
H13110098-013	STS-PT-2013-13	0	0	3.9	42	34	24	L	32.2	4.9	0.4	1.07	0.58	0.33
H13110098-014	STS-PT-2013-14	0	0	10.9	34	26	40	C	53.4	3.8	3.0	24.6	10.5	0.33
H13110098-015	STS-PT-2013-15	0	0	5.9	40	28	32	CL	36.1	5.1	0.3	0.35	0.18	0.08
H13110098-016	STS-PT-2013-16	0	0	6.0	33	23	44	C	62.4	5.4	0.6	2.46	1.01	0.19
H13110098-017	STS-PT-2013-17	0	0	5.9	32	28	40	C	48.8	7.6	0.6	4.60	0.65	0.23
H13110098-018	STS-PT-2013-18	0	0	4.7	54	24	22	SCL	30.4	4.1	0.3	1.14	0.29	0.10
H13110098-019	STS-PT-2013-19	0	0	3.2	62	22	16	SL	26.9	4.6	0.4	1.79	0.44	0.13
H13110098-020	STS-PT-2013-20	0	0	5.3	46	34	20	L	41.4	7.5	0.5	3.67	0.37	0.09
H13110098-021	STS-PT-2013-21	0	0	5.7	48	20	32	SCL	38.1	4.2	0.2	0.71	0.24	0.11
H13110098-022	STS-PT-2013-22	0	0	4.0	58	26	16	SL	35.1	3.9	2.7	22.4	5.78	0.33
H13110098-023	STS-PT-2013-23	0	0	2.6	68	20	12	SL	24.1	4.4	0.4	1.52	0.35	0.17
H13110098-024	STS-PT-2013-24	0	0	3.6	64	18	18	SL	33.6	7.7	0.5	3.73	0.31	0.23
H13110098-025	STS-PT-2013-25	0	0	1.3	74	18	8	SL	22.8	7.7	0.6	3.57	0.46	0.80
H13110098-026	STS-PT-2013-26	0	0	5.5	42	30	28	CL	40.0	7.6	0.4	2.74	0.23	0.26
H13110098-027	STS-PT-2013-27	0	0	4.9	58	20	22	SCL	30.0	4.6	0.3	0.78	0.33	0.16
H13110098-028	STS-PT-2013-28	0	0	5.7	44	23	33	CL	40.0	7.5	0.4	2.02	0.42	0.15
H13110098-029	STS-PT-2013-29	0	0	2.1	66	19	15	SL	21.4	4.5	0.2	0.56	0.16	0.25
H13110098-030	STS-PT-2013-30	0	0	2.2	67	20	13	SL	23.6	3.7	1.0	5.80	0.94	0.27
H13110098-031	STS-PT-2013-31	0	0	11.8	32	23	45	C	56.4	5.1	0.4	1.53	0.60	0.09
H13110098-032	STS-PT-2013-32	0	0	7.0	42	33	25	L	35.3	5.1	0.4	1.89	0.58	0.32
H13110098-033	STS-PT-2013-33	0	0	3.2	46	45	9	L	29.0	4.3	12.8	18.8	35.4	< 0.03
H13110098-034	Dup1	0	0	3.9	50	31	19	L	29.0	4.8	0.8	4.51	1.25	0.25
H13110098-035	Dup2	0	0	3.0	46	45	9	L	27.2	4.0	21.8	18.1	42.6	0.03
H13110098-036	Dup3	0	0	3.8	48	31	21	L	38.4	7.6	0.5	3.68	0.37	0.13

LABORATORY ANALYTICAL REPORT

Prepared by Helena, MT Branch

Revised Date: 12/20/13
Report Date: 12/18/13
Date Received: 11/01/13

Client: Chino Mine Company
Project: Phytotoxicity Soil Samples
Workorder: H13110098

		Analysis		Na-SatPst	Alk SatPst	HCO3 SatPst	Fluoride	SO4-SatPst	Cl-SatPst	Ca-NH4OAC	Cu-NH4OAC	Mg-NH4OAC	Na-NH4OAC	Ca-Ext-NH4OAC
		Units		meq/L	meq/L	meq/L	mg/L	meq/L	meq/L	mg/kg	mg/kg	mg/kg	mg/kg	meq/100g
Sample ID	**Client Sample ID**	**Up**	**Low**	**Results**	**Results**	**Results**	**Results**	**Results**	**Results**	**Results**	**Results**	**Results**	**Results**	**Results**
H13110098-001	STS-PT-2013-1	0	0	0.69	0.44	0.44	< 2	5.9	0.2	1180	227	168	20	5.87
H13110098-002	STS-PT-2013-2	0	0	0.66	3.53	3.53	< 2	17.7	0.3	5790	38	343	20	28.9
H13110098-003	STS-PT-2013-3	0	0	0.61	0.56	0.56	< 2	3.7	0.2	1610	16	312	18	8.01
H13110098-004	STS-PT-2013-4	0	0	1.04	0.62	0.62	< 2	6.6	0.8	1840	8	422	23	9.21
H13110098-005	STS-PT-2013-5	0	0	1.47	1.75	1.75	< 2	10.0	0.3	6140	41	999	84	30.6
H13110098-006	STS-PT-2013-6	0	0	0.33	0.11	0.11	< 2	2.6	0.2	212	5	26	10	1.06
H13110098-007	STS-PT-2013-7	0	0	0.81	< 0.02	< 0.02	6	40.6	0.2	745	8	55	17	3.72
H13110098-008	STS-PT-2013-8	0	0	1.10	0.64	0.64	< 2	2.0	0.4	3380	53	752	46	16.9
H13110098-009	STS-PT-2013-9	0	0	0.59	0.43	0.43	< 2	1.9	0.2	688	452	110	12	3.44
H13110098-010	STS-PT-2013-10	0	0	0.81	0.44	0.44	< 2	4.2	0.3	672	109	78	19	3.35
H13110098-011	STS-PT-2013-11	0	0	0.50	0.41	0.41	< 2	1.4	0.2	176	11	21	12	0.876
H13110098-012	STS-PT-2013-12	0	0	0.80	2.92	2.91	< 2	3.3	0.2	2100	15	161	22	10.5
H13110098-013	STS-PT-2013-13	0	0	0.95	0.58	0.58	< 2	1.6	0.3	1600	19	403	20	7.99
H13110098-014	STS-PT-2013-14	0	0	1.32	< 0.02	< 0.02	5	39.3	0.2	3930	100	728	46	19.6
H13110098-015	STS-PT-2013-15	0	0	0.63	0.55	0.55	< 2	1.1	0.4	2410	44	463	69	12.0
H13110098-016	STS-PT-2013-16	0	0	1.21	0.85	0.85	< 2	3.5	0.5	4590	95	945	51	22.9
H13110098-017	STS-PT-2013-17	0	0	0.71	3.03	3.02	< 2	2.8	0.4	6830	43	354	21	34.1
H13110098-018	STS-PT-2013-18	0	0	0.75	0.41	0.41	< 2	2.1	0.2	281	34	39	20	1.40
H13110098-019	STS-PT-2013-19	0	0	0.79	0.43	0.43	< 2	2.1	0.2	888	163	106	18	4.43
H13110098-020	STS-PT-2013-20	0	0	0.94	4.24	4.24	< 2	< 0.4	0.8	5940	2	135	34	29.6
H13110098-021	STS-PT-2013-21	0	0	0.71	0.43	0.43	< 2	1.5	0.2	390	2	61	18	1.95
H13110098-022	STS-PT-2013-22	0	0	1.89	< 0.02	< 0.02	7	35.0	0.4	1230	19	114	36	6.14
H13110098-023	STS-PT-2013-23	0	0	0.61	0.41	0.41	< 2	2.1	0.2	330	17	46	14	1.65
H13110098-024	STS-PT-2013-24	0	0	0.52	4.50	4.49	< 2	< 0.4	0.3	5060	< 1	155	11	25.3
H13110098-025	STS-PT-2013-25	0	0	0.55	4.85	4.85	< 2	0.5	0.4	7500	2	216	14	37.4
H13110098-026	STS-PT-2013-26	0	0	0.61	3.08	3.08	< 2	0.7	0.3	1190	8	226	20	5.94
H13110098-027	STS-PT-2013-27	0	0	0.87	0.48	0.48	< 2	1.4	0.3	4360	< 1	403	17	21.8
H13110098-028	STS-PT-2013-28	0	0	0.84	2.74	2.74	< 2	0.6	0.4	489	48	73	17	2.44
H13110098-029	STS-PT-2013-29	0	0	0.61	0.46	0.46	< 2	0.9	0.3	391	4	44	12	1.95
H13110098-030	STS-PT-2013-30	0	0	0.61	< 0.02	< 0.02	< 2	8.7	0.3	376	4	41	12	1.88
H13110098-031	STS-PT-2013-31	0	0	1.20	0.46	0.46	< 2	1.9	0.5	4300	7	797	123	21.5
H13110098-032	STS-PT-2013-32	0	0	0.44	0.63	0.63	< 2	1.7	0.3	1300	119	166	32	6.50
H13110098-033	STS-PT-2013-33	0	0	1.33	0.64	0.64	44	260	4.9	20500	16100	190	26	102
H13110098-034	Dup1	0	0	0.82	0.44	0.44	< 2	9.1	0.3	1070	291	145	21	5.34
H13110098-035	Dup2	0	0	1.23	0.59	0.59	64	491	5.5	20600	16800	211	18	103
H13110098-036	Dup3	0	0	0.37	3.66	3.66	< 2	4.4	0.5	5680	10	129	15	28.3

LABORATORY ANALYTICAL REPORT

Prepared by Helena, MT Branch

Client: Chino Mine Company
Project: Phytotoxicity Soil Samples
Workorder: H13110098

Revised Date: 12/20/13
Report Date: 12/18/13
Date Received: 11/01/13

		Analysis		Mg-Ext-NH4OAC	K-Ext-NH4OAC	K-NH4OAC	Na-Ext-NH4OAC	Exch Ca	Exch Mg	Exch K	Exch Na	Exch Cu	OM-WB	Lime
		Units		meq/100g	meq/100g	mg/kg	meq/100g	meq/100g	meq/100g	meq/100g	meq/100g	meq/100g	%	%
Sample ID	**Client Sample ID**	**Up**	**Low**	**Results**	**Results**	**Results**	**Results**	**Results**	**Results**	**Results**	**Results**	**Results**	**Results**	**Results**
H13110098-001	STS-PT-2013-1	0	0	1.39	0.496	194	0.087	5.8	1.4	0.5	< 0.1	0.6	1.1	0.53
H13110098-002	STS-PT-2013-2	0	0	2.85	0.650	254	0.086	28.2	2.7	0.6	< 0.1	0.1	1.4	2.07
H13110098-003	STS-PT-2013-3	0	0	2.59	0.786	307	0.080	7.9	2.6	0.8	< 0.1	< 0.1	0.9	0.58
H13110098-004	STS-PT-2013-4	0	0	3.50	0.806	315	0.101	8.6	3.1	0.8	< 0.1	< 0.1	1.6	0.66
H13110098-005	STS-PT-2013-5	0	0	8.29	1.21	473	0.368	30.1	8.1	1.2	0.3	0.1	2.6	1.99
H13110098-006	STS-PT-2013-6	0	0	0.215	0.165	65	0.042	1.0	0.2	0.2	< 0.1	< 0.1	2.0	< 0.01
H13110098-007	STS-PT-2013-7	0	0	0.453	0.062	24	0.073	2.5	0.2	< 0.1	< 0.1	< 0.1	3.9	< 0.01
H13110098-008	STS-PT-2013-8	0	0	6.24	0.942	368	0.201	16.8	6.2	0.9	0.2	0.2	1.6	1.41
H13110098-009	STS-PT-2013-9	0	0	0.912	0.356	139	0.051	3.4	0.9	0.4	< 0.1	1.1	1.0	0.24
H13110098-010	STS-PT-2013-10	0	0	0.651	< 1	91	0.083	3.3	0.6	< 0.1	< 0.1	0.3	0.8	0.24
H13110098-011	STS-PT-2013-11	0	0	0.173	0.174	68	0.054	0.8	0.2	0.2	< 0.1	< 0.1	1.3	0.06
H13110098-012	STS-PT-2013-12	0	0	1.33	0.335	131	0.097	10.4	1.3	0.3	< 0.1	< 0.1	1.3	0.75
H13110098-013	STS-PT-2013-13	0	0	3.35	1.11	435	0.088	8.0	3.3	1.1	< 0.1	< 0.1	1.6	0.84
H13110098-014	STS-PT-2013-14	0	0	6.04	0.691	270	0.202	18.3	5.5	0.7	0.1	0.2	1.2	0.86
H13110098-015	STS-PT-2013-15	0	0	3.85	0.885	346	0.298	12.0	3.8	0.9	0.3	0.1	1.6	0.97
H13110098-016	STS-PT-2013-16	0	0	7.84	1.34	523	0.222	22.7	7.8	1.3	0.1	0.3	3.0	1.66
H13110098-017	STS-PT-2013-17	0	0	2.94	1.22	477	0.090	33.8	2.9	1.2	< 0.1	0.1	1.5	3.69
H13110098-018	STS-PT-2013-18	0	0	0.326	0.184	72	0.088	1.4	0.3	0.2	< 0.1	< 0.1	1.0	0.09
H13110098-019	STS-PT-2013-19	0	0	0.883	0.393	154	0.078	4.4	0.9	0.4	< 0.1	0.4	0.7	0.30
H13110098-020	STS-PT-2013-20	0	0	1.12	0.500	195	0.149	29.0	1.1	0.5	< 0.1	< 0.1	2.3	22.3
H13110098-021	STS-PT-2013-21	0	0	0.510	0.275	108	0.078	1.8	0.4	0.3	< 0.1	< 0.1	1.2	0.10
H13110098-022	STS-PT-2013-22	0	0	0.946	0.255	100	0.158	5.4	0.8	0.2	< 0.1	< 0.1	3.3	0.24
H13110098-023	STS-PT-2013-23	0	0	0.381	0.235	92	0.060	1.6	0.3	0.2	< 0.1	< 0.1	0.8	0.16
H13110098-024	STS-PT-2013-24	0	0	1.29	0.713	278	0.049	25.2	1.3	0.7	< 0.1	< 0.1	1.4	2.41
H13110098-025	STS-PT-2013-25	0	0	1.79	1.89	737	0.061	37.5	1.8	1.9	< 0.1	< 0.1	1.1	0.91
H13110098-026	STS-PT-2013-26	0	0	1.88	0.562	220	0.086	5.9	1.9	0.6	< 0.1	< 0.1	2.3	18.1
H13110098-027	STS-PT-2013-27	0	0	3.34	1.15	449	0.074	21.5	3.4	1.1	< 0.1	< 0.1	1.3	0.45
H13110098-028	STS-PT-2013-28	0	0	0.609	0.472	184	0.073	2.3	0.5	0.5	< 0.1	0.1	1.0	1.68
H13110098-029	STS-PT-2013-29	0	0	0.361	0.149	58	0.054	1.9	0.3	0.2	< 0.1	< 0.1	0.3	0.20
H13110098-030	STS-PT-2013-30	0	0	0.341	0.156	61	0.053	1.8	0.3	0.2	< 0.1	< 0.1	0.5	< 0.01
H13110098-031	STS-PT-2013-31	0	0	6.62	0.759	297	0.537	21.7	7.0	0.7	0.4	< 0.1	1.2	1.39
H13110098-032	STS-PT-2013-32	0	0	1.38	1.77	692	0.139	6.4	1.4	1.8	0.1	0.4	1.9	0.60
H13110098-033	STS-PT-2013-33	0	0	1.57	0.018	7	0.113	114	0.5	< 0.1	< 0.1	75.4	2.4	< 0.01
H13110098-034	Dup1	0	0	1.21	0.465	182	0.090	5.2	1.2	0.5	< 0.1	0.8	0.8	0.57
H13110098-035	Dup2	0	0	1.75	0.020	8	0.078	114	0.4	< 0.1	< 0.1	68.2	2.2	< 0.01
H13110098-036	Dup3	0	0	1.07	0.600	234	0.064	27.8	1.0	0.6	< 0.1	< 0.1	2.0	21.7

LABORATORY ANALYTICAL REPORT

Prepared by Helena, MT Branch

Client: Chino Mine Company
Project: Phytotoxicity Soil Samples
Workorder: H13110098

Revised Date: 12/20/13
Report Date: 12/18/13
Date Received: 11/01/13

		Analysis		Olsen Phos-Olsen	P-Bray	PO4	NO3	Cu-CACL2	Al-DTPA	Fe-DTPA	Mn-DTPA	Cu-T	Organic Carbon,	Conductivity , CaCl2
		Units		mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mmhos/cm
Sample ID	**Client Sample ID**	**Up**	**Low**	**Results**	**Results**	**Results**	**Results**	**Results**	**Results**	**Results**	**Results**	**Results**	**Results**	**Results**
H13110098-001	STS-PT-2013-1	0	0		68.4	0.2	4	27.9	5.2	37	24.3	1030	6	1.5
H13110098-002	STS-PT-2013-2	0	0	16		< 0.1	2	0.3	1.7	26	2.9	809	12	1.8
H13110098-003	STS-PT-2013-3	0	0		17.7	< 0.2	8	0.4	1.4	18	31.0	189	10	1.4
H13110098-004	STS-PT-2013-4	0	0		30.2	< 0.2	23	0.3	1.4	38	18.9	193	24	1.6
H13110098-005	STS-PT-2013-5	0	0		16.0	< 0.1	9	0.4	1.3	13	7.9	632	18	1.7
H13110098-006	STS-PT-2013-6	0	0		6.3	< 0.1	< 1	3.5	27.6	252	3.4	202	14	1.5
H13110098-007	STS-PT-2013-7	0	0		16.2	< 1	2	10.9	27.3	314	16.8	279	14	2.4
H13110098-008	STS-PT-2013-8	0	0		52.3	0.9	3	0.5	1.9	32	34.0	626	15	1.7
H13110098-009	STS-PT-2013-9	0	0		15.1	< 0.1	3	114	5.0	9	8.7	1350	4	1.6
H13110098-010	STS-PT-2013-10	0	0		5.2	< 0.2	1	9.9	12.8	29	8.0	557	8	1.7
H13110098-011	STS-PT-2013-11	0	0		20.3	< 1	1	8.4	79.2	58	2.4	189	5	1.5
H13110098-012	STS-PT-2013-12	0	0	6		< 0.2	< 1	0.2	1.0	24	7.3	449	15	1.5
H13110098-013	STS-PT-2013-13	0	0		56.9	2	3	0.4	2.6	53	23.2	360	11	1.5
H13110098-014	STS-PT-2013-14	0	0		57.7	< 0.1	17	36.3	57.4	24	43.4	725	10	2.8
H13110098-015	STS-PT-2013-15	0	0		41.7	3	< 5	0.6	2.2	31	19.2	501	17	1.5
H13110098-016	STS-PT-2013-16	0	0		22.3	0.9	4	1.0	1.3	27	19.4	1200	23	1.6
H13110098-017	STS-PT-2013-17	0	0	9		0.2	6	0.4	1.5	9	2.8	1120	14	1.5
H13110098-018	STS-PT-2013-18	0	0		2.9	< 0.1	< 1	25.3	34.5	37	4.3	311	6	1.5
H13110098-019	STS-PT-2013-19	0	0		8.9	< 0.1	3	28.0	5.2	30	16.6	714	4	1.5
H13110098-020	STS-PT-2013-20	0	0	5		0.1	2	0.2	0.7	3	4.5	131	22	1.5
H13110098-021	STS-PT-2013-21	0	0		6.3	< 1	< 1	2.3	93.9	18	3.3	61	7	1.6
H13110098-022	STS-PT-2013-22	0	0		11.8	< 0.1	< 1	10.7	46.9	95	18.8	248	27	2.6
H13110098-023	STS-PT-2013-23	0	0		30.9	< 0.1	2	9.1	53.8	55	6.1	253	4	1.6
H13110098-024	STS-PT-2013-24	0	0	7		0.7	2	< 0.1	1.3	6	4.2	56	11	1.7
H13110098-025	STS-PT-2013-25	0	0	9		1.4	2	0.2	1.4	4	3.9	130	12	1.6
H13110098-026	STS-PT-2013-26	0	0	7		< 0.2	2	0.1	0.9	4	3.9	109	15	1.6
H13110098-027	STS-PT-2013-27	0	0		9.5	1	1	2.4	3.5	34	23.6	164	12	1.6
H13110098-028	STS-PT-2013-28	0	0	6		< 0.2	3	0.2	0.9	6	4.0	58	12	1.6
H13110098-029	STS-PT-2013-29	0	0		27.9	1	1	11.2	6.5	26	48.3	234	6	1.6
H13110098-030	STS-PT-2013-30	0	0		11.2	< 0.1	3	4.0	18.2	137	4.5	152	7	1.8
H13110098-031	STS-PT-2013-31	0	0		11.0	5	10	0.2	1.2	20	6.8	153	23	1.7
H13110098-032	STS-PT-2013-32	0	0		20.9	1	7	2.4	11.3	38	16.4	816	15	1.6
H13110098-033	STS-PT-2013-33	0	0		5.5	1.7	2	3410	0.9	< 1	67.8	95300	13	5.0
H13110098-034	Dup1	0	0		72.0	< 1	4	31.8	6.2	39	23.0	879	5	1.7
H13110098-035	Dup2	0	0		5.7	1	2	5620	1.5	< 1	66.6	92500	13	5.8
H13110098-036	Dup3	0	0	7		< 0.1	1	1.6	1.1	4	5.4	174	19	2.1

LABORATORY ANALYTICAL REPORT

Prepared by Helena, MT Branch

Client: Chino Mine Company
Project: Phytotoxicity Soil Samples
Workorder: H13110098

Revised Date: 12/20/13
Report Date: 12/18/13
Date Received: 11/01/13

		Analysis		Millivolts	pCu, Measured	ph, CaCl2
		Units		mV	s_u_	s_u_
Sample ID	**Client Sample ID**	**Up**	**Low**	**Results**	**Results**	**Results**
H13110098-001	STS-PT-2013-1	0	0	101	3.11	4.0
H13110098-002	STS-PT-2013-2	0	0	17	6.57	7.1
H13110098-003	STS-PT-2013-3	0	0	37	5.76	5.6
H13110098-004	STS-PT-2013-4	0	0	26	6.21	5.1
H13110098-005	STS-PT-2013-5	0	0	12	6.79	6.1
H13110098-006	STS-PT-2013-6	0	0	82	3.88	3.4
H13110098-007	STS-PT-2013-7	0	0	89	3.59	3.2
H13110098-008	STS-PT-2013-8	0	0	55	4.99	5.5
H13110098-009	STS-PT-2013-9	0	0	125	2.09	4.0
H13110098-010	STS-PT-2013-10	0	0	95	3.87	4.5
H13110098-011	STS-PT-2013-11	0	0	92	3.95	3.7
H13110098-012	STS-PT-2013-12	0	0	4	7.44	6.2
H13110098-013	STS-PT-2013-13	0	0	54	5.46	5.0
H13110098-014	STS-PT-2013-14	0	0	106	3.43	3.7
H13110098-015	STS-PT-2013-15	0	0	58	5.30	5.5
H13110098-016	STS-PT-2013-16	0	0	54	5.48	5.4
H13110098-017	STS-PT-2013-17	0	0	-2	7.66	6.8
H13110098-018	STS-PT-2013-18	0	0	106	3.40	3.8
H13110098-019	STS-PT-2013-19	0	0	109	3.32	4.3
H13110098-020	STS-PT-2013-20	0	0	-30	8.79	6.5
H13110098-021	STS-PT-2013-21	0	0	78	4.55	3.5
H13110098-022	STS-PT-2013-22	0	0	91	4.02	3.6
H13110098-023	STS-PT-2013-23	0	0	94	3.89	3.8
H13110098-024	STS-PT-2013-24	0	0	-25	8.57	6.7
H13110098-025	STS-PT-2013-25	0	0	-22	8.49	6.6
H13110098-026	STS-PT-2013-26	0	0	-26	8.63	6.7
H13110098-027	STS-PT-2013-27	0	0	78	4.54	4.9
H13110098-028	STS-PT-2013-28	0	0	-22	8.49	6.6
H13110098-029	STS-PT-2013-29	0	0	98	3.76	4.1
H13110098-030	STS-PT-2013-30	0	0	86	4.21	3.4
H13110098-031	STS-PT-2013-31	0	0	38	6.10	5.4
H13110098-032	STS-PT-2013-32	0	0	76	4.61	5.4
H13110098-033	STS-PT-2013-33	0	0	152	1.04	4.3
H13110098-034	Dup1	0	0	110	3.28	4.6
H13110098-035	Dup2	0	0	154	0.95	4.2
H13110098-036	Dup3	0	0	4	7.36	7.5

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: Chino Mine Company **Report Date:** 12/18/13

Project: Phytotoxicity Soil Samples **Work Order:** H13110098

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: A5310 C									Analytical Run: SUB-C181718
Sample ID: ICV-7684	Initial Calibration Verification Standard								12/13/13 16:37
Organic Carbon, Dissolved (DOC)	10.1	mg/L	0.50	101	90	110			
Sample ID: CCV-7343	Continuing Calibration Verification Standard								12/13/13 21:50
Organic Carbon, Dissolved (DOC)	10.1	mg/L	0.50	101	90	110			
Method: A5310 C									Batch: C_40070
Sample ID: MBLK	Method Blank				Run: SUB-C181718				12/13/13 16:26
Organic Carbon, Dissolved (DOC)	ND	mg/L	0.04						
Sample ID: MB-22702	Method Blank				Run: SUB-C181718				12/13/13 16:47
Organic Carbon, Dissolved (DOC)	0.6	mg/kg	0.04						
Sample ID: H13110098-008A	Sample Matrix Spike				Run: SUB-C181718				12/13/13 18:31
Organic Carbon, Dissolved (DOC)	65.8	mg/kg	1.0	102	85	115			
Sample ID: H13110098-008A	Sample Matrix Spike Duplicate				Run: SUB-C181718				12/13/13 18:42
Organic Carbon, Dissolved (DOC)	66.3	mg/kg	1.0	103	85	115	0.9	10	
Sample ID: H13110098-010A	Sample Duplicate				Run: SUB-C181718				12/13/13 20:05
Organic Carbon, Dissolved (DOC)	8.30	mg/kg	1.0				1.3	10	
Sample ID: H13110098-017A	Sample Matrix Spike				Run: SUB-C181718				12/13/13 21:27
Organic Carbon, Dissolved (DOC)	65.5	mg/kg	1.0	103	85	115			
Sample ID: H13110098-017A	Sample Matrix Spike Duplicate				Run: SUB-C181718				12/13/13 21:39
Organic Carbon, Dissolved (DOC)	65.5	mg/kg	1.0	103	85	115	0.1	10	
Sample ID: H13110098-020A	Sample Duplicate				Run: SUB-C181718				12/13/13 23:02
Organic Carbon, Dissolved (DOC)	19.7	mg/kg	1.0				10	10	R
Method: A5310 C									Batch: C_40071
Sample ID: MB-22703	Method Blank				Run: SUB-C181718				12/13/13 23:11
Organic Carbon, Dissolved (DOC)	0.8	mg/kg	0.04						
Sample ID: H13110098-024A	Sample Matrix Spike				Run: SUB-C181718				12/14/13 00:14
Organic Carbon, Dissolved (DOC)	63.3	mg/kg	1.0	105	85	115			
Sample ID: H13110098-024A	Sample Matrix Spike Duplicate				Run: SUB-C181718				12/14/13 00:25
Organic Carbon, Dissolved (DOC)	63.1	mg/kg	1.0	105	85	115	0.3	10	
Sample ID: LCS-7684	Laboratory Control Sample				Run: SUB-C181718				12/14/13 00:36
Organic Carbon, Dissolved (DOC)	10.1	mg/L	0.50	101	90	110			

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

R - RPD exceeds advisory limit.

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: Chino Mine Company
Report Date: 12/18/13
Project: Phytotoxicity Soil Samples
Work Order: H13110098

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: **A5310 C**									Analytical Run: SUB-C181773
Sample ID: **ICV-7684**	Initial Calibration Verification Standard								12/16/13 07:47
Organic Carbon, Dissolved (DOC)	10.2	mg/L	0.50	102	90	110			
Sample ID: **CCV-7343**	Continuing Calibration Verification Standard								12/16/13 07:58
Organic Carbon, Dissolved (DOC)	10.1	mg/L	0.50	101	90	110			
Sample ID: **CCV-7343**	Continuing Calibration Verification Standard								12/16/13 10:44
Organic Carbon, Dissolved (DOC)	10.2	mg/L	0.50	102	90	110			
Sample ID: **CCV-7343**	Continuing Calibration Verification Standard								12/16/13 13:39
Organic Carbon, Dissolved (DOC)	10.2	mg/L	0.50	102	90	110			
Method: **A5310 C**									Batch: C_40070
Sample ID: **MB-22702**	Method Blank				Run: SUB-C181773				12/16/13 14:20
Organic Carbon, Dissolved (DOC)	0.7	mg/kg	0.04						
Sample ID: **H13110098-020A**	Sample Matrix Spike				Run: SUB-C181773				12/16/13 15:03
Organic Carbon, Dissolved (DOC)	74.2	mg/kg	1.0	104	85	115			
Sample ID: **H13110098-020A**	Sample Matrix Spike Duplicate				Run: SUB-C181773				12/16/13 15:14
Organic Carbon, Dissolved (DOC)	74.5	mg/kg	1.0	104	85	115	0.4	10	
Method: **A5310 C**									Batch: C_40071
Sample ID: **MBLK**	Method Blank				Run: SUB-C181773				12/16/13 08:08
Organic Carbon, Dissolved (DOC)	ND	mg/L	0.04						
Sample ID: **MB-22703**	Method Blank				Run: SUB-C181773				12/16/13 08:39
Organic Carbon, Dissolved (DOC)	0.9	mg/kg	0.04						
Sample ID: **H13110098-030A**	Sample Duplicate				Run: SUB-C181773				12/16/13 09:59
Organic Carbon, Dissolved (DOC)	6.89	mg/kg	1.0				0.0	10	
Sample ID: **H13110098-031A**	Sample Matrix Spike				Run: SUB-C181773				12/16/13 10:21
Organic Carbon, Dissolved (DOC)	75.0	mg/kg	1.0	103	85	115			
Sample ID: **H13110098-031A**	Sample Matrix Spike Duplicate				Run: SUB-C181773				12/16/13 10:32
Organic Carbon, Dissolved (DOC)	75.5	mg/kg	1.0	104	85	115	0.6	10	
Sample ID: **H13110098-036A**	Sample Duplicate				Run: SUB-C181773				12/16/13 12:15
Organic Carbon, Dissolved (DOC)	19.5	mg/kg	1.0				0.4	10	
Sample ID: **H13120008-003A**	Sample Matrix Spike				Run: SUB-C181773				12/16/13 13:06
Organic Carbon, Dissolved (DOC)	59.2	mg/kg	1.0	106	85	115			
Sample ID: **H13120008-003A**	Sample Matrix Spike Duplicate				Run: SUB-C181773				12/16/13 13:17
Organic Carbon, Dissolved (DOC)	59.6	mg/kg	1.0	106	85	115	0.6	10	

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: Chino Mine Company **Report Date:** 12/18/13
Project: Phytotoxicity Soil Samples **Work Order:** H13110098

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: A5310 C								Batch: C_40071	
Sample ID: LCS-7684	Laboratory Control Sample				Run: SUB-C181773			12/16/13 13:28	
Organic Carbon, Dissolved (DOC)	10.3	mg/L	0.50	103	90	110			

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: Chino Mine Company **Report Date:** 12/18/13
Project: Phytotoxicity Soil Samples **Work Order:** H13110098

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: arcadis SOP									Batch: 131211_1_PH-S-PASTE
Sample ID: LCS-22738	Laboratory Control Sample				Run: MISC SOILS_131216B				12/17/13 09:16
Conductivity, CaCl2	2.15	mmhos/cm	0.10	82	70	130			
pCu, Measured	8.89	s.u.	0.010	102	70	130			
ph, CaCl2	7.31	s.u.	0.10	101	70	130			
Sample ID: H13110098-010Adup	Sample Duplicate				Run: MISC SOILS_131216B				12/17/13 09:29
Conductivity, CaCl2	1.65	mmhos/cm	0.10						
Millivolts	94.0	mV							
pCu, Measured	3.89	s.u.	0.010						
ph, CaCl2	4.64	s.u.	0.10						
Sample ID: H13110098-020Adup	Sample Duplicate				Run: MISC SOILS_131216B				12/17/13 09:44
Conductivity, CaCl2	1.51	mmhos/cm	0.10						
Millivolts	-32.9	mV							
pCu, Measured	8.90	s.u.	0.010						
ph, CaCl2	6.51	s.u.	0.10						
Sample ID: LCS-22739	Laboratory Control Sample				Run: MISC SOILS_131216B				12/17/13 09:47
Conductivity, CaCl2	2.49	mmhos/cm	0.10	95	70	130			
pCu, Measured	9.15	s.u.	0.010	105	70	130			
ph, CaCl2	7.02	s.u.	0.10	97	70	130			
Sample ID: H13110098-030Adup	Sample Duplicate				Run: MISC SOILS_131216B				12/17/13 09:59
Conductivity, CaCl2	1.77	mmhos/cm	0.10						
Millivolts	85.3	mV							
pCu, Measured	4.24	s.u.	0.010						
ph, CaCl2	3.43	s.u.	0.10						
Sample ID: H13110098-036Adup	Sample Duplicate				Run: MISC SOILS_131216B				12/17/13 10:07
Millivolts	-10.1	mV	0.10						
pCu, Measured	8.00	s.u.							
Method: arcadis SOP									Batch: 131216_1_PH-S-PASTE
Sample ID: LCS-22839	Laboratory Control Sample				Run: MISC SOILS_131216B				12/17/13 10:20
Conductivity, CaCl2	2.86	mmhos/cm	0.10	109	70	130			
pCu, Measured	8.43	s.u.	0.010	97	70	130			
ph, CaCl2	7.36	s.u.	0.10	101	70	130			
Sample ID: H13110098-036Adup	Sample Duplicate				Run: MISC SOILS_131216B				12/17/13 10:22
Conductivity, CaCl2	2.10	mmhos/cm	0.10						
Millivolts	-22.8	mV							
pCu, Measured	8.52	s.u.	0.010						
ph, CaCl2	7.46	s.u.	0.10						

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: Chino Mine Company **Report Date:** 12/18/13
Project: Phytotoxicity Soil Samples **Work Order:** H13110098

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: **arcadis SOP**						Batch: 131216_1_PH-S-PASTE			
Sample ID: **LCS-22754**	Laboratory Control Sample				Run: MISC SOILS_131216B				12/17/13 10:28
Conductivity, CaCl2	2.96	mmhos/cm	0.10	113	70	130			
pCu, Measured	8.34	s.u.	0.010	96	70	130			
ph, CaCl2	7.37	s.u.	0.10	101	70	130			

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: Chino Mine Company **Report Date:** 12/18/13

Project: Phytotoxicity Soil Samples **Work Order:** H13110098

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: ASA10-3									Batch: 22413
Sample ID: MB-22413	Method Blank				Run: MAN-TECH_131120B				11/20/13 16:36
Alkalinity, sat paste	1	mg/L	0.1						
Bicarbonate, sat paste	2	mg/L	0.5						
Alkalinity, sat. paste	0.03	meq/L	0.002						
Bicarbonate, sat. paste	0.03	meq/L	0.008						
Sample ID: LCS-22413	Laboratory Control Sample				Run: MAN-TECH_131120B				11/20/13 16:42
Alkalinity, sat paste	228	mg/L	1.0	132	70	135			
Bicarbonate, sat paste	278	mg/L	1.0	132	70	135			
Alkalinity, sat. paste	4.56	meq/L	0.020	132	70	135			
Bicarbonate, sat. paste	4.56	meq/L	0.016	132	70	135			
Sample ID: H13110098-010ADUP	Sample Duplicate				Run: MAN-TECH_131120B				11/20/13 17:33
Alkalinity, sat paste	21.1	mg/L	1.0				3.6	30	
Bicarbonate, sat paste	25.8	mg/L	1.0				3.6	30	
Alkalinity, sat. paste	0.422	meq/L	0.020				3.6	30	
Bicarbonate, sat. paste	0.422	meq/L	0.016				3.6	30	
Sample ID: H13110098-020ADUP	Sample Duplicate				Run: MAN-TECH_131120B				11/20/13 18:28
Alkalinity, sat paste	231	mg/L	1.0				8.7	30	
Bicarbonate, sat paste	282	mg/L	1.0				8.7	30	
Alkalinity, sat. paste	4.62	meq/L	0.020				8.7	30	
Bicarbonate, sat. paste	4.62	meq/L	0.016				8.7	30	
Method: ASA10-3									Batch: 22414
Sample ID: MB-22414	Method Blank				Run: MAN-TECH_131120B				11/20/13 18:40
Alkalinity, sat paste	1	mg/L	0.1						
Bicarbonate, sat paste	1	mg/L	0.5						
Alkalinity, sat. paste	0.02	meq/L	0.002						
Bicarbonate, sat. paste	0.02	meq/L	0.008						
Sample ID: LCS-22414	Laboratory Control Sample				Run: MAN-TECH_131120B				11/20/13 18:46
Alkalinity, sat paste	211	mg/L	1.0	122	70	135			
Bicarbonate, sat paste	257	mg/L	1.0	122	70	135			
Alkalinity, sat. paste	4.21	meq/L	0.020	122	70	135			
Bicarbonate, sat. paste	4.21	meq/L	0.016	122	70	135			
Sample ID: H13110098-030ADUP	Sample Duplicate				Run: MAN-TECH_131120B				11/20/13 19:40
Alkalinity, sat paste	ND	mg/L	1.0					30	
Bicarbonate, sat paste	ND	mg/L	1.0					30	
Alkalinity, sat. paste	ND	meq/L	0.020					30	
Bicarbonate, sat. paste	ND	meq/L	0.016					30	
Sample ID: H13110098-036ADUP	Sample Duplicate				Run: MAN-TECH_131120B				11/20/13 20:13
Alkalinity, sat paste	191	mg/L	1.0				3.9	30	

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: Chino Mine Company **Report Date:** 12/18/13

Project: Phytotoxicity Soil Samples **Work Order:** H13110098

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: ASA10-3								Batch: 22414	
Sample ID: H13110098-036ADUP	Sample Duplicate				Run: MAN-TECH_131120B			11/20/13 20:13	
Bicarbonate, sat paste	233	mg/L	1.0				3.9	30	
Alkalinity, sat. paste	3.81	meq/L	0.020				3.9	30	
Bicarbonate, sat. paste	3.81	meq/L	0.016				3.9	30	

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: Chino Mine Company **Report Date:** 12/18/13

Project: Phytotoxicity Soil Samples **Work Order:** H13110098

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: ASA15-5									Batch: R93367
Sample ID: H13110098-030ADUP	Sample Duplicate				Run: SOIL HYDROMETER_131209				12/06/13 08:24
Sand	68.0	%	1.0				1.5	20	
Silt	19.0	%	1.0				5.1	20	
Clay	13.0	%	1.0				0.0	20	
Texture	ND	%	1.0						
Sample ID: H13110098-036ADUP	Sample Duplicate				Run: SOIL HYDROMETER_131209				12/06/13 08:24
Sand	46.0	%	1.0				4.3	20	
Silt	33.0	%	1.0				6.2	20	
Clay	21.0	%	1.0				0.0	20	
Texture	ND	%	1.0						
Sample ID: LCS-22721	Laboratory Control Sample				Run: SOIL HYDROMETER_131209				12/06/13 08:24
Sand	36.0	%	1.0	106	70	130			
Silt	33.0	%	1.0	94	70	130			
Clay	31.0	%	1.0	100	70	130			
Sample ID: H13110098-010ADUP	Sample Duplicate				Run: SOIL HYDROMETER_131209				12/05/13 08:15
Sand	72.0	%	1.0				1.4	20	
Silt	18.0	%	1.0				5.7	20	
Clay	10.0	%	1.0				0.0	20	
Texture	ND	%	1.0						
Sample ID: H13110098-020ADUP	Sample Duplicate				Run: SOIL HYDROMETER_131209				12/05/13 08:15
Sand	46.0	%	1.0				0.0	20	
Silt	34.0	%	1.0				0.0	20	
Clay	20.0	%	1.0				0.0	20	
Texture	ND	%	1.0						
Sample ID: H13110098-027ADUP	Sample Duplicate				Run: SOIL HYDROMETER_131209				12/05/13 08:15
Sand	58.0	%	1.0				0.0	20	
Silt	20.0	%	1.0				0.0	20	
Clay	22.0	%	1.0				0.0	20	
Texture	ND	%	1.0						

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: Chino Mine Company

Project: Phytotoxicity Soil Samples

Report Date: 12/18/13

Work Order: H13110098

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: ASA24-5					Analytical Run: FIA202-HE_131115A				
Sample ID: ICV	Initial Calibration Verification Standard								11/15/13 10:02
Phosphorus, Olsen	5.0	mg/kg	1.0	99	90	110			
Sample ID: ICB	Initial Calibration Blank, Instrument Blank								11/15/13 10:06
Phosphorus, Olsen	0.024	mg/kg	1.0		0	0			
Method: ASA24-5									Batch: 22437
Sample ID: LCS-22437	Laboratory Control Sample				Run: FIA202-HE_131115A				11/15/13 10:09
Phosphorus, Olsen	46	mg/kg	1.0	103	70	130			
Sample ID: MB-22437	Method Blank				Run: FIA202-HE_131115A				11/15/13 10:10
Phosphorus, Olsen	0.8	mg/kg	0.05						
Sample ID: H13110098-002AMS	Sample Matrix Spike				Run: FIA202-HE_131115A				11/15/13 10:12
Phosphorus, Olsen	65	mg/kg	1.0	97	80	120			
Sample ID: H13110098-002AMSD	Sample Matrix Spike Duplicate				Run: FIA202-HE_131115A				11/15/13 10:13
Phosphorus, Olsen	65	mg/kg	1.0	97	80	120	0.2	20	
Sample ID: H13110098-020ADUP	Sample Duplicate				Run: FIA202-HE_131115A				11/15/13 10:17
Phosphorus, Olsen	5.0	mg/kg	1.0				6.5	30	
Sample ID: H13110098-036ADUP	Sample Duplicate				Run: FIA202-HE_131115A				11/15/13 10:23
Phosphorus, Olsen	5.6	mg/kg	1.0				16	30	

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: Chino Mine Company
Project: Phytotoxicity Soil Samples

Report Date: 12/18/13
Work Order: H13110098

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: ASA24-5									Analytical Run: FIA202-HE_131119B
Sample ID: ICV	Initial Calibration Verification Standard								11/19/13 16:26
Phosphorus	5.0	mg/kg	1.0	100	90	110			
Sample ID: ICB	Initial Calibration Blank, Instrument Blank								11/19/13 16:30
Phosphorus	0.012	mg/kg	1.0		0	0			
Sample ID: ICV	Initial Calibration Verification Standard								11/20/13 09:43
Phosphorus	4.9	mg/kg	1.0	98	90	110			
Sample ID: ICB	Initial Calibration Blank, Instrument Blank								11/20/13 09:47
Phosphorus	-0.00088	mg/kg	1.0		0	0			
Method: ASA24-5									Batch: 22495
Sample ID: MB-22495	Method Blank				Run: FIA202-HE_131119B				11/19/13 16:34
Phosphorus	ND	mg/kg	0.5						
Sample ID: H13110098-008AMS	Sample Matrix Spike				Run: FIA202-HE_131119B				11/19/13 16:42
Phosphorus	103	mg/kg	1.0	102	70	130			
Sample ID: H13110098-008AMSD	Sample Matrix Spike Duplicate				Run: FIA202-HE_131119B				11/19/13 16:43
Phosphorus	104	mg/kg	1.0	104	70	130			
Sample ID: H13110098-010ADUP	Sample Duplicate				Run: FIA202-HE_131119B				11/19/13 16:47
Phosphorus	5.1	mg/kg	1.0				1.7	30	
Sample ID: H13110098-023AMS	Sample Matrix Spike				Run: FIA202-HE_131119B				11/19/13 17:01
Phosphorus	79.7	mg/kg	1.0	97	70	130			
Sample ID: H13110098-023AMSD	Sample Matrix Spike Duplicate				Run: FIA202-HE_131119B				11/19/13 17:02
Phosphorus	80.3	mg/kg	1.0	99	70	130			
Sample ID: H13110098-031ADUP	Sample Duplicate				Run: FIA202-HE_131119B				11/19/13 17:09
Phosphorus	11.6	mg/kg	1.0				4.9	30	
Sample ID: H13110098-034AMS	Sample Matrix Spike				Run: FIA202-HE_131119B				11/19/13 17:13
Phosphorus	127	mg/kg	1.0	109	70	130			
Sample ID: H13110098-034AMSD	Sample Matrix Spike Duplicate				Run: FIA202-HE_131119B				11/19/13 17:14
Phosphorus	127	mg/kg	1.0	110	70	130			
Sample ID: LCS-22495	Laboratory Control Sample				Run: FIA202-HE_131119B				11/20/13 09:48
Phosphorus	98.3	mg/kg	2.0	98	80	120			

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: Chino Mine Company **Report Date:** 12/18/13
Project: Phytotoxicity Soil Samples **Work Order:** H13110098

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: ASA24-5.3					Analytical Run: FIA202-HE_131210A				
Sample ID: ICV	Initial Calibration Verification Standard								12/10/13 13:44
Phosphate, Soluble	0.243	mg/kg	0.10	97	90	110			
Sample ID: CCV	Continuing Calibration Verification Standard								12/10/13 13:46
Phosphate, Soluble	0.0937	mg/kg	0.10	94	90	110			
Sample ID: CCV	Continuing Calibration Verification Standard								12/10/13 14:05
Phosphate, Soluble	0.0916	mg/kg	0.10	92	90	110			
Sample ID: CCV	Continuing Calibration Verification Standard								12/10/13 14:20
Phosphate, Soluble	0.0932	mg/kg	0.10	93	90	110			
Sample ID: CCV	Continuing Calibration Verification Standard								12/10/13 14:34
Phosphate, Soluble	0.0938	mg/kg	0.10	94	90	110			
Method: ASA24-5.3									Batch: 22694
Sample ID: MB-22694	Method Blank				Run: FIA202-HE_131210A				12/10/13 13:49
Phosphate, Soluble	ND	mg/kg	0.1						
Sample ID: LCS-22694	Laboratory Control Sample				Run: FIA202-HE_131210A				12/10/13 13:50
Phosphate, Soluble	0.336	mg/kg	0.10	90	70	130			
Sample ID: H13110098-007AMS	Sample Matrix Spike				Run: FIA202-HE_131210A				12/10/13 13:58
Phosphate, Soluble	3.72	mg/kg	1.0	112	70	130			
Sample ID: H13110098-007AMSD	Sample Matrix Spike Duplicate				Run: FIA202-HE_131210A				12/10/13 13:59
Phosphate, Soluble	3.59	mg/kg	1.0	108	70	130	3.7	30	
Sample ID: H13110098-010ADUP	Sample Duplicate				Run: FIA202-HE_131210A				12/10/13 14:03
Phosphate, Soluble	ND	mg/kg	0.20					30	
Sample ID: H13110098-011AMS	Sample Matrix Spike				Run: FIA202-HE_131210A				12/10/13 14:07
Phosphate, Soluble	3.99	mg/kg	1.0	120	70	130			
Sample ID: H13110098-011AMSD	Sample Matrix Spike Duplicate				Run: FIA202-HE_131210A				12/10/13 14:08
Phosphate, Soluble	3.90	mg/kg	1.0	118	70	130	2.2	30	
Sample ID: H13110098-020ADUP	Sample Duplicate				Run: FIA202-HE_131210A				12/10/13 14:19
Phosphate, Soluble	0.104	mg/kg	0.10				0.3	30	
Method: ASA24-5.3									Batch: 22695
Sample ID: MB-22695	Method Blank				Run: FIA202-HE_131210A				12/10/13 14:22
Phosphate, Soluble	ND	mg/kg	0.1						
Sample ID: LCS-22695	Laboratory Control Sample				Run: FIA202-HE_131210A				12/10/13 14:23
Phosphate, Soluble	0.359	mg/kg	0.20	96	70	130			

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: Chino Mine Company
Project: Phytotoxicity Soil Samples

Report Date: 12/18/13
Work Order: H13110098

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: **ASA24-5.3**								Batch: 22695	
Sample ID: **H13110098-021AMS**	Sample Matrix Spike				Run: FIA202-HE_131210A			12/10/13 14:25	
Phosphate, Soluble	3.97	mg/kg	1.0	120	70	130			
Sample ID: **H13110098-021AMSD**	Sample Matrix Spike Duplicate				Run: FIA202-HE_131210A			12/10/13 14:26	
Phosphate, Soluble	3.99	mg/kg	1.0	120	70	130	0.5	30	
Sample ID: **H13110098-030ADUP**	Sample Duplicate				Run: FIA202-HE_131210A			12/10/13 14:38	
Phosphate, Soluble	ND	mg/kg	0.10					30	
Sample ID: **H13110098-034AMS**	Sample Matrix Spike				Run: FIA202-HE_131210A			12/10/13 14:43	
Phosphate, Soluble	4.12	mg/kg	1.0	124	70	130			
Sample ID: **H13110098-034AMSD**	Sample Matrix Spike Duplicate				Run: FIA202-HE_131210A			12/10/13 14:45	
Phosphate, Soluble	4.19	mg/kg	1.0	126	70	130	1.8	30	
Sample ID: **H13110098-036ADUP**	Sample Duplicate				Run: FIA202-HE_131210A			12/10/13 14:48	
Phosphate, Soluble	0.104	mg/kg	0.10					30	

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: Chino Mine Company **Report Date:** 12/18/13
Project: Phytotoxicity Soil Samples **Work Order:** H13110098

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: ASA29-3									Batch: 22600
Sample ID: LCS-226001312020839	Laboratory Control Sample				Run: MISC SOILS_131201A				12/02/13 08:39
Organic Matter	1.43	%	0.17	104	70	130			
Sample ID: H13110098-010ADUP	Sample Duplicate				Run: MISC SOILS_131201A				12/02/13 08:39
Organic Matter	0.783	%	0.17						
Sample ID: H13110098-020ADUP	Sample Duplicate				Run: MISC SOILS_131201A				12/02/13 08:39
Organic Matter	2.50	%	0.17						
Method: ASA29-3									Batch: 22601
Sample ID: LCS-226011312020839	Laboratory Control Sample				Run: MISC SOILS_131201A				12/02/13 08:39
Organic Matter	1.34	%	0.17	98	70	130			
Sample ID: H13110098-030ADUP	Sample Duplicate				Run: MISC SOILS_131201A				12/02/13 08:39
Organic Matter	0.499	%	0.17						
Sample ID: H13110098-036ADUP	Sample Duplicate				Run: MISC SOILS_131201A				12/02/13 08:39
Organic Matter	2.03	%	0.17						

Qualifiers:

RL - Analyte reporting limit.	ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: Chino Mine Company **Report Date:** 12/18/13
Project: Phytotoxicity Soil Samples **Work Order:** H13110098

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: ASA33-8									Analytical Run: FIA203-HE_131203A
Sample ID: ICV	Initial Calibration Verification Standard								12/03/13 08:31
Nitrate as N, KCL Extract	1.0	mg/kg	1.0	104	90	110			
Sample ID: CCV	Continuing Calibration Verification Standard								12/03/13 08:33
Nitrate as N, KCL Extract	0.48	mg/kg	1.0	96	90	110			
Sample ID: ICB	Initial Calibration Blank, Instrument Blank								12/03/13 08:34
Nitrate as N, KCL Extract	-0.0096	mg/kg	1.0		0	0			
Sample ID: CCV	Continuing Calibration Verification Standard								12/03/13 08:56
Nitrate as N, KCL Extract	0.49	mg/kg	1.0	98	90	110			
Sample ID: CCV	Continuing Calibration Verification Standard								12/03/13 09:12
Nitrate as N, KCL Extract	0.49	mg/kg	1.0	99	90	110			
Sample ID: CCV	Continuing Calibration Verification Standard								12/03/13 09:30
Nitrate as N, KCL Extract	0.50	mg/kg	1.0	99	90	110			
Method: ASA33-8									Batch: 22662
Sample ID: LCS-22662	Laboratory Control Sample				Run: FIA203-HE_131203A				12/03/13 08:37
Nitrate as N, KCL Extract	3.6	mg/kg	2.0	113	70	130			
Sample ID: MB-22662	Method Blank				Run: FIA203-HE_131203A				12/03/13 08:38
Nitrate as N, KCL Extract	ND	mg/kg	0.1						
Sample ID: H13110098-003AMS	Sample Matrix Spike				Run: FIA203-HE_131203A				12/03/13 08:43
Nitrate as N, KCL Extract	19	mg/kg	5.5	103	80	120			
Sample ID: H13110098-003AMSD	Sample Matrix Spike Duplicate				Run: FIA203-HE_131203A				12/03/13 08:44
Nitrate as N, KCL Extract	19	mg/kg	5.5	104	80	120	0.5	30	
Sample ID: H13110098-010ADUP	Sample Duplicate				Run: FIA203-HE_131203A				12/03/13 08:54
Nitrate as N, KCL Extract	1.3	mg/kg	1.0				1.4	30	
Sample ID: H13110098-020ADUP	Sample Duplicate				Run: FIA203-HE_131203A				12/03/13 09:09
Nitrate as N, KCL Extract	1.7	mg/kg	1.0				0.9	30	
Method: ASA33-8									Batch: 22663
Sample ID: H13110098-023AMS	Sample Matrix Spike				Run: FIA203-HE_131203A				12/03/13 09:17
Nitrate as N, KCL Extract	4.0	mg/kg	1.1	105	80	120			
Sample ID: H13110098-023AMSD	Sample Matrix Spike Duplicate				Run: FIA203-HE_131203A				12/03/13 09:18
Nitrate as N, KCL Extract	4.0	mg/kg	1.1	105	80	120	0.1	30	
Sample ID: H13110098-030ADUP	Sample Duplicate				Run: FIA203-HE_131203A				12/03/13 09:27
Nitrate as N, KCL Extract	2.8	mg/kg	1.0				1.3	30	

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: Chino Mine Company

Report Date: 12/18/13

Project: Phytotoxicity Soil Samples

Work Order: H13110098

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: ASA33-8									Batch: 22663
Sample ID: H13110098-036ADUP	Sample Duplicate				Run: FIA203-HE_131203A				12/03/13 09:38
Nitrate as N, KCL Extract	1.5	mg/kg	1.0				6.1	30	
Sample ID: LCS-22663	Laboratory Control Sample				Run: FIA203-HE_131203A				12/03/13 09:39
Nitrate as N, KCL Extract	3.8	mg/kg	2.0	119	70	130			
Sample ID: MB-22663	Method Blank				Run: FIA203-HE_131203A				12/03/13 09:40
Nitrate as N, KCL Extract	ND	mg/kg	0.1						

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: Chino Mine Company **Report Date:** 12/18/13

Project: Phytotoxicity Soil Samples **Work Order:** H13110098

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: ASAM10-3									Analytical Run: SOIL EC_131113A
Sample ID: ICV_1_131112_1	Initial Calibration Verification Standard								11/13/13 10:25
Conductivity, sat. paste	20.0	mmhos/cm	0.10	100	90	110			
Sample ID: ICV_1_131112_1	Initial Calibration Verification Standard								11/13/13 10:35
Conductivity, sat. paste	19.9	mmhos/cm	0.10	100	90	110			
Sample ID: ICV_1_131111_1	Initial Calibration Verification Standard								11/12/13 13:49
Conductivity, sat. paste	20.0	mmhos/cm	0.10	100	90	110			
Sample ID: CCV_1_131111_1	Continuing Calibration Verification Standard								11/13/13 09:51
Conductivity, sat. paste	1.42	mmhos/cm	0.10	101	90	110			
Sample ID: CCV1_1_131111_1	Continuing Calibration Verification Standard								11/13/13 09:51
Conductivity, sat. paste	5.14	mmhos/cm	0.10	103	90	110			
Sample ID: ICV_1_131111_1	Initial Calibration Verification Standard								11/13/13 09:52
Conductivity, sat. paste	20.0	mmhos/cm	0.10	100	90	110			
Sample ID: CCV_3_131111_1	Continuing Calibration Verification Standard								11/13/13 10:00
Conductivity, sat. paste	1.44	mmhos/cm	0.10	102	90	110			
Sample ID: CCV_1_131111_1	Continuing Calibration Verification Standard								11/13/13 10:07
Conductivity, sat. paste	1.43	mmhos/cm	0.10	101	90	110			
Sample ID: CCV1_1_131111_1	Continuing Calibration Verification Standard								11/13/13 10:08
Conductivity, sat. paste	5.06	mmhos/cm	0.10	101	90	110			
Sample ID: ICV_1_131111_1	Initial Calibration Verification Standard								11/13/13 10:08
Conductivity, sat. paste	20.0	mmhos/cm	0.10	100	90	110			
Sample ID: CCV_3_131111_1	Continuing Calibration Verification Standard								11/13/13 10:18
Conductivity, sat. paste	1.41	mmhos/cm	0.10	100	90	110			
Sample ID: ICV_1_131111_1	Initial Calibration Verification Standard								11/12/13 13:33
Conductivity, sat. paste	20.5	mmhos/cm	0.10	102	90	110			
Method: ASAM10-3									Batch: 131111_1_COND-S-PASTE
Sample ID: LCS-22405	Laboratory Control Sample				Run: SOIL EC_131113A				11/12/13 13:51
Conductivity, sat. paste	5.57	mmhos/cm	0.10	92	80	120			
Sample ID: H13110098-010ADUP	Sample Duplicate				Run: SOIL EC_131113A				11/13/13 09:59
Conductivity, sat. paste	0.576	mmhos/cm	0.10				1.3	20	
Sample ID: H13110098-020ADUP	Sample Duplicate				Run: SOIL EC_131113A				11/13/13 10:06
Conductivity, sat. paste	0.532	mmhos/cm	0.10				1.0	20	

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: Chino Mine Company
Project: Phytotoxicity Soil Samples

Report Date: 12/18/13
Work Order: H13110098

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: **ASAM10-3**									
Batch: 131111_1_COND-S-PASTE									
Sample ID: **H13110098-030ADUP**	Sample Duplicate				Run: SOIL EC_131113A				11/13/13 10:18
Conductivity, sat. paste	1.02	mmhos/cm	0.10				1.3	20	
Sample ID: **H13110098-036ADUP**	Sample Duplicate				Run: SOIL EC_131113A				11/13/13 10:23
Conductivity, sat. paste	0.479	mmhos/cm	0.10				2.0	20	

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: Chino Mine Company **Report Date:** 12/18/13

Project: Phytotoxicity Soil Samples **Work Order:** H13110098

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: ASAM10-3.2									Analytical Run: SOIL PH METER_131112A
Sample ID: ICV_1_131111_1	Initial Calibration Verification Standard								11/12/13 08:30
pH, sat. paste	9.99	s.u.	0.10	100	99	101			
Sample ID: CCV_1_131111_1	Continuing Calibration Verification Standard								11/12/13 09:14
pH, sat. paste	7.03	s.u.	0.10	100	98.6	101.4			
Sample ID: CCV1_1_131111_1	Continuing Calibration Verification Standard								11/12/13 09:15
pH, sat. paste	4.01	s.u.	0.10	100	97.5	102.5			
Sample ID: ICV_1_131111_1	Initial Calibration Verification Standard								11/12/13 09:15
pH, sat. paste	10.0	s.u.	0.10	100	99	101			
Sample ID: CCV_3_131111_1	Continuing Calibration Verification Standard								11/12/13 09:23
pH, sat. paste	7.01	s.u.	0.10	100	98.6	101.4			
Sample ID: CCV_1_131111_1	Continuing Calibration Verification Standard								11/12/13 09:34
pH, sat. paste	7.01	s.u.	0.10	100	98.6	101.4			
Sample ID: CCV1_1_131111_1	Continuing Calibration Verification Standard								11/12/13 09:34
pH, sat. paste	4.02	s.u.	0.10	100	97.5	102.5			
Sample ID: ICV_1_131111_1	Initial Calibration Verification Standard								11/12/13 09:35
pH, sat. paste	10.0	s.u.	0.10	100	99	101			
Sample ID: CCV_3_131111_1	Continuing Calibration Verification Standard								11/12/13 09:43
pH, sat. paste	7.02	s.u.	0.10	100	98.6	101.4			
Sample ID: ICV_1_131111_1	Initial Calibration Verification Standard								11/12/13 08:02
pH, sat. paste	10.0	s.u.	0.10	100	99	101			
Method: ASAM10-3.2									Batch: 22413
Sample ID: LCS-22413	Laboratory Control Sample				Run: SOIL PH METER_131112A				11/12/13 09:16
pH, sat. paste	7.57	s.u.	0.10	99	95	105			
Sample ID: H13110098-010ADUP	Sample Duplicate				Run: SOIL PH METER_131112A				11/12/13 09:23
pH, sat. paste	4.85	s.u.	0.10				0.2	30	
Sample ID: H13110098-020ADUP	Sample Duplicate				Run: SOIL PH METER_131112A				11/12/13 09:30
pH, sat. paste	7.50	s.u.	0.10				0.0	30	
Method: ASAM10-3.2									Batch: 22414
Sample ID: LCS-22414	Laboratory Control Sample				Run: SOIL PH METER_131112A				11/12/13 09:35
pH, sat. paste	7.56	s.u.	0.10	99	95	105			
Sample ID: H13110098-030ADUP	Sample Duplicate				Run: SOIL PH METER_131112A				11/12/13 09:42
pH, sat. paste	3.70	s.u.	0.10				0.3	30	

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: Chino Mine Company **Report Date:** 12/18/13

Project: Phytotoxicity Soil Samples **Work Order:** H13110098

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: ASAM10-3.2								Batch: 22414	
Sample ID: H13110098-036ADUP	Sample Duplicate				Run: SOIL PH METER_131112A			11/12/13 09:47	
pH, sat. paste	7.58	s.u.	0.10				0.3	30	

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: Chino Mine Company **Report Date:** 12/18/13
Project: Phytotoxicity Soil Samples **Work Order:** H13110098

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: Calculation								Batch: R93628	
Sample ID: H13110098-010ADUP	Sample Duplicate				Run: MISC SOILS_131218A			11/19/13 13:06	
Exchangeable Calcium	3.31	meq/100g	0.10				0.9	30	
Exchangeable Magnesium	0.650	meq/100g	0.10				3.1	30	
Exchangeable Potassium	0.230	meq/100g	0.10					30	
Exchangeable Sodium	0.0600	meq/100g	0.10					30	
Exchangeable Copper	109	meq/100g	0.10						
Sample ID: H13110098-020ADUP	Sample Duplicate				Run: MISC SOILS_131218A			11/19/13 13:06	
Exchangeable Calcium	28.7	meq/100g	0.10				0.9	30	
Exchangeable Magnesium	1.07	meq/100g	0.10				0.0	30	
Exchangeable Potassium	0.500	meq/100g	0.10				2.0	30	
Exchangeable Sodium	0.0900	meq/100g	0.10					30	
Exchangeable Copper	1.75	meq/100g	0.10						
Sample ID: H13110098-030ADUP	Sample Duplicate				Run: MISC SOILS_131218A			11/19/13 13:06	
Exchangeable Calcium	1.77	meq/100g	0.10				1.7	30	
Exchangeable Magnesium	0.290	meq/100g	0.10				0.0	30	
Exchangeable Potassium	0.150	meq/100g	0.10				0.0	30	
Exchangeable Sodium	0.0400	meq/100g	0.10					30	
Exchangeable Copper	3.88	meq/100g	0.10						
Sample ID: H13110098-036ADUP	Sample Duplicate				Run: MISC SOILS_131218A			11/19/13 13:06	
Exchangeable Calcium	27.6	meq/100g	0.10				0.8	30	
Exchangeable Magnesium	1.01	meq/100g	0.10				1.0	30	
Exchangeable Potassium	0.600	meq/100g	0.10				0.0	30	
Exchangeable Sodium	0.0500	meq/100g	0.10					30	
Exchangeable Copper	8.96	meq/100g	0.10						

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: Chino Mine Company **Report Date:** 12/18/13
Project: Phytotoxicity Soil Samples **Work Order:** H13110098

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: D2974								Batch: R92803	
Sample ID: H13110098-010ADUP	Sample Duplicate				Run: SOIL DRYING OVEN 2_13110			11/14/13 11:44	
Moisture (As Received)	3.52	wt%	0.20				2.0	20	
Sample ID: H13110098-020ADUP	Sample Duplicate				Run: SOIL DRYING OVEN 2_13110			11/14/13 11:44	
Moisture (As Received)	5.38	wt%	0.20				0.9	20	
Sample ID: H13110098-030ADUP	Sample Duplicate				Run: SOIL DRYING OVEN 2_13110			11/14/13 11:44	
Moisture (As Received)	2.15	wt%	0.20				1.5	20	
Sample ID: H13110098-036ADUP	Sample Duplicate				Run: SOIL DRYING OVEN 2_13110			11/14/13 11:44	
Moisture (As Received)	4.41	wt%	0.20				15	20	

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: Chino Mine Company **Report Date:** 12/18/13
Project: Phytotoxicity Soil Samples **Work Order:** H13110098

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: E200.7									Analytical Run: ICP2-HE_131112A
Sample ID: ICV	Initial Calibration Verification Standard								11/12/13 08:20
Copper	0.791	mg/L	0.010	99	90	110			
Sample ID: ICSA	Interference Check Sample A								11/12/13 08:35
Copper	0.00165	mg/L	0.010		0	0			
Sample ID: ICSAB	Interference Check Sample AB								11/12/13 08:39
Copper	0.482	mg/L	0.010	96	80	120			
Method: E200.7									Analytical Run: ICP2-HE_131122C
Sample ID: ICV	Initial Calibration Verification Standard								11/22/13 11:01
Calcium	39.5	mg/L	1.0	99	90	110			
Magnesium	40.1	mg/L	1.0	100	90	110			
Potassium	40.4	mg/L	1.0	101	90	110			
Sodium	40.5	mg/L	1.0	101	90	110			
Sample ID: ICSA	Interference Check Sample A								11/22/13 11:15
Calcium	467	mg/L	1.0	93	80	120			
Magnesium	519	mg/L	1.0	104	80	120			
Potassium	-0.127	mg/L	1.0		0	0			
Sodium	0.0276	mg/L	1.0		0	0			
Sample ID: ICSAB	Interference Check Sample AB								11/22/13 11:19
Calcium	459	mg/L	1.0	92	80	120			
Magnesium	504	mg/L	1.0	101	80	120			
Potassium	23.7	mg/L	1.0	118	80	120			
Sodium	23.8	mg/L	1.0	119	80	120			

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: Chino Mine Company **Report Date:** 12/18/13

Project: Phytotoxicity Soil Samples **Work Order:** H13110098

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: E200.7									Analytical Run: ICP2-HE_131125B
Sample ID: ICV	Initial Calibration Verification Standard								11/25/13 14:39
Calcium	40.9	mg/L	1.0	102	95	105			
Copper	0.802	mg/L	0.010	100	95	105			
Magnesium	41.9	mg/L	1.0	105	95	105			
Potassium	40.6	mg/L	1.0	102	95	105			
Sodium	40.5	mg/L	1.0	101	95	105			
Sample ID: ICSA	Interference Check Sample A								11/25/13 14:53
Calcium	493	mg/L	1.0	99	80	120			
Copper	0.00223	mg/L	0.010		0	0			
Magnesium	554	mg/L	1.0	111	80	120			
Potassium	-0.141	mg/L	1.0		0	0			
Sodium	-0.0108	mg/L	1.0		0	0			
Sample ID: ICSAB	Interference Check Sample AB								11/25/13 15:16
Calcium	437	mg/L	1.0	87	80	120			
Copper	0.462	mg/L	0.010	93	80	120			
Magnesium	482	mg/L	1.0	96	80	120			
Potassium	21.7	mg/L	1.0	109	80	120			
Sodium	21.7	mg/L	1.0	109	80	120			

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: Chino Mine Company
Project: Phytotoxicity Soil Samples
Report Date: 12/18/13
Work Order: H13110098

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: E200.7									Analytical Run: ICP2-HE_131127A
Sample ID: ICV	Initial Calibration Verification Standard								11/27/13 12:30
Aluminum	4.07	mg/L	0.10	102	95	105			
Copper	0.809	mg/L	0.010	101	95	105			
Iron	3.96	mg/L	0.030	99	95	105			
Manganese	4.02	mg/L	0.010	100	95	105			
Sodium	39.1	mg/L	1.0	98	95	105			
Sample ID: ICSA	Interference Check Sample A								11/27/13 12:45
Aluminum	518	mg/L	0.10	104	80	120			
Copper	0.0103	mg/L	0.010		0	0			
Iron	180	mg/L	0.030	90	80	120			
Manganese	0.00596	mg/L	0.010		0	0			
Sodium	0.0415	mg/L	1.0		0	0			
Sample ID: ICSAB	Interference Check Sample AB								11/27/13 12:49
Aluminum	466	mg/L	0.10	93	80	120			
Copper	0.462	mg/L	0.010	92	80	120			
Iron	166	mg/L	0.030	83	80	120			
Manganese	0.437	mg/L	0.010	87	80	120			
Sodium	20.6	mg/L	1.0	103	80	120			
Sample ID: ICSAB	Interference Check Sample AB								11/27/13 13:04
Aluminum	477	mg/L	0.10	95	80	120			
Copper	0.473	mg/L	0.010	95	80	120			
Iron	167	mg/L	0.030	83	80	120			
Manganese	0.445	mg/L	0.010	89	80	120			
Sodium	21.0	mg/L	1.0	105	80	120			
Method: E200.7									Analytical Run: ICP2-HE_131218A
Sample ID: ICV	Initial Calibration Verification Standard								12/18/13 10:44
Copper	0.803	mg/L	0.010	100	95	105			
Sample ID: ICSA	Interference Check Sample A								12/18/13 10:58
Copper	0.000530	mg/L	0.010		0	0			
Sample ID: ICSAB	Interference Check Sample AB								12/18/13 11:02
Copper	0.517	mg/L	0.010	103	80	120			

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: Chino Mine Company
Report Date: 12/18/13
Project: Phytotoxicity Soil Samples
Work Order: H13110098

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: E300.0									Analytical Run: IC102-H_131114A
Sample ID: ICV	Initial Calibration Verification Standard								11/14/13 11:44
Chloride	110	mg/L	1.0	106	90	110			
Sulfate	420	mg/L	1.0	106	90	110			
Fluoride	53	mg/L	0.10	106	90	110			
Sample ID: CCV111413-1	Continuing Calibration Verification Standard								11/14/13 12:34
Chloride	100	mg/L	1.0	105	90	110			
Sulfate	420	mg/L	1.0	106	90	110			
Fluoride	53	mg/L	0.10	105	90	110			
Sample ID: CCV111413-3	Continuing Calibration Verification Standard								11/14/13 18:14
Chloride	100	mg/L	1.0	105	90	110			
Sulfate	420	mg/L	1.0	105	90	110			
Fluoride	54	mg/L	0.10	108	90	110			
Sample ID: CCV111413-4	Continuing Calibration Verification Standard								11/14/13 21:36
Chloride	100	mg/L	1.0	104	90	110			
Sulfate	420	mg/L	1.0	105	90	110			
Fluoride	53	mg/L	0.10	106	90	110			
Method: E300.0									Batch: 22413
Sample ID: MB-22413	Method Blank				Run: IC102-H_131114A				11/14/13 18:40
Chloride	ND	mg/L	0.008						
Sulfate	ND	mg/L	0.08						
Fluoride	ND	mg/L	0.002						
Sample ID: LCS-22413	Laboratory Control Sample				Run: IC102-H_131114A				11/14/13 18:52
Chloride	100	mg/L	5.0	100	80	120			
Sulfate	2500	mg/L	2.0	86	80	120			
Sample ID: H13110098-010ADUP	Sample Duplicate				Run: IC102-H_131114A				11/14/13 21:11
Fluoride	ND	mg/L	2.0					20	
Sulfate, sat. paste	4.55	meq/L	0.42				9.1	20	
Chloride, sat. paste	0.258	meq/L	0.14				1.7	20	
Sample ID: H13110098-010AMS	Sample Matrix Spike				Run: IC102-H_131114A				11/14/13 21:23
Fluoride	513	mg/L	2.3	103	90	110			
Sulfate, sat. paste	88.4	meq/L	0.47	101	90	110			
Chloride, sat. paste	28.4	meq/L	0.16	99	90	110			
Sample ID: H13110098-020ADUP	Sample Duplicate				Run: IC102-H_131114A				11/15/13 00:07
Fluoride	0.221	mg/L	2.0					20	
Sulfate, sat. paste	0.445	meq/L	0.42					20	
Chloride, sat. paste	0.817	meq/L	0.14				7.9	20	

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: Chino Mine Company **Report Date:** 12/18/13
Project: Phytotoxicity Soil Samples **Work Order:** H13110098

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: E300.0									Batch: 22413
Sample ID: H13110098-020AMS	Sample Matrix Spike				Run: IC102-H_131114A				11/15/13 00:20
Fluoride	511	mg/L	2.3	102	90	110			
Sulfate, sat. paste	84.2	meq/L	0.47	101	90	110			
Chloride, sat. paste	28.8	meq/L	0.16	98	90	110			

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: Chino Mine Company **Report Date:** 12/18/13
Project: Phytotoxicity Soil Samples **Work Order:** H13110098

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: E300.0									Analytical Run: IC102-H_131122A
Sample ID: ICV	Initial Calibration Verification Standard								11/22/13 16:38
Chloride	100	mg/L	1.0	100	90	110			
Sulfate	400	mg/L	1.0	100	90	110			
Fluoride	50	mg/L	0.10	101	90	110			
Sample ID: CCV112013-1	Continuing Calibration Verification Standard								11/22/13 20:24
Chloride	110	mg/L	1.0	106	90	110			
Sulfate	430	mg/L	1.0	107	90	110			
Fluoride	53	mg/L	0.10	107	90	110			
Sample ID: ICV	Initial Calibration Verification Standard								11/24/13 11:30
Chloride	110	mg/L	1.0	107	90	110			
Sulfate	420	mg/L	1.0	106	90	110			
Fluoride	54	mg/L	0.10	108	90	110			
Method: E300.0									Batch: 22414
Sample ID: MB-22414	Method Blank				Run: IC102-H_131122A				11/22/13 17:28
Fluoride	ND	mg/L	0.002						
Sulfate, sat. paste	ND	meq/L	0.002						
Chloride, sat. paste	0.0005	meq/L	0.0002						
Sample ID: LCS-22414	Laboratory Control Sample				Run: IC102-H_131122A				11/22/13 17:41
Sulfate, sat. paste	50.8	meq/L	0.42	85	80	120			
Chloride, sat. paste	2.89	meq/L	0.14	95	80	120			
Sample ID: H13110098-030AMS	Sample Matrix Spike				Run: IC102-H_131122A				11/22/13 19:59
Fluoride	520	mg/L	2.3	104	90	110			
Sulfate, sat. paste	93.9	meq/L	0.47	102	90	110			
Chloride, sat. paste	29.2	meq/L	0.16	101	90	110			
Sample ID: H13110098-030ADUP	Sample Duplicate				Run: IC102-H_131122A				11/22/13 20:12
Fluoride	0.638	mg/L	2.0					20	
Sulfate, sat. paste	8.24	meq/L	0.42				5.2	20	
Chloride, sat. paste	0.319	meq/L	0.14				12	20	
Sample ID: H13110098-036AMS	Sample Matrix Spike				Run: IC102-H_131122A				11/22/13 22:05
Fluoride	530	mg/L	2.3	106	90	110			
Sulfate, sat. paste	89.0	meq/L	0.47	102	90	110			
Chloride, sat. paste	30.3	meq/L	0.16	104	90	110			

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: Chino Mine Company
Project: Phytotoxicity Soil Samples
Report Date: 12/18/13
Work Order: H13110098

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: **SW6010B**								Batch: 22389	
Sample ID: **MB-22389**	Method Blank				Run: ICP2-HE_131112A			11/12/13 08:54	
Copper	ND	mg/kg	0.3						
Sample ID: **LFB-22389**	Laboratory Fortified Blank				Run: ICP2-HE_131112A			11/12/13 08:58	
Copper	46.3	mg/kg	1.0	93	80	120			
Sample ID: **LCS-22389**	Laboratory Control Sample				Run: ICP2-HE_131112A			11/12/13 09:02	
Copper	250	mg/kg	1.3	89	77.5	109.6			
Sample ID: **H13110098-018AMS**	Sample Matrix Spike				Run: ICP2-HE_131112A			11/12/13 10:33	
Copper	352	mg/kg	1.3		75	125			A
Sample ID: **H13110098-018AMSD**	Sample Matrix Spike Duplicate				Run: ICP2-HE_131112A			11/12/13 10:44	
Copper	332	mg/kg	1.3		75	125	5.9	20	A
Method: **SW6010B**								Batch: 22390	
Sample ID: **MB-22390**	Method Blank				Run: ICP2-HE_131112A			11/12/13 10:47	
Copper	ND	mg/kg	0.3						
Sample ID: **LFB-22390**	Laboratory Fortified Blank				Run: ICP2-HE_131112A			11/12/13 10:51	
Copper	43.2	mg/kg	1.0	86	80	120			
Sample ID: **LCS-22390**	Laboratory Control Sample				Run: ICP2-HE_131112A			11/12/13 10:55	
Copper	251	mg/kg	1.3	90	77.5	109.6			
Sample ID: **H13110098-036AMS**	Sample Matrix Spike				Run: ICP2-HE_131112A			11/12/13 12:53	
Copper	212	mg/kg	1.3	77	75	125			
Sample ID: **H13110098-036AMSD**	Sample Matrix Spike Duplicate				Run: ICP2-HE_131112A			11/12/13 12:57	
Copper	211	mg/kg	1.3	74	75	125	0.7	20	S

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

A - The analyte level was greater than four times the spike level. In accordance with the method % recovery is not calculated.

S - Spike recovery outside of advisory limits.

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: Chino Mine Company **Report Date:** 12/18/13

Project: Phytotoxicity Soil Samples **Work Order:** H13110098

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: SW6010B									Batch: 22413
Sample ID: MB-22413	Method Blank				Run: ICP2-HE_131122C				11/22/13 16:13
Calcium	0.05	mg/L	0.03						
Magnesium	ND	mg/L	0.02						
Potassium	ND	mg/L	0.03						
Sodium	ND	mg/L	0.03						
Calcium, sat. paste	0.003	meq/L	0.001						
Magnesium, sat. paste	ND	meq/L	0.001						
Potassium, sat. paste	ND	meq/L	0.0007						
Sodium, sat. paste	ND	meq/L	0.001						
Sample ID: LCS-22413	Laboratory Control Sample				Run: ICP2-HE_131122C				11/22/13 16:17
Calcium	385	mg/L	1.0	93	70	130			
Magnesium	127	mg/L	1.0	93	70	130			
Potassium	12.7	mg/L	1.0	97	70	130			
Sodium	672	mg/L	1.0	93	70	130			
Calcium, sat. paste	19.2	meq/L	0.050	93	70	130			
Magnesium, sat. paste	10.5	meq/L	0.082	93	70	130			
Potassium, sat. paste	0.324	meq/L	0.026	97	70	130			
Sodium, sat. paste	29.2	meq/L	0.043	93	70	130			
Sample ID: H13110098-007AMS2	Sample Matrix Spike				Run: ICP2-HE_131122C				11/22/13 16:58
Calcium	593	mg/L	1.0		70	130			A
Magnesium	150	mg/L	1.0	101	70	130			
Potassium	104	mg/L	1.0	100	70	130			
Sodium	119	mg/L	1.0	100	70	130			
Calcium, sat. paste	29.6	meq/L	0.050		70	130			A
Magnesium, sat. paste	12.4	meq/L	0.082	101	70	130			
Potassium, sat. paste	2.67	meq/L	0.026	100	70	130			
Sodium, sat. paste	5.17	meq/L	0.043	100	70	130			
Sample ID: H13110098-007AMSD2	Sample Matrix Spike Duplicate				Run: ICP2-HE_131122C				11/22/13 17:02
Calcium	592	mg/L	1.0		70	130	0.2	20	A
Magnesium	152	mg/L	1.0	102	70	130	0.9	20	
Potassium	107	mg/L	1.0	103	70	130	2.5	20	
Sodium	122	mg/L	1.0	103	70	130	2.5	20	
Calcium, sat. paste	29.5	meq/L	0.050		70	130	0.2	20	A
Magnesium, sat. paste	12.5	meq/L	0.082	102	70	130	0.9	20	
Potassium, sat. paste	2.74	meq/L	0.026	103	70	130	2.5	20	
Sodium, sat. paste	5.30	meq/L	0.043	103	70	130	2.5	20	
Sample ID: H13110098-010Adup	Sample Duplicate				Run: ICP2-HE_131122C				11/22/13 17:16
Calcium	63.9	mg/L	1.0				11	30	
Magnesium	9.55	mg/L	1.0				11	30	
Potassium	7.51	mg/L	1.0				8.1	30	
Sodium	19.4	mg/L	1.0				4.5	30	

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

A - The analyte level was greater than four times the spike level. In accordance with the method % recovery is not calculated.

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: Chino Mine Company **Report Date:** 12/18/13
Project: Phytotoxicity Soil Samples **Work Order:** H13110098

Method: **SW6010B** Batch: 22413

Sample ID: **H13110098-010Adup** Sample Duplicate Run: ICP2-HE_131122C 11/22/13 17:16

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Calcium, sat. paste	3.19	meq/L	0.050				11	30	
Magnesium, sat. paste	0.786	meq/L	0.082				11	30	
Potassium, sat. paste	0.192	meq/L	0.026				8.1	30	
Sodium, sat. paste	0.842	meq/L	0.043				4.5	30	

Sample ID: **H13110098-020Adup** Sample Duplicate Run: ICP2-HE_131122C 11/22/13 18:05

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Calcium	79.7	mg/L	1.0				7.9	30	
Magnesium	4.36	mg/L	1.0				1.6	30	
Potassium	3.45	mg/L	1.0				1.8	30	
Sodium	23.0	mg/L	1.0				6.7	30	
Calcium, sat. paste	3.98	meq/L	0.050				7.9	30	
Magnesium, sat. paste	0.359	meq/L	0.082				1.6	30	
Potassium, sat. paste	0.0882	meq/L	0.026				1.8	30	
Sodium, sat. paste	1.000	meq/L	0.043				6.7	30	

Method: **SW6010B** Batch: 22414

Sample ID: **MB-22414** Method Blank Run: ICP2-HE_131122C 11/22/13 18:13

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Calcium	0.04	mg/L	0.03						
Magnesium	ND	mg/L	0.02						
Potassium	ND	mg/L	0.03						
Sodium	ND	mg/L	0.03						
Calcium, sat. paste	0.002	meq/L	0.001						
Magnesium, sat. paste	ND	meq/L	0.001						
Potassium, sat. paste	ND	meq/L	0.0007						
Sodium, sat. paste	ND	meq/L	0.001						

Sample ID: **LCS-22414** Laboratory Control Sample Run: ICP2-HE_131122C 11/22/13 18:24

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Calcium	361	mg/L	1.0	87	70	130			
Magnesium	118	mg/L	1.0	86	70	130			
Potassium	12.5	mg/L	1.0	96	70	130			
Sodium	664	mg/L	1.0	92	70	130			
Calcium, sat. paste	18.0	meq/L	0.050	87	70	130			
Magnesium, sat. paste	9.71	meq/L	0.082	86	70	130			
Potassium, sat. paste	0.321	meq/L	0.026	96	70	130			
Sodium, sat. paste	28.9	meq/L	0.043	92	70	130			

Sample ID: **H13110098-030Adup** Sample Duplicate Run: ICP2-HE_131122C 11/22/13 19:39

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Calcium	115	mg/L	1.0				1.0	30	
Magnesium	11.2	mg/L	1.0				2.1	30	
Potassium	10.3	mg/L	1.0				2.7	30	
Sodium	13.9	mg/L	1.0				1.3	30	
Calcium, sat. paste	5.74	meq/L	0.050				1.0	30	
Magnesium, sat. paste	0.922	meq/L	0.082				2.1	30	

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: Chino Mine Company

Report Date: 12/18/13

Project: Phytotoxicity Soil Samples

Work Order: H13110098

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: SW6010B									Batch: 22414
Sample ID: H13110098-030Adup	Sample Duplicate				Run: ICP2-HE_131122C				11/22/13 19:39
Potassium, sat. paste	0.264	meq/L	0.026				2.7	30	
Sodium, sat. paste	0.606	meq/L	0.043				1.3	30	
Sample ID: H13110098-035AMS2	Sample Matrix Spike				Run: ICP2-HE_131122C				11/22/13 20:05
Calcium	807	mg/L	1.0	89	70	130			
Magnesium	972	mg/L	1.0	91	70	130			
Potassium	500	mg/L	1.0	100	70	130			
Sodium	530	mg/L	1.0	100	70	130			
Calcium, sat. paste	40.3	meq/L	0.050	89	70	130			
Magnesium, sat. paste	80.0	meq/L	0.082	91	70	130			
Potassium, sat. paste	12.8	meq/L	0.026	100	70	130			
Sodium, sat. paste	23.0	meq/L	0.043	100	70	130			
Sample ID: H13110098-035AMSD2	Sample Matrix Spike Duplicate				Run: ICP2-HE_131122C				11/22/13 20:09
Calcium	800	mg/L	1.0	88	70	130	0.8	20	
Magnesium	964	mg/L	1.0	89	70	130	0.9	20	
Potassium	489	mg/L	1.0	98	70	130	2.3	20	
Sodium	519	mg/L	1.0	98	70	130	2.1	20	
Calcium, sat. paste	39.9	meq/L	0.050	88	70	130	0.8	20	
Magnesium, sat. paste	79.3	meq/L	0.082	89	70	130	0.9	20	
Potassium, sat. paste	12.5	meq/L	0.026	98	70	130	2.3	20	
Sodium, sat. paste	22.6	meq/L	0.043	98	70	130	2.1	20	
Sample ID: H13110098-036Adup	Sample Duplicate				Run: ICP2-HE_131122C				11/22/13 20:24
Calcium	73.3	mg/L	1.0				0.8	30	
Magnesium	4.17	mg/L	1.0				8.3	30	
Potassium	4.99	mg/L	1.0				0.9	30	
Sodium	8.48	mg/L	1.0				0.3	30	
Calcium, sat. paste	3.66	meq/L	0.050				0.8	30	
Magnesium, sat. paste	0.343	meq/L	0.082				8.3	30	
Potassium, sat. paste	0.128	meq/L	0.026				0.9	30	
Sodium, sat. paste	0.369	meq/L	0.043				0.3	30	

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: Chino Mine Company **Report Date:** 12/18/13

Project: Phytotoxicity Soil Samples **Work Order:** H13110098

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: SW6010B									Batch: 22591
Sample ID: MB-22591	Method Blank				Run: ICP2-HE_131125B				11/25/13 15:50
Calcium	10	mg/kg	0.1						
Copper	0.6	mg/kg	0.007						
Magnesium	2	mg/kg	0.03						
Sodium	1	mg/kg	0.6						
Potassium	0.4	mg/kg	0.3						
Calcium, Extractable	0.05	meq/100g	0.0006						
Magnesium, Extractable	0.02	meq/100g	0.0003						
Potassium, Extractable	0.0010	meq/100g	0.0009						
Sodium, Extractable	0.005	meq/100g	0.003						
Sample ID: LCS-22591	Laboratory Control Sample				Run: ICP2-HE_131125B				11/25/13 15:54
Calcium	6040	mg/kg	1.0	116	70	130			
Magnesium	780	mg/kg	1.0	119	70	130			
Sodium	829	mg/kg	1.0	106	70	130			
Potassium	218	mg/kg	1.0	103	70	130			
Calcium, Extractable	30.1	meq/100g	0.0050	116	70	130			
Magnesium, Extractable	6.48	meq/100g	0.0083	119	70	130			
Potassium, Extractable	0.558	meq/100g	0.0026	103	70	130			
Sodium, Extractable	3.61	meq/100g	0.0044	106	70	130			
Sample ID: H13110098-001AMS2	Sample Matrix Spike				Run: ICP2-HE_131125B				11/25/13 16:05
Calcium	6380	mg/kg	1.0	104	75	125			
Copper	333	mg/kg	1.0	106	75	125			
Magnesium	5550	mg/kg	1.0	108	75	125			
Sodium	5140	mg/kg	1.0	102	75	125			
Potassium	5340	mg/kg	1.0	103	75	125			
Calcium, Extractable	31.9	meq/100g	0.0050	104	75	125			
Magnesium, Extractable	46.1	meq/100g	0.0083	109	75	125			
Potassium, Extractable	13.7	meq/100g	0.0026	103	75	125			
Sodium, Extractable	22.3	meq/100g	0.0044	102	75	125			
Sample ID: H13110098-001AMSD2	Sample Matrix Spike Duplicate				Run: ICP2-HE_131125B				11/25/13 16:08
Calcium	6230	mg/kg	1.0	101	75	125	2.4	20	
Copper	337	mg/kg	1.0	110	75	125	1.3	20	
Magnesium	5190	mg/kg	1.0	100	75	125	6.7	20	
Sodium	5120	mg/kg	1.0	102	75	125	0.3	20	
Potassium	5230	mg/kg	1.0	101	75	125	2.0	20	
Calcium, Extractable	31.1	meq/100g	0.0050	101	75	125	2.4	20	
Magnesium, Extractable	43.0	meq/100g	0.0083	101	75	125	6.7	20	
Potassium, Extractable	13.4	meq/100g	0.0026	101	75	125	2.0	20	
Sodium, Extractable	22.3	meq/100g	0.0044	102	75	125	0.3	20	
Sample ID: H13110098-010ADUP	Sample Duplicate				Run: ICP2-HE_131125B				11/25/13 16:53
Calcium	680	mg/kg	1.0				1.3	20	

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: Chino Mine Company **Report Date:** 12/18/13

Project: Phytotoxicity Soil Samples **Work Order:** H13110098

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: SW6010B									Batch: 22591
Sample ID: H13110098-010ADUP	Sample Duplicate				Run: ICP2-HE_131125B				11/25/13 16:53
Copper	109	mg/kg	1.0				0.3	20	
Magnesium	81.0	mg/kg	1.0				3.2	20	
Sodium	17.3	mg/kg	1.0				9.5	20	
Potassium	91.2	mg/kg	1.0				0.0	20	
Calcium, Extractable	3.39	meq/100g	0.0050				1.3	20	
Magnesium, Extractable	0.672	meq/100g	0.0083				3.2	20	
Potassium, Extractable	0.234	meq/100g	0.0026					20	
Sodium, Extractable	0.0750	meq/100g	0.0044				9.5	20	
Sample ID: H13110098-011AMS2	Sample Matrix Spike				Run: ICP2-HE_131125B				11/25/13 17:12
Calcium	5250	mg/kg	1.0	101	75	125			
Copper	113	mg/kg	1.0	102	75	125			
Magnesium	5150	mg/kg	1.0	103	75	125			
Sodium	5000	mg/kg	1.0	100	75	125			
Potassium	5030	mg/kg	1.0	99	75	125			
Calcium, Extractable	26.2	meq/100g	0.0050	101	75	125			
Magnesium, Extractable	42.8	meq/100g	0.0083	104	75	125			
Potassium, Extractable	12.9	meq/100g	0.0026	99	75	125			
Sodium, Extractable	21.8	meq/100g	0.0044	100	75	125			
Sample ID: H13110098-011AMSD2	Sample Matrix Spike Duplicate				Run: ICP2-HE_131125B				11/25/13 17:15
Calcium	5160	mg/kg	1.0	100	75	125	1.6	20	
Copper	111	mg/kg	1.0	100	75	125	1.9	20	
Magnesium	5020	mg/kg	1.0	100	75	125	2.7	20	
Sodium	5020	mg/kg	1.0	100	75	125	0.4	20	
Potassium	5050	mg/kg	1.0	100	75	125	0.6	20	
Calcium, Extractable	25.8	meq/100g	0.0050	100	75	125	1.6	20	
Magnesium, Extractable	41.6	meq/100g	0.0083	101	75	125	2.7	20	
Potassium, Extractable	12.9	meq/100g	0.0026	100	75	125	0.6	20	
Sodium, Extractable	21.9	meq/100g	0.0044	100	75	125	0.4	20	
Sample ID: H13110098-020ADUP	Sample Duplicate				Run: ICP2-HE_131125B				11/25/13 18:00
Calcium	5830	mg/kg	1.0				1.9	20	
Copper	1.72	mg/kg	1.0				0.6	20	
Magnesium	132	mg/kg	1.0				2.2	20	
Sodium	33.3	mg/kg	1.0				3.1	20	
Potassium	190	mg/kg	1.0				2.7	20	
Calcium, Extractable	29.1	meq/100g	0.0050				1.9	20	
Magnesium, Extractable	1.10	meq/100g	0.0083				2.2	20	
Potassium, Extractable	0.487	meq/100g	0.0026				2.7	20	
Sodium, Extractable	0.145	meq/100g	0.0044				3.1	20	
Method: SW6010B									Batch: 22592

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: Chino Mine Company **Report Date:** 12/18/13
Project: Phytotoxicity Soil Samples **Work Order:** H13110098

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: SW6010B									Batch: 22592
Sample ID: MB-22592	Method Blank				Run: ICP2-HE_131125B				11/25/13 18:08
Calcium	10	mg/kg	0.1						
Copper	0.06	mg/kg	0.007						
Magnesium	3	mg/kg	0.03						
Sodium	2	mg/kg	0.05						
Potassium	ND	mg/kg	0.06						
Calcium, Extractable	0.05	meq/100g	0.0006						
Magnesium, Extractable	0.02	meq/100g	0.0003						
Potassium, Extractable	ND	meq/100g	0.0001						
Sodium, Extractable	0.01	meq/100g	0.0002						
Sample ID: LCS-22592	Laboratory Control Sample				Run: ICP2-HE_131125B				11/25/13 18:12
Calcium	6090	mg/kg	1.0	117	70	130			
Magnesium	787	mg/kg	1.0	120	70	130			
Sodium	843	mg/kg	1.0	108	70	130			
Potassium	224	mg/kg	1.0	106	70	130			
Calcium, Extractable	30.4	meq/100g	0.0050	117	70	130			
Magnesium, Extractable	6.53	meq/100g	0.0083	120	70	130			
Potassium, Extractable	0.573	meq/100g	0.0026	106	70	130			
Sodium, Extractable	3.67	meq/100g	0.0044	108	70	130			
Sample ID: H13110098-021AMS2	Sample Matrix Spike				Run: ICP2-HE_131125B				11/25/13 18:23
Calcium	5410	mg/kg	1.0	100	75	125			
Copper	105	mg/kg	1.0	102	75	125			
Magnesium	5070	mg/kg	1.0	100	75	125			
Sodium	5000	mg/kg	1.0	100	75	125			
Potassium	5040	mg/kg	1.0	99	75	125			
Calcium, Extractable	27.0	meq/100g	0.0050	100	75	125			
Magnesium, Extractable	42.1	meq/100g	0.0083	101	75	125			
Potassium, Extractable	12.9	meq/100g	0.0026	99	75	125			
Sodium, Extractable	21.7	meq/100g	0.0044	100	75	125			
Sample ID: H13110098-030ADUP	Sample Duplicate				Run: ICP2-HE_131125B				11/25/13 19:45
Calcium	366	mg/kg	1.0				2.7	20	
Copper	4.37	mg/kg	1.0				3.1	20	
Magnesium	39.3	mg/kg	1.0				4.4	20	
Potassium	58.8	mg/kg	1.0				3.5	20	
Calcium, Extractable	1.83	meq/100g	0.0050				2.7	20	
Magnesium, Extractable	0.326	meq/100g	0.0083				4.4	20	
Potassium, Extractable	0.151	meq/100g	0.0026				3.5	20	
Sample ID: H13110098-031AMS2	Sample Matrix Spike				Run: ICP2-HE_131125B				11/25/13 19:57
Calcium	9150	mg/kg	1.0	97	75	125			
Copper	109	mg/kg	1.0	102	75	125			
Magnesium	5550	mg/kg	1.0	95	75	125			

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: Chino Mine Company **Report Date:** 12/18/13

Project: Phytotoxicity Soil Samples **Work Order:** H13110098

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: SW6010B									Batch: 22592
Sample ID: H13110098-031AMS2	Sample Matrix Spike				Run: ICP2-HE_131125B				11/25/13 19:57
Sodium	5070	mg/kg	1.0	99	75	125			
Potassium	5140	mg/kg	1.0	97	75	125			
Calcium, Extractable	45.7	meq/100g	0.0050	97	75	125			
Magnesium, Extractable	46.1	meq/100g	0.0083	96	75	125			
Potassium, Extractable	13.2	meq/100g	0.0026	97	75	125			
Sodium, Extractable	22.0	meq/100g	0.0044	99	75	125			
Sample ID: H13110098-031AMSD2	Sample Matrix Spike Duplicate				Run: ICP2-HE_131125B				11/25/13 20:00
Calcium	9240	mg/kg	1.0	99	75	125	0.9	20	
Copper	109	mg/kg	1.0	102	75	125	0.2	20	
Magnesium	5610	mg/kg	1.0	96	75	125	0.9	20	
Sodium	5090	mg/kg	1.0	99	75	125	0.4	20	
Potassium	5160	mg/kg	1.0	97	75	125	0.4	20	
Calcium, Extractable	46.1	meq/100g	0.0050	99	75	125	0.9	20	
Magnesium, Extractable	46.5	meq/100g	0.0083	97	75	125	0.9	20	
Potassium, Extractable	13.2	meq/100g	0.0026	97	75	125	0.4	20	
Sodium, Extractable	22.1	meq/100g	0.0044	99	75	125	0.4	20	
Sample ID: H13110098-036ADUP	Sample Duplicate				Run: ICP2-HE_131125B				11/25/13 20:30
Calcium	5490	mg/kg	1.0				3.4	20	
Magnesium	121	mg/kg	1.0				5.7	20	
Sodium	17.3	mg/kg	1.0				3.3	20	
Potassium	226	mg/kg	1.0				3.4	20	
Calcium, Extractable	27.4	meq/100g	0.0050				3.4	20	
Magnesium, Extractable	1.01	meq/100g	0.0083				5.7	20	
Potassium, Extractable	0.579	meq/100g	0.0026				3.4	20	
Sodium, Extractable	0.0751	meq/100g	0.0044				3.3	20	

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: Chino Mine Company
Project: Phytotoxicity Soil Samples
Report Date: 12/18/13
Work Order: H13110098

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: SW6010B									Batch: 22591
Sample ID: MB-22591	Method Blank				Run: ICP2-HE_131127A				11/27/13 17:29
Calcium	20	mg/kg	0.06						
Copper	1	mg/kg	0.007						
Magnesium	5	mg/kg	0.03						
Sodium	6	mg/kg	0.05						
Potassium	1	mg/kg	0.06						
Calcium, Extractable	0.1	meq/100g	0.0003						
Magnesium, Extractable	0.04	meq/100g	0.0003						
Potassium, Extractable	0.003	meq/100g	0.0001						
Sodium, Extractable	0.03	meq/100g	0.0002						
Sample ID: LCS-22591	Laboratory Control Sample				Run: ICP2-HE_131127A				11/27/13 17:40
Calcium	5650	mg/kg	1.0	109	70	130			
Magnesium	713	mg/kg	1.0	108	70	130			
Sodium	806	mg/kg	1.0	102	70	130			
Potassium	217	mg/kg	1.0	102	70	130			
Calcium, Extractable	28.2	meq/100g	0.0050	109	70	130			
Magnesium, Extractable	5.91	meq/100g	0.0083	108	70	130			
Potassium, Extractable	0.556	meq/100g	0.0026	102	70	130			
Sodium, Extractable	3.51	meq/100g	0.0044	102	70	130			
Sample ID: H13110098-004AMS2	Sample Matrix Spike				Run: ICP2-HE_131127A				11/27/13 17:51
Calcium	2710	mg/kg	1.0	93	75	125			
Copper	26.8	mg/kg	1.0	96	75	125			
Magnesium	1350	mg/kg	1.0	96	75	125			
Sodium	1020	mg/kg	1.0	100	75	125			
Potassium	1300	mg/kg	1.0	99	75	125			
Calcium, Extractable	13.5	meq/100g	0.0050	93	75	125			
Magnesium, Extractable	11.2	meq/100g	0.0083	97	75	125			
Potassium, Extractable	3.32	meq/100g	0.0026	99	75	125			
Sodium, Extractable	4.44	meq/100g	0.0044	100	75	125			
Sample ID: H13110098-004AMSD2	Sample Matrix Spike Duplicate				Run: ICP2-HE_131127A				11/27/13 17:55
Calcium	2700	mg/kg	1.0	92	75	125	0.2	20	
Copper	26.8	mg/kg	1.0	96	75	125	0.1	20	
Magnesium	1350	mg/kg	1.0	96	75	125	0.1	20	
Sodium	992	mg/kg	1.0	97	75	125	2.9	20	
Potassium	1260	mg/kg	1.0	95	75	125	2.7	20	
Calcium, Extractable	13.5	meq/100g	0.0050	92	75	125	0.2	20	
Magnesium, Extractable	11.2	meq/100g	0.0083	97	75	125	0.1	20	
Potassium, Extractable	3.23	meq/100g	0.0026	95	75	125	2.7	20	
Sodium, Extractable	4.32	meq/100g	0.0044	97	75	125	2.9	20	
Sample ID: H13110098-020ADUP	Sample Duplicate				Run: ICP2-HE_131127A				11/27/13 18:10
Calcium	5780	mg/kg	1.0				0.9	20	

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: Chino Mine Company **Report Date:** 12/18/13
Project: Phytotoxicity Soil Samples **Work Order:** H13110098

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: SW6010B									Batch: 22591
Sample ID: H13110098-020ADUP	Sample Duplicate				Run: ICP2-HE_131127A				11/27/13 18:10
Copper	1.75	mg/kg	1.0				2.2	20	
Magnesium	130	mg/kg	1.0				1.0	20	
Sodium	31.0	mg/kg	1.0				1.5	20	
Potassium	195	mg/kg	1.0				1.7	20	
Calcium, Extractable	28.9	meq/100g	0.0050				0.9	20	
Magnesium, Extractable	1.08	meq/100g	0.0083				1.0	20	
Potassium, Extractable	0.499	meq/100g	0.0026				1.7	20	
Sodium, Extractable	0.135	meq/100g	0.0044				1.5	20	
Method: SW6010B									Batch: 22592
Sample ID: MB-22592	Method Blank				Run: ICP2-HE_131127A				11/27/13 18:14
Calcium	20	mg/kg	0.06						
Copper	0.2	mg/kg	0.007						
Magnesium	5	mg/kg	0.03						
Sodium	5	mg/kg	0.05						
Potassium	0.8	mg/kg	0.06						
Calcium, Extractable	0.1	meq/100g	0.0003						
Magnesium, Extractable	0.04	meq/100g	0.0003						
Potassium, Extractable	0.002	meq/100g	0.0001						
Sodium, Extractable	0.02	meq/100g	0.0002						
Sample ID: LCS-22592	Laboratory Control Sample				Run: ICP2-HE_131127A				11/27/13 18:25
Calcium	5580	mg/kg	1.0	107	70	130			
Magnesium	699	mg/kg	1.0	106	70	130			
Sodium	808	mg/kg	1.0	103	70	130			
Potassium	220	mg/kg	1.0	103	70	130			
Calcium, Extractable	27.8	meq/100g	0.0050	107	70	130			
Magnesium, Extractable	5.80	meq/100g	0.0083	106	70	130			
Potassium, Extractable	0.564	meq/100g	0.0026	103	70	130			
Sodium, Extractable	3.52	meq/100g	0.0044	103	70	130			
Sample ID: H13110098-023AMS2	Sample Matrix Spike				Run: ICP2-HE_131127A				11/27/13 18:40
Calcium	1280	mg/kg	1.0	95	75	125			
Copper	34.6	mg/kg	1.0	94	75	125			
Magnesium	994	mg/kg	1.0	95	75	125			
Sodium	994	mg/kg	1.0	98	75	125			
Potassium	1060	mg/kg	1.0	97	75	125			
Calcium, Extractable	6.38	meq/100g	0.0050	95	75	125			
Magnesium, Extractable	8.25	meq/100g	0.0083	96	75	125			
Potassium, Extractable	2.72	meq/100g	0.0026	97	75	125			
Sodium, Extractable	4.32	meq/100g	0.0044	98	75	125			

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: Chino Mine Company
Report Date: 12/18/13
Project: Phytotoxicity Soil Samples
Work Order: H13110098

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: SW6010B									Batch: 22592
Sample ID: H13110098-023AMSD2	Sample Matrix Spike Duplicate				Run: ICP2-HE_131127A				11/27/13 18:43
Calcium	1290	mg/kg	1.0	97	75	125	1.2	20	
Copper	35.1	mg/kg	1.0	96	75	125	1.5	20	
Magnesium	1010	mg/kg	1.0	97	75	125	1.7	20	
Sodium	1000	mg/kg	1.0	99	75	125	1.0	20	
Potassium	1080	mg/kg	1.0	98	75	125	1.3	20	
Calcium, Extractable	6.46	meq/100g	0.0050	97	75	125	1.2	20	
Magnesium, Extractable	8.39	meq/100g	0.0083	98	75	125	1.7	20	
Potassium, Extractable	2.76	meq/100g	0.0026	98	75	125	1.3	20	
Sodium, Extractable	4.37	meq/100g	0.0044	99	75	125	1.0	20	
Sample ID: H13110098-030ADUP	Sample Duplicate				Run: ICP2-HE_131127A				11/27/13 19:21
Calcium	383	mg/kg	1.0				1.4	20	
Copper	3.89	mg/kg	1.0				6.8	20	
Magnesium	36.8	mg/kg	1.0				1.8	20	
Sodium	11.8	mg/kg	1.0				3.8	20	
Potassium	61.1	mg/kg	1.0				2.9	20	
Calcium, Extractable	1.91	meq/100g	0.0050				1.4	20	
Magnesium, Extractable	0.305	meq/100g	0.0083				1.8	20	
Potassium, Extractable	0.156	meq/100g	0.0026				2.9	20	
Sodium, Extractable	0.0513	meq/100g	0.0044				3.8	20	
Sample ID: H13110098-036ADUP	Sample Duplicate				Run: ICP2-HE_131127A				11/27/13 19:37
Calcium	5560	mg/kg	1.0				0.8	20	
Magnesium	123	mg/kg	1.0				1.3	20	
Sodium	13.6	mg/kg	1.0				8.2	20	
Potassium	233	mg/kg	1.0				0.4	20	
Calcium, Extractable	27.7	meq/100g	0.0050				0.8	20	
Magnesium, Extractable	1.02	meq/100g	0.0083				1.3	20	
Potassium, Extractable	0.597	meq/100g	0.0026				0.4	20	
Sodium, Extractable	0.0592	meq/100g	0.0044				8.2	20	
Method: SW6010B									Batch: 22606
Sample ID: MB-22606	Method Blank				Run: ICP2-HE_131127A				11/27/13 20:19
Aluminum	ND	mg/kg	0.05						
Sample ID: LCS-22606	Laboratory Control Sample				Run: ICP2-HE_131127A				11/27/13 20:23
Aluminum	1.72	mg/kg	0.11	123	70	130			
Sample ID: H13110098-002AMS2	Sample Matrix Spike				Run: ICP2-HE_131127A				11/27/13 21:11
Aluminum	126	mg/kg	0.12	99	75	125			
Sample ID: H13110098-002AMSD2	Sample Matrix Spike Duplicate				Run: ICP2-HE_131127A				11/27/13 21:15
Aluminum	126	mg/kg	0.12	99	75	125	0.0	20	

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: Chino Mine Company **Report Date:** 12/18/13

Project: Phytotoxicity Soil Samples **Work Order:** H13110098

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: SW6010B								Batch: 22606	
Sample ID: H13110098-009Adup	Sample Duplicate				Run: ICP2-HE_131127A			11/27/13 21:29	
Aluminum	5.14	mg/kg	0.11				2.5	30	
Sample ID: H13110098-034Adup	Sample Duplicate				Run: ICP2-HE_131127A			11/27/13 22:14	
Aluminum	6.56	mg/kg	0.11				5.3	30	
Sample ID: H13110098-035AMS2	Sample Matrix Spike				Run: ICP2-HE_131127A			11/27/13 22:25	
Aluminum	124	mg/kg	0.12	98	75	125			
Sample ID: H13110098-035AMSD2	Sample Matrix Spike Duplicate				Run: ICP2-HE_131127A			11/27/13 22:36	
Aluminum	124	mg/kg	0.12	98	75	125	0.0	20	
Sample ID: H13110098-002AMS2	Sample Matrix Spike				Run: ICP2-HE_131127A			11/27/13 22:58	
Aluminum	50.1	mg/kg	0.10	98	75	125			
Sample ID: H13110098-002AMSD2	Sample Matrix Spike Duplicate				Run: ICP2-HE_131127A			11/27/13 23:02	
Aluminum	50.1	mg/kg	0.10	98	75	125	0.0	20	
Sample ID: H13110098-019AMS2	Sample Matrix Spike				Run: ICP2-HE_131127A			11/28/13 00:31	
Aluminum	49.8	mg/kg	0.10	94	75	125			
Sample ID: H13110098-019AMSD2	Sample Matrix Spike Duplicate				Run: ICP2-HE_131127A			11/28/13 00:35	
Aluminum	50.1	mg/kg	0.10	95	75	125	0.6	20	
Method: SW6010B								Batch: 22626	
Sample ID: MB-22626	Method Blank				Run: ICP2-HE_131127A			11/27/13 22:39	
Aluminum	0.3	mg/kg	0.05						
Iron	0.04	mg/kg	0.02						
Manganese	0.007	mg/kg	0.003						
Sample ID: LCS-22626	Laboratory Control Sample				Run: ICP2-HE_131127A			11/27/13 22:43	
Aluminum	0.727	mg/kg	0.10	81	70	130			
Iron	16.1	mg/kg	1.0	110	70	130			
Manganese	5.99	mg/kg	0.10	105	70	130			
Sample ID: H13110098-010Adup	Sample Duplicate				Run: ICP2-HE_131127A			11/27/13 23:43	
Aluminum	5.75	mg/kg	0.10				5.8	30	
Iron	29.1	mg/kg	1.0				0.3	30	
Manganese	7.96	mg/kg	0.10				0.4	30	
Sample ID: H13110098-020Adup	Sample Duplicate				Run: ICP2-HE_131127A			11/28/13 01:16	
Aluminum	1.06	mg/kg	0.10				45	30	R
Iron	3.38	mg/kg	1.0				0.1	30	
Manganese	4.53	mg/kg	0.10				0.6	30	
Method: SW6010B								Batch: 22627	

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

R - RPD exceeds advisory limit.

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: Chino Mine Company **Report Date:** 12/18/13
Project: Phytotoxicity Soil Samples **Work Order:** H13110098

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: **SW6010B**									Batch: 22627
Sample ID: **MB-22627**	Method Blank				Run: ICP2-HE_131127A				11/28/13 01:19
Aluminum	0.3	mg/kg	0.05						
Iron	0.07	mg/kg	0.02						
Manganese	0.006	mg/kg	0.003						
Sample ID: **LCS-22627**	Laboratory Control Sample				Run: ICP2-HE_131127A				11/28/13 01:23
Aluminum	0.852	mg/kg	0.10	101	70	130			
Iron	15.6	mg/kg	1.0	107	70	130			
Manganese	5.65	mg/kg	0.10	99	70	130			
Sample ID: **H13110098-022AMS2**	Sample Matrix Spike				Run: ICP2-HE_131127A				11/28/13 01:38
Aluminum	94.8	mg/kg	0.10	96	75	125			
Iron	143	mg/kg	1.0	96	75	125			
Manganese	63.6	mg/kg	0.10	90	75	125			
Sample ID: **H13110098-022AMSD2**	Sample Matrix Spike Duplicate				Run: ICP2-HE_131127A				11/28/13 01:42
Aluminum	96.0	mg/kg	0.10	98	75	125	1.3	20	
Iron	144	mg/kg	1.0	98	75	125	0.7	20	
Manganese	64.8	mg/kg	0.10	92	75	125	1.7	20	
Sample ID: **H13110098-030Adup**	Sample Duplicate				Run: ICP2-HE_131127A				11/28/13 02:23
Aluminum	18.6	mg/kg	0.10				2.2	30	
Iron	134	mg/kg	1.0				2.2	30	
Manganese	4.32	mg/kg	0.10				4.4	30	
Sample ID: **H13110098-032AMS2**	Sample Matrix Spike				Run: ICP2-HE_131127A				11/28/13 02:45
Aluminum	50.8	mg/kg	0.10	93	75	125			
Iron	84.5	mg/kg	1.0	94	75	125			
Manganese	61.4	mg/kg	0.10	90	75	125			
Sample ID: **H13110098-032AMSD2**	Sample Matrix Spike Duplicate				Run: ICP2-HE_131127A				11/28/13 02:49
Aluminum	50.6	mg/kg	0.10	93	75	125	0.4	20	
Iron	84.1	mg/kg	1.0	93	75	125	0.4	20	
Manganese	61.0	mg/kg	0.10	89	75	125	0.6	20	
Sample ID: **H13110098-036Adup**	Sample Duplicate				Run: ICP2-HE_131127A				11/28/13 03:07
Aluminum	0.867	mg/kg	0.10				25	30	
Iron	3.55	mg/kg	1.0				6.0	30	
Manganese	6.23	mg/kg	0.10				14	30	

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: Chino Mine Company **Report Date:** 12/18/13

Project: Phytotoxicity Soil Samples **Work Order:** H13110098

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: SW6010B									Batch: 22591
Sample ID: MB-22591	Method Blank				Run: ICP2-HE_131218A				12/18/13 15:04
Calcium	40	mg/kg	0.1						
Copper	0.3	mg/kg	0.10						
Magnesium	7	mg/kg	0.08						
Sodium	6	mg/kg	2						
Potassium	ND	mg/kg	0.1						
Calcium, Extractable	0.2	meq/100g	0.0007						
Magnesium, Extractable	0.06	meq/100g	0.0007						
Potassium, Extractable	ND	meq/100g	0.0004						
Sodium, Extractable	0.02	meq/100g	0.007						
Sample ID: LFB-22591	Laboratory Fortified Blank				Run: ICP2-HE_131218A				12/18/13 15:07
Calcium	2520	mg/kg	1.0	99	85	115			
Copper	50.7	mg/kg	1.0	101	85	115			
Magnesium	2490	mg/kg	1.0	99	85	115			
Sodium	2560	mg/kg	1.0	102	85	115			
Potassium	2510	mg/kg	1.0	101	85	115			
Method: SW6010B									Batch: 22592
Sample ID: MB-22592	Method Blank				Run: ICP2-HE_131218A				12/18/13 15:11
Calcium	30	mg/kg	0.1						
Copper	0.5	mg/kg	0.02						
Magnesium	7	mg/kg	0.08						
Sodium	9	mg/kg	0.1						
Potassium	ND	mg/kg	0.1						
Calcium, Extractable	0.1	meq/100g	0.0007						
Magnesium, Extractable	0.06	meq/100g	0.0007						
Potassium, Extractable	ND	meq/100g	0.0004						
Sodium, Extractable	0.04	meq/100g	0.0006						
Sample ID: LFB-22592	Laboratory Fortified Blank				Run: ICP2-HE_131218A				12/18/13 15:15
Calcium	2550	mg/kg	1.0	101	85	115			
Copper	51.2	mg/kg	1.0	101	85	115			
Magnesium	2560	mg/kg	1.0	102	85	115			
Sodium	2540	mg/kg	1.0	101	85	115			
Potassium	2520	mg/kg	1.0	101	85	115			
Method: SW6010B									Batch: 22838
Sample ID: MB-22838	Method Blank				Run: ICP2-HE_131218A				12/18/13 11:18
Copper	0.7	mg/kg	0.02						
Sample ID: LFB-22838	Laboratory Fortified Blank				Run: ICP2-HE_131218A				12/18/13 11:25
Copper	52.9	mg/kg	1.0	104	85	115			

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: Chino Mine Company **Report Date:** 12/18/13

Project: Phytotoxicity Soil Samples **Work Order:** H13110098

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: SW6010B									Batch: 22838
Sample ID: H13110098-036AMS2	Sample Matrix Spike				Run: ICP2-HE_131218A				12/18/13 11:44
Copper	61.3	mg/kg	1.0	103	75	125			
Sample ID: H13110098-036AMSD2	Sample Matrix Spike Duplicate				Run: ICP2-HE_131218A				12/18/13 11:47
Copper	62.2	mg/kg	1.0	104	75	125	1.3	20	
Sample ID: H13110098-036Adup	Sample Duplicate				Run: ICP2-HE_131218A				12/18/13 11:51
Copper	8.96	mg/kg	1.0				10	20	
Magnesium	128	mg/kg	1.0				0.5	20	
Sodium	20.0	mg/kg	1.0				5.4	20	
Potassium	267	mg/kg	1.0				2.2	20	
Magnesium, Extractable	1.06	meq/100g	0.0083				0.5	20	
Potassium, Extractable	0.685	meq/100g	0.0026				2.2	20	
Sodium, Extractable	0.0870	meq/100g	0.0044				5.4	20	
Sample ID: H13110098-036ADUP	Sample Duplicate				Run: ICP2-HE_131218A				12/18/13 12:09
Copper	8.69	mg/L	1.0						

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: Chino Mine Company **Report Date:** 12/18/13
Project: Phytotoxicity Soil Samples **Work Order:** H13110098

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: **SW6020**									Analytical Run: ICPMS204-B_131210B
Sample ID: **ICV STD**	Initial Calibration Verification Standard								12/10/13 10:13
Copper	0.0610	mg/L	0.0010	102	90	110			
Method: **SW6020**									Batch: 22738
Sample ID: **MB-22738**	Method Blank				Run: ICPMS204-B_131210B				12/11/13 01:29
Copper	0.02	mg/kg	0.0003						
Sample ID: **LFB-22738**	Laboratory Fortified Blank				Run: ICPMS204-B_131210B				12/11/13 01:38
Copper	0.512	mg/kg	0.10	99	80	120			
Sample ID: **H13110098-001AMS**	Sample Matrix Spike				Run: ICPMS204-B_131210B				12/11/13 01:51
Copper	23.3	mg/kg	0.10		0	0			A
Method: **SW6020**									Batch: 22739
Sample ID: **MB-22739**	Method Blank				Run: ICPMS204-B_131210B				12/11/13 03:55
Copper	0.08	mg/kg	0.0003						
Sample ID: **LFB-22739**	Laboratory Fortified Blank				Run: ICPMS204-B_131210B				12/11/13 04:04
Copper	0.548	mg/kg	0.10	93	80	120			
Sample ID: **H13110098-021AMS**	Sample Matrix Spike				Run: ICPMS204-B_131210B				12/11/13 04:31
Copper	2.66	mg/kg	0.10		0	0			A
Sample ID: **H13110098-030Adup**	Sample Duplicate				Run: ICPMS204-B_131210B				12/11/13 05:28
Copper	3.49	mg/kg	0.10						
Method: **SW6020**									Analytical Run: ICPMS204-B_131211B
Sample ID: **ICV STD**	Initial Calibration Verification Standard								12/11/13 09:25
Copper	0.0602	mg/L	0.0010	100	90	110			
Method: **SW6020**									Batch: 22738
Sample ID: **MB-22738**	Method Blank				Run: ICPMS204-B_131211B				12/11/13 22:41
Copper	0.02	mg/kg	0.003						
Sample ID: **H13110098-010Adup**	Sample Duplicate				Run: ICPMS204-B_131211B				12/11/13 23:12
Copper	9.38	mg/kg	0.10						
Sample ID: **H13110098-020Adup**	Sample Duplicate				Run: ICPMS204-B_131211B				12/11/13 23:52
Copper	0.115	mg/kg	0.10						
Method: **SW6020**									Batch: 22739
Sample ID: **MB-22739**	Method Blank				Run: ICPMS204-B_131211B				12/12/13 00:01
Copper	0.009	mg/kg	0.0003						

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

A - The analyte level was greater than four times the spike level. In accordance with the method % recovery is not calculated.

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: Chino Mine Company
Report Date: 12/18/13
Project: Phytotoxicity Soil Samples
Work Order: H13110098

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: SW6020									Batch: 22739
Sample ID: H13110098-033AMS	Sample Matrix Spike				Run: ICPMS204-B_131216B				12/17/13 06:50
Copper	3140	mg/kg	0.13		75	125			A
Method: SW6020									Analytical Run: ICPMS204-B_131217A
Sample ID: ICV STD	Initial Calibration Verification Standard								12/17/13 10:52
Copper	0.0597	mg/L	0.0010	99	90	110			
Method: SW6020									Batch: 22663
Sample ID: H13110098-036Adup	Sample Duplicate				Run: ICPMS204-B_131217A				12/17/13 12:53
Copper	0.429	mg/kg	0.10						

Qualifiers:

RL - Analyte reporting limit.

A - The analyte level was greater than four times the spike level. In accordance with the method % recovery is not calculated.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: Chino Mine Company
Project: Phytotoxicity Soil Samples

Report Date: 12/18/13
Work Order: H13110098

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: USDA23c									Batch: 22425
Sample ID: MB-22425	Method Blank				Run: MAN-TECH_131113A				11/13/13 07:23
Neutralization Potential	ND	Tons/1000T	0.05						
Lime as CaCO3	ND	%	0.005						
Sample ID: LCS-22425	Laboratory Control Sample				Run: MAN-TECH_131113A				11/13/13 07:30
Neutralization Potential	52.4	Tons/1000T	0.10	107	80	120			
Lime as CaCO3	5.24	%	0.010	107	80	120			
Sample ID: H13110098-010ADUP	Sample Duplicate				Run: MAN-TECH_131113A				11/13/13 09:05
Neutralization Potential	2.15	Tons/1000T	0.10				11	20	
Lime as CaCO3	0.215	%	0.010				11	20	
Sample ID: H13110098-020ADUP	Sample Duplicate				Run: MAN-TECH_131113A				11/13/13 10:35
Neutralization Potential	231	Tons/1000T	0.10				3.3	20	
Lime as CaCO3	23.1	%	0.010				3.3	20	
Method: USDA23c									Batch: 22426
Sample ID: MB-22426	Method Blank				Run: MAN-TECH_131113A				11/13/13 10:43
Neutralization Potential	ND	Tons/1000T	0.05						
Lime as CaCO3	ND	%	0.005						
Sample ID: LCS-22426	Laboratory Control Sample				Run: MAN-TECH_131113A				11/13/13 10:50
Neutralization Potential	56.0	Tons/1000T	0.10	114	80	120			
Lime as CaCO3	5.60	%	0.010	114	80	120			
Sample ID: H13110098-030ADUP	Sample Duplicate				Run: MAN-TECH_131113A				11/13/13 12:23
Neutralization Potential	0.210	Tons/1000T	0.10					20	
Lime as CaCO3	0.0210	%	0.010					20	
Sample ID: H13110098-036ADUP	Sample Duplicate				Run: MAN-TECH_131113A				11/13/13 13:24
Neutralization Potential	214	Tons/1000T	0.10				1.8	20	
Lime as CaCO3	21.4	%	0.010				1.8	20	
Method: USDA23c									Batch: 22480
Sample ID: MB-22480	Method Blank				Run: MAN-TECH_131115A				11/15/13 09:21
Neutralization Potential	ND	Tons/1000T	0.05						
Lime as CaCO3	ND	%	0.005						
Sample ID: LCS-22480	Laboratory Control Sample				Run: MAN-TECH_131115A				11/15/13 09:29
Neutralization Potential	52.2	Tons/1000T	0.10	106	80	120			
Lime as CaCO3	5.22	%	0.010	106	80	120			
Sample ID: H13110098-035ADUP	Sample Duplicate				Run: MAN-TECH_131115A				11/15/13 12:15
Neutralization Potential	ND	Tons/1000T	0.10					20	
Lime as CaCO3	ND	%	0.010					20	

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: Chino Mine Company

Project: Phytotoxicity Soil Samples

Report Date: 12/18/13

Work Order: H13110098

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: USDA27a									Batch: 22413
Sample ID: LCS-22413	Laboratory Control Sample				Run: SOIL DRYING OVEN 2_13111				11/12/13 08:29
Saturation	43.9	%	0.10	97	80	120			
Sample ID: H13110098-010ADUP	Sample Duplicate				Run: SOIL DRYING OVEN 2_13111				11/12/13 08:30
Saturation	25.8	%	0.10				2.9	20	
Sample ID: H13110098-020ADUP	Sample Duplicate				Run: SOIL DRYING OVEN 2_13111				11/12/13 08:32
Saturation	40.2	%	0.10				3.1	20	
Method: USDA27a									Batch: 22414
Sample ID: LCS-22414	Laboratory Control Sample				Run: SOIL DRYING OVEN 2_13111				11/12/13 08:44
Saturation	43.4	%	0.10	96	80	120			
Sample ID: H13110098-030ADUP	Sample Duplicate				Run: SOIL DRYING OVEN 2_13111				11/12/13 08:46
Saturation	23.8	%	0.10				1.0	20	
Sample ID: H13110098-036ADUP	Sample Duplicate				Run: SOIL DRYING OVEN 2_13111				11/12/13 08:47
Saturation	37.3	%	0.10				3.1	20	

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

Workorder Receipt Checklist

Chino Mine Company

H13110098

Login completed by:	Skyler T. Pester	Date Received:	11/1/2013
Reviewed by:	BL2000\sdull	Received by:	stp
Reviewed Date:	12/10/2013	Carrier name:	NPT

Shipping container/cooler in good condition?	Yes ☑	No ☐	Not Present ☐
Custody seals intact on all shipping container(s)/cooler(s)?	Yes ☑	No ☐	Not Present ☐
Custody seals intact on all sample bottles?	Yes ☐	No ☐	Not Present ☑
Chain of custody present?	Yes ☑	No ☐	
Chain of custody signed when relinquished and received?	Yes ☑	No ☐	
Chain of custody agrees with sample labels?	Yes ☑	No ☐	
Samples in proper container/bottle?	Yes ☑	No ☐	
Sample containers intact?	Yes ☑	No ☐	
Sufficient sample volume for indicated test?	Yes ☑	No ☐	
All samples received within holding time? (Exclude analyses that are considered field parameters such as pH, DO, Res Cl, Sulfite, Ferrous Iron, etc.)	Yes ☑	No ☐	
Temp Blank received in all shipping container(s)/cooler(s)?	Yes ☐	No ☑	Not Applicable ☐
Container/Temp Blank temperature:	°C See Comments		
Water - VOA vials have zero headspace?	Yes ☐	No ☐	No VOA vials submitted ☑
Water - pH acceptable upon receipt?	Yes ☐	No ☐	Not Applicable ☑

Standard Reporting Procedures:

Lab measurement of analytes considered field parameters that require analysis within 15 minutes of sampling such as pH, Dissolved Oxygen and Residual Chlorine, are qualified as being analyzed outside of recommended holding time.

Solid/soil samples are reported on a wet weight basis (as received) unless specifically indicated. If moisture corrected, data units are typically noted as –dry. For agricultural and mining soil parameters/characteristics, all samples are dried and ground prior to sample analysis.

Contact and Corrective Action Comments:

No collection date or time for samples Dup1, Dup2, or Dup3. Collection date and time estimated in laboratory. Samples initially received at ELI-Billings 10/29/2013 9:30AM, via UPS NDA. Six coolers received with custody seals and not on ice. Temperatures upon arrival in Billings were cooler 1: 15.8°C, cooler 2: 15.2°C, cooler 3: 17.6°C, cooler 4: 14.0°C (temperature taken from a temp blank), cooler 5: 13.8°C, and cooler 6: 14.6°C. Three more coolers were received at ELI-Billings before shipping to ELI-Helena, no information available for these three coolers when they were received in ELI-Billings. All nine coolers then shipped to ELI-H. Seven coolers received for the Phytotoxicity study. Cooler 1 received at 2.8°C, cooler 2: 2.9°C, cooler 3: 3.4°C, cooler 4: 3.3°C, cooler 5: 0.8°C, cooler 6: 1.5°C, and cooler 7: 1.4°C. Samples received not on ice and temperatures taken from a client sample. 11/6/2013 STP.

Chain of Custody and Analytical Request Record

PLEASE PRINT- Provide as much information as possible.

Page 1 of 4

Company Name: ARCADIS	Project Name, PWS, Permit, Etc. Phytotoxicity Soil Samples	Sample Origin State: NM	EPA/State Compliance: Yes ☐ No ☐
Report Mail Address: Pam Pinson -Chino Mines Company P.O. Box 10 Bayard, NM 88023	Contact Name: Emily Schlenker Phone/Fax: 303-231-9115 ext 114	Email: Emily.schlenker@arcadis-us.com	Sampler: (Please Print) Matthew Barkley
Invoice Address: Pam Pinson- Chino Mines Company P.O. Box 10 Bayard, NM 88023	Invoice Contact & Phone: Pam Pinson 575-912-5213	Purchase Order:	Quote/Bottle Order:

Special Report/Formats – ELI must be notified prior to sample submittal for the following:

☐ DW
☐ GSA
☐ POTW/WWTP
☐ State: ____
☐ Other: ____

☐ A2LA
☐ EDD/EDT(Electronic Data)
Format: ____
☐ LEVEL IV
☐ NELAC

Number of Containers
Sample Type: A W S V B O
Air Water Soils/Solids
Vegetation Bioassay Other

ANALYSIS REQUESTED

SEE ATTACHED

Normal Turnaround (TAT)

R U S H

Contact ELI prior to **RUSH** sample submittal for charges and scheduling – See Instruction Page

Comments:
Please include all analytes from ARCADIS-Table 4'
Cooler #1 - 15.8
#2 - 15.2
#3 - 17.6
#4 - 14.0 TB
#5 - 13.8
#6 - 14.6

H1511009B

	SAMPLE IDENTIFICATION (Name, Location, Interval, etc.)	Collection Date	Collection Time	MATRIX	soil sieved to < 2mm	All Arcadis-Table 4 Analytes
1	STS-PT-2013-31	10/23/13	1400	1 S	X	X
2	STS-PT-2013-32	10/23/13	1255	1 S	X	X
3	STS-PT-2013-33	10/25/13	0920	1 S	X	X
4	Dup1	—	—	1 S	X	X
5	Dup2	—	—	1 S	X	X
6	Dup3	—	—	1 S	X	X
7						
8						
9						
10						

LABORATORY USE ONLY

Shipped by: UPSNDA
Cooler ID(s):
Receipt Temp ____ °C
2.8°C
2.9°C
3.4°C
3.3°C
0.8°C
1.5°C
On Ice: Yes [✓ No]
Custody Seal [✓ Y] N
Intact C [✓ Y] N
Signature Match [✓ Y] N

NPL

Custody Record MUST be Signed

Relinquished by (print): Pam Pinson	Date/Time: 10-25-13 2100	Signature: Pam Pinson	Received by (print):	Date/Time:	Signature:
Relinquished by (print):	Date/Time:	Signature:	Received by (print): Skyles Yester	Date/Time: 11-1-13 9:20AM	Signature: *
Sample Disposal: Return to Client: ____	Lab Disposal: ____		Received by Laboratory: Michelle Kleinhammer	Date/Time: 10/29/13 9:30	Signature:

In certain circumstances, samples submitted to Energy Laboratories, Inc. may be subcontracted to other certified laboratories in order to complete the analysis requested. This serves as notice of this possibility. All sub-contract data will be clearly notated on your analytical report. Visit our web site at www.energylab.com for additional information, downloadable fee schedule, forms, and links.

ENERGY LABORATORIES

Chain of Custody and Analytical Request Record

PLEASE PRINT- Provide as much information as possible.

Page - 2 of 4

Company Name: ARCADIS	Project Name, PWS, Permit, Etc. Phytotoxicity Soil Samples	Sample Origin State: NM	EPA/State Compliance: Yes ☐ No ☐
Report Mail Address: Pam Pinson -Chino Mines Company P.O. Box 10 Bayard, NM 88023	Contact Name: Emily Schlenker Phone/Fax: 303-231-9115 ext 114	Email: Emily.schlenker@arcadis-us.com	Sampler: (Please Print) Matthew Barkley
Invoice Address: Pam Pinson- Chino Mines Company P.O. Box 10 Bayard, NM 88023	Invoice Contact & Phone: Pam Pinson 575-912-5213	Purchase Order:	Quote/Bottle Order:

Special Report/Formats – ELI must be notified prior to sample submittal for the following:

☐ DW
☐ GSA
☐ POTW/WWTP
☐ State: ________
☐ Other: ________
☐ A2LA
☐ EDD/EDT(Electronic Data)
Format: ________
☐ LEVEL IV
☐ NELAC

ANALYSIS REQUESTED

SEE ATTACHED

Normal Turnaround (TAT)

R U S H

Contact ELI prior to **RUSH** sample submittal for charges and scheduling – See Instruction Page

Comments:

Please include all analytes from ARCADIS-Table 4'

cooler #1 - 15.8
#2 - 15.2
#3 - 17.6
#4 - 14.0 TB
#5 - 13.8
#6 - 14.6

H13110098

Shipped by: UPSNDA NPt

Cooler ID(s):

Receipt Temp ______ °C

2.8C
2.9C
3.4C
3.5C
0.8C
1.5C

On Ice: Yes [✓ No]

Custody Seal [✓ Y] N

Intact [✓ Y] N

Signature Match [✓ Y] N

LABORATORY USE ONLY

	SAMPLE IDENTIFICATION (Name, Location, Interval, etc.)	Collection Date	Collection Time	MATRIX (Number of Containers, Sample Type: A W S V B O, Air Water Soils/Solids Vegetation Bioassay Other)	soil sieved to < 2mm	All Arcadis-Table 4 Analytes
	1 STS-PT-2013-21	10/22/13	1100	1 S	☒	☒
	2 STS-PT-2013-22	10/22/13	1135	1 S	☒	☒
	3 STS-PT-2013-23	10/22/13	1030	1 S	☒	☒
	4 STS-PT-2013-24	10/24/13	1830	1 S	☒	☒
	5 STS-PT-2013-25	10/22/13	1600	1 S	☒	☒
	6 STS-PT-2013-26	10/22/13	1515	1 S	☒	☒
X	7 STS-PT-2013-27	10/25/13	1415	1 S	☒	☒
*	8 STS-PT-2013-28	10/24/13	1715	1 S	☒	☒
	9 STS-PT-2013-29	10/25/13	1600	1 S	☒	☒
X	10 STS-PT-2013-30	10/24/13	1240	1 S	☒	☒

Custody Record MUST be Signed

Relinquished by (print): Pinson Pam	Date/Time: 10-25-13 2100	Signature: Pam Pinson	Received by (print):	Date/Time:	Signature:
Relinquished by (print):	Date/Time:	Signature:	Received by (print): Skyler Pester	Date/Time: 11-1-13 9:20AM	Signature: *
Sample Disposal: Return to Client: ______	Lab Disposal: ______		Received by Laboratory: Michelle Kleehammer	Date/Time: 10/29/13 9:30	Signature:

In certain circumstances, samples submitted to Energy Laboratories, Inc. may be subcontracted to other certified laboratories in order to complete the analysis requested. This serves as notice of this possibility. All sub-contract data will be clearly notated on your analytical report.
Visit our web site at www.energylab.com for additional information, downloadable fee schedule, forms, and links

ENERGY LABORATORIES

Chain of Custody and Analytical Request Record

PLEASE PRINT- Provide as much information as possible.

Page = 3 of 4

Company Name: ARCADIS

Project Name, PWS, Permit, Etc.: Phytotoxicity Soil Samples

Sample Origin State: NM

EPA/State Compliance: Yes ☐ No ☐

Report Mail Address: Pam Pinson -Chino Mines Company
P.O. Box 10
Bayard, NM 88023

Contact Name: Emily Schlenker

Phone/Fax: 303-231-9115 ext 114

Email: Emily.schlenker@arcadis-us.com

Sampler: (Please Print) Matthew Barkley

Invoice Address: Pam Pinson- Chino Mines Company
P.O. Box 10
Bayard, NM 88023

Invoice Contact & Phone: Pam Pinson 575-912-5213

Purchase Order:

Quote/Bottle Order:

Special Report/Formats – ELI must be notified prior to sample submittal for the following:

☐ DW
☐ GSA
☐ POTW/WWTP
☐ State: ____
☐ Other: ____

☐ A2LA
☐ EDD/EDT(Electronic Data)
Format: ____
☐ LEVEL IV
☐ NELAC

Number of Containers
Sample Type: A W S V B O
Air Water Soils/Solids Vegetation Bioassay Other

ANALYSIS REQUESTED

SEE ATTACHED

Normal Turnaround (TAT)

RUSH

Contact ELI prior to **RUSH** sample submittal for charges and scheduling – See Instruction Page

Comments: Please include all analytes from ARCADIS-Table 4'

Cooler#1- 15.8
#2. 15.2
#3. 17.6
#4. 14.0 TB
#5. 13.8
#6. 14.6

H13110098

		SAMPLE IDENTIFICATION (Name, Location, Interval, etc.)	Collection Date	Collection Time	MATRIX	soil sieved to < 2mm	All Arcadis-Table 4 Analytes
X	1	STS-PT-2013-11	10/24/13	1530	1 S	☒	☒
	2	STS-PT-2013-12	10/22/13	0940	1 S	☒	☒
X	3	STS-PT-2013-13	10/25/13	1210	1 S	☒	☒
	4	STS-PT-2013-14	10/24/13	1050	1 S	☒	☒
	5	STS-PT-2013-15	10/25/13	1600	1 S	☒	☒
	6	STS-PT-2013-16	10/23/13	1750	1 S	☒	☒
	7	STS-PT-2013-17	10/25/13	1230	1 S	☒	☒
	8	STS-PT-2013-18	10/23/13	0945	1 S	☒	☒
X	9	STS-PT-2013-19	10/24/13	0900	1 S	☒	☒
	10	STS-PT-2013-20	10/25/13	1045	1 S	☒	☒

Shipped by: UPSNDA NPA

Cooler ID(s):

Receipt Temp ____ °C

2.8C
2.9C
3.4C
3.5C
0.8C
1.5C

On Ice: Yes [✓ No]

Custody Seal [✓ Y] N
Intact [✓ Y] N
Signature Match [✓ Y] N

LABORATORY USE ONLY

Custody Record MUST be Signed

Relinquished by (print): Pam Pinson Date/Time: 10-25-13 2100 Signature: Pam Pinson

Relinquished by (print): Date/Time: Signature:

Received by (print): Date/Time: Signature:

Received by (print): Skyler Tester Date/Time: 11-1-13 9:20AM Signature: *

Sample Disposal: Return to Client: ____ Lab Disposal: ____

Received by Laboratory: Michelle Kleehammer Date/Time: 10/29/13 9:30 Signature:

In certain circumstances, samples submitted to Energy Laboratories, Inc. may be subcontracted to other certified laboratories in order to complete the analysis requested. This serves as notice of this possibility. All sub-contract data will be clearly notated on your analytical report. Visit our web site at www.energylab.com for additional information, downloadable fee schedule, forms, and links.

ENERGY LABORATORIES

Chain of Custody and Analytical Request Record

PLEASE PRINT- Provide as much information as possible.

Page 4 of 4

Company Name: ARCADIS

Project Name, PWS, Permit, Etc.: Phytotoxicity Soil Samples

Sample Origin State: NM

EPA/State Compliance: Yes ☐ No ☐

Report Mail Address: Pam Pinson -Chino Mines Company
P.O. Box 10
Bayard, NM 88023

Contact Name: Emily Schlenker

Phone/Fax: 303-231-9115 ext 114

Email: Emily.schlenker@arcadis-us.com

Sampler: (Please Print) Matthew Barkley

Invoice Address: Pam Pinson- Chino Mines Company
P.O. Box 10
Bayard, NM 88023

Invoice Contact & Phone: Pam Pinson 575-912-5213

Purchase Order:

Quote/Bottle Order:

Special Report/Formats – ELI must be notified prior to sample submittal for the following:

☐ DW
☐ GSA
☐ POTW/WWTP
☐ State: ________
☐ Other: ________
☐ A2LA
☐ EDD/EDT(Electronic Data)
Format: ________
☐ LEVEL IV
☐ NELAC

ANALYSIS REQUESTED

SEE ATTACHED

Normal Turnaround (TAT)

RUSH

Contact ELI prior to **RUSH** sample submittal for charges and scheduling – See Instruction Page

Comments: Please include all analytes from ARCADIS-Table 4'
Cooler #1-15.8
#2-15.2
#3-17.6
#4-14.0 TB
#5-13.8
#6-14.6

H13110098

Shipped by: UPS NDA

NPL

Cooler ID(s):

Receipt Temp ____ °C

2.8C
2.9C
3.4C
3.3C
0.8C
1.5C

On Ice: Yes [✓ No]

Custody Seal [✓ Y] N
Intact C [✓ Y] N
Signature Match [✓ Y] N

LABORATORY USE ONLY

		SAMPLE IDENTIFICATION (Name, Location, Interval, etc.)	Collection Date	Collection Time	MATRIX (Number of Containers; Sample Type: A W S V B O; Air Water Soils/Solids Vegetation Bioassay Other)	soil sieved to < 2mm	All Arcadis-Table 4 Analytes
	1	STS-PT-2013-1	10/24/13	1000	1 S	X	X
X	2	STS-PT-2013-2	10/23/13	1645	1 S	X	X
	3	STS-PT-2013-3	10/24/13	1630	1 S	X	X
	4	STS-PT-2013-4	10/22/13	1400	1 S	X	X
X	5	STS-PT-2013-5	10/23/13	1445	1 S	X	X
	6	STS-PT-2013-6	10/24/13	1425	1 S	X	X
	7	STS-PT-2013-7	10/24/13	1300	1 S	X	X
X	8	STS-PT-2013-8	10/23/13	1745	1 S	X	X
X	9	STS-PT-2013-9	10/23/13	1045	1 S	X	X
X	10	STS-PT-2013-10	10/23/13	1115	1 S	X	X

Custody Record MUST be Signed

Relinquished by (print): Pam Pinson Date/Time: 10-25-13 2100 Signature: Pam Pinson

Relinquished by (print): Date/Time: Signature:

Received by (print): Date/Time: Signature:

Received by (print): Skyler Pester Date/Time: 11-1-13 9:20AM Signature: *

Received by Laboratory: Michelle Kluhammer Date/Time: 10/29/13 9:30 Signature:

Sample Disposal: Return to Client: ________ Lab Disposal: ________

In certain circumstances, samples submitted to Energy Laboratories, Inc. may be subcontracted to other certified laboratories in order to complete the analysis requested.
This serves as notice of this possibility. All sub-contract data will be clearly notated on your analytical report.
Visit our web site at www.energylab.com for additional information, downloadable fee schedule, forms, and links.

TABLE 4
SOIL SAMPLE ANALYTICAL ANALYSES

FREEPORT-MCMORAN CHINO MINES COMPANY
VANADIUM, NEW MEXICO
SMELTER/TAILING SOILS IU - PHYTOTOXICITY AND VEGETATION COMMUNITY STUDY

Parameter	Extraction Method	Analytical Method
Alkalinity (total)	ASA Mono #9, Part 2, 10-2.3.1	A 2320B
Chloride	ASA Mono #9, Part 2, 10-3.2	E300.0
Fluoride	ASA Mono #9, Part 2, 10-3.2	A 4500 F-C/Technicon 380-7WE
Exchangeable Calcium (NH4Oac)	ASA Mono #9, Part 2, 13-4	6010/6020
Exchangeable Copper (NH4Oac)	ASA Mono #9, Part 2, 13-4	6010/6020
Exchangeable Magnesium (NH4Oac)	ASA Mono #9, Part 2, 13-4	6010/6020
Exchangeable Potassium (NH4Oac)	ASA Mono #9, Part 2, 13-4	6010/6020
Exchangeable Sodium (NH4Oac)	ASA Mono #9, Part 2, 13-4	6010/6020
Sulfate (soluble)	ASA Mono #9, Part 2, 10-3.2	6010/6020
Copper (total)	3050	6010B
Copper (soluble), $CaCl_2$	ARCADIS SOP	ARCADIS SOP
Aluminum (soluble)	ASA Mono. #9, Part 2, Method 19-3.3	6010/6020
Iron (soluble)	ASA Mono. #9, Part 2, Method 19-3.3	6010/6020
Manganese (soluble)	ASA Mono. #9, Part 2, Method 19-3.3	6010/6020
Nitrate/Nitrite, $CaCl_2$	ASA Mono. #9, Part 2, Method 38-8.1	350.1, 353.2, 351.4
pH (saturated paste with saturated %)	ASA Mono #9, Part 2, 10-3.2	9045C
pH, $CaCl_2$	ARCADIS SOP	ARCADIS SOP
Plant Available Phosphorus (Bray/Olsen)	ASA Mono. #9, Part 2, Method 24-5.1	365.1
Phosphate	ASA Mono. #9, Part 2, Method 24-5.3	365.1
Electrical Conductivity, saturated paste	ASA Mono. #9, Part 2,Method 10-3.3	ASA Mono #9 Part 2
Electrical Conductivity, $CaCl_2$	ARCADIS SOP	ARCADIS SOP
Total Organic Matter	ASA Mono. #9, Part 2, Method 29-3.5.2	Handbook 60
DOC	ASA Mono. #9, Part 2, Method 10-3	ASA Mono #9 Part 2
Soil Texture	ASA Mono. #9, Part 1, Method 15-4	NAPT S-10.10[1]
$CaCO_3$	USDA Handbook 60, Method 23C	Handbook 60
Measured pCu	ARCADIS SOP	ARCADIS SOP
Moisture (dry basis)	USDA Handbook 60,Method 26	

41310098

ANALYTICAL SUMMARY REPORT

December 24, 2013

Chino Mine Company
PO Box 10
Bayard, NM 88023

Workorder No.: H13120008

Project Name: Phytotoxicity

Energy Laboratories Inc Helena MT received the following 3 samples for Chino Mine Company on 11/26/2013 for analysis.

Sample ID	Client Sample ID	Collect Date	Receive Date	Matrix	Test
H13120008-001	STS-PT-2013-34	11/21/13 11:30	11/26/13	Soil	Metals by ICP/ICPMS, Total Metals, Water Extractable DPTA extractable metals Metals, NH4Ac Metals, Saturated Paste Alkalinity, Water Extractable Carbon, Dissolved Organic Conductivity, Saturated Paste Extract Copper Activity Exchangeable Cations Anions by Ion Chromatography Lime as CaCO3 Moisture Nitrate as N, CaCL2 Extract Organic Carbon/Matter Walkley-Black Phosphorus-Bray pH, Saturated Paste Soluble Phosphate Digestion, Total Metals CaCl2 Hot Water Soil Extraction Water extraction DTPA extraction for metals Preparation, Dissolved Filtration Lime Percentage NaHCO3 Soil Extract NH4AC Soil Extraction Total Organic Matter Prep Particle Size Analysis / Texture Prep Saturated Paste Extraction Particle Size Analysis / Texture Saturation Percentage Soil Preparation

ANALYTICAL SUMMARY REPORT

H13120008-002	STS-PT-2013-35	11/21/13 12:35	11/26/13	Soil	Metals by ICP/ICPMS, Total Metals, Water Extractable DPTA extractable metals Metals, NH4Ac Metals, Saturated Paste Alkalinity, Water Extractable Carbon, Dissolved Organic Conductivity, Saturated Paste Extract Copper Activity Exchangeable Cations Anions by Ion Chromatography Lime as CaCO3 Moisture Nitrate as N, CaCL2 Extract Organic Carbon/Matter Walkley-Black Phosphorus-Bray pH, Saturated Paste Soluble Phosphate Digestion, Total Metals CaCl2 Hot Water Soil Extraction Water extraction DTPA extraction for metals Preparation, Dissolved Filtration Lime Percentage NaHCO3 Soil Extract NH4AC Soil Extraction Total Organic Matter Prep Particle Size Analysis / Texture Prep Saturated Paste Extraction Particle Size Analysis / Texture Saturation Percentage
H13120008-003	STS-PT-2013-36	11/21/13 13:30	11/26/13	Soil	Same As Above

The analyses presented in this report were performed by Energy Laboratories, Inc., 3161 E. Lyndale Ave., Helena, MT 59604, unless otherwise noted. Any exceptions or problems with the analyses are noted in the Laboratory Analytical Report, the QA/QC Summary Report, or the Case Narrative.

The results as reported relate only to the item(s) submitted for testing.

If you have any questions regarding these test results, please call.

Report Approved By: Jonathan D. Hager
Branch Manager - Helena, MT

Digitally signed by
Jonathan Hager
Date: 2013.12.24 14:25:35 -07:00

CLIENT: Chino Mine Company
Project: Phytotoxicity
Sample Delivery Group: H13120008

Report Date: 12/24/13

CASE NARRATIVE

Tests associated with analyst identified as ELI-CA were subcontracted to Energy Laboratories, 2393 Salt Creek Hwy., Casper, WY, EPA Number WY00002 and WY00937.
Comments imported for SUBBED Workorder: C13120442

End of comments imported for SUBBED Workorder: C13120442.

Standard operating procedure submitted by Arcadis as "Standard Operating Procedures for Measurement of Cu2+ Activity in Soil by Ion-Selective Electrode" (ed. September 2013). Copper activity measured with a Combination Cupric Sure-Flow Ion Selective Electrode (Thermo Scientific, 9629BNWP) as per SOP. All samples and standards were filtered through 0.22µm membrane cellulose-acetate filters (Whatman, 10404112), prior to analysis. All analysis was performed under reduced light conditions.
Exchangeable copper values calculated from "Copper (Soluble), CaCl2" and extractable copper results. Exchangeable Ca, Mg, Na, and K, calculated from soluble cations and extractable cation results.

LABORATORY ANALYTICAL REPORT

Prepared by Helena, MT Branch

Client: Chino Mine Company
Project: Phytotoxicity
Workorder: H13120008

Report Date: 12/24/13
Date Received: 11/26/13

		Analysis		Moisture (As	Sand	Silt	Clay	Texture	Percent Sat	pH-SatPst	Alk-SatPst	HCO3-SatPst	COND	Ca-SatPst
		Units		wt%	%	%	%	%	%	s_u_	mg/L	mg/L	mmhos/cm	meq/L
Sample ID	**Client Sample ID**	**Up**	**Low**	**Results**	**Results**	**Results**	**Results**	**Results**	**Results**	**Results**	**Results**	**Results**	**Results**	**Results**
H13120008-001	STS-PT-2013-34	0	0	7.5	60	21	19	SL	24.1	4.8	22	27	0.4	2.74
H13120008-002	STS-PT-2013-35	0	0	11.1	34	41	25	L	33.8	4.5	21	26	0.3	1.70
H13120008-003	STS-PT-2013-36	0	0	7.6	56	23	21	SCL	33.0	5.9	211	258	2.6	31.2

LABORATORY ANALYTICAL REPORT

Prepared by Helena, MT Branch

Client: Chino Mine Company
Project: Phytotoxicity
Workorder: H13120008

Report Date: 12/24/13
Date Received: 11/26/13

		Analysis		Mg-SatPst	K-SatPst	Na-SatPst	Alk SatPst	HCO3 SatPst	Fluoride	SO4-SatPst	Cl-SatPst	Ca-NH4OAC	Cu-NH4OAC	Mg-NH4OAC
		Units		meq/L	meq/L	meq/L	meq/L	meq/L	mg/L	meq/L	meq/L	mg/kg	mg/kg	mg/kg
Sample ID	**Client Sample ID**	**Up**	**Low**	**Results**	**Results**	**Results**	**Results**	**Results**	**Results**	**Results**	**Results**	**Results**	**Results**	**Results**
H13120008-001	STS-PT-2013-34	0	0	0.86	0.31	0.31	0.44	0.44	< 0.1	2.74	0.16	552	266	61
H13120008-002	STS-PT-2013-35	0	0	0.61	0.16	0.24	0.42	0.42	< 0.1	1.57	0.13	1290	648	145
H13120008-003	STS-PT-2013-36	0	0	5.02	0.18	0.56	4.23	4.22	< 1	31.7	0.22	2700	1040	170

LABORATORY ANALYTICAL REPORT

Prepared by Helena, MT Branch

Client: Chino Mine Company
Project: Phytotoxicity
Workorder: H13120008

Report Date: 12/24/13
Date Received: 11/26/13

		Analysis		Na-NH4OAC	Ca-Ext-NH4OAC	Mg-Ext-NH4OAC	K-Ext-NH4OAC	K-NH4OAC	Na-Ext-NH4OAC	Exch Ca	Exch Mg	Exch K	Exch Na	Exch Cu
		Units		mg/kg	meq/100g	meq/100g	meq/100g	mg/kg	meq/100g	meq/100g	meq/100g	meq/100g	meq/100g	meq/100g
Sample ID	**Client Sample ID**	**Up**	**Low**	**Results**	**Results**	**Results**	**Results**	**Results**	**Results**	**Results**	**Results**	**Results**	**Results**	**Results**
H13120008-001	STS-PT-2013-34	0	0	17	2.76	0.506	0.429	168	0.075	2.7	0.5	0.4	< 0.1	0.8
H13120008-002	STS-PT-2013-35	0	0	23	6.46	1.21	0.732	286	0.098	6.4	1.2	0.7	< 0.1	1.8
H13120008-003	STS-PT-2013-36	0	0	28	13.5	1.41	0.329	129	0.120	12.4	1.2	0.3	0.1	3.2

LABORATORY ANALYTICAL REPORT

Prepared by Helena, MT Branch

Client:	Chino Mine Company	**Report Date:**	12/24/13
Project:	Phytotoxicity	**Date Received:**	11/26/13
Workorder:	H13120008		

		Analysis		OM-WB	Lime	P-Bray	PO4	NO3	Cu-CACL2	Al-DTPA	Fe-DTPA	Mn-DTPA	Cu-T	Organic Carbon,
		Units		%	%	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
Sample ID	**Client Sample ID**	**Up**	**Low**	**Results**	**Results**	**Results**	**Results**	**Results**	**Results**	**Results**	**Results**	**Results**	**Results**	**Results**
H13120008-001	STS-PT-2013-34	0	0	1.8	0.33	55.4	3	2	22.4	10.5	91	28.3	1200	10
H13120008-002	STS-PT-2013-35	0	0	1.9	0.51	21.8	2	2	73.6	0.7	7	11.4	1630	10
H13120008-003	STS-PT-2013-36	0	0	1.4	1.38	12.9	< 1	3	30.7	0.8	3	2.7	3770	6

LABORATORY ANALYTICAL REPORT

Prepared by Helena, MT Branch

Client: Chino Mine Company
Project: Phytotoxicity
Workorder: H13120008

Report Date: 12/24/13
Date Received: 11/26/13

		Analysis		Conductivity, CaCl2	Millivolts	pCu, Measured	ph, CaCl2
		Units		mmhos/cm	mV	s_u_	s_u_
Sample ID	**Client Sample ID**	**Up**	**Low**	**Results**	**Results**	**Results**	**Results**
H13120008-001	STS-PT-2013-34	0	0	1.6	105	3.45	4.7
H13120008-002	STS-PT-2013-35	0	0	1.6	120	2.87	4.3
H13120008-003	STS-PT-2013-36	0	0	1.8	108	3.33	6.1

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: Chino Mine Company
Project: Phytotoxicity

Report Date: 12/24/13
Work Order: H13120008

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: A5310 C									Analytical Run: SUB-C181773
Sample ID: ICV-7684	Initial Calibration Verification Standard								12/16/13 07:47
Organic Carbon, Dissolved (DOC)	10.2	mg/L	0.50	102	90	110			
Sample ID: CCV-7343	Continuing Calibration Verification Standard								12/16/13 10:44
Organic Carbon, Dissolved (DOC)	10.2	mg/L	0.50	102	90	110			
Method: A5310 C									Batch: C_40071
Sample ID: MBLK	Method Blank				Run: SUB-C181773				12/16/13 08:08
Organic Carbon, Dissolved (DOC)	ND	mg/L	0.04						
Sample ID: MB-22703	Method Blank				Run: SUB-C181773				12/16/13 08:39
Organic Carbon, Dissolved (DOC)	0.9	mg/kg	0.04						
Sample ID: H13120008-003A	Sample Matrix Spike				Run: SUB-C181773				12/16/13 13:06
Organic Carbon, Dissolved (DOC)	59.2	mg/kg	1.0	106	85	115			
Sample ID: H13120008-003A	Sample Matrix Spike Duplicate				Run: SUB-C181773				12/16/13 13:17
Organic Carbon, Dissolved (DOC)	59.6	mg/kg	1.0	106	85	115	0.6	10	
Sample ID: LCS-7684	Laboratory Control Sample				Run: SUB-C181773				12/16/13 13:28
Organic Carbon, Dissolved (DOC)	10.3	mg/L	0.50	103	90	110			
Sample ID: H13120008-002A	Sample Duplicate				Run: SUB-C181773				12/16/13 12:45
Organic Carbon, Dissolved (DOC)	9.81	mg/kg	1.0				2.8	10	

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: Chino Mine Company **Report Date:** 12/24/13
Project: Phytotoxicity **Work Order:** H13120008

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: arcadis SOP									Batch: 131211_1_PH-S-PASTE
Sample ID: LCS-22738	Laboratory Control Sample				Run: MISC SOILS_131216B				12/17/13 09:16
Conductivity, CaCl2	2.15	mmhos/cm	0.10	82	70	130			
pCu, Measured	8.89	s.u.	0.010	102	70	130			
ph, CaCl2	7.31	s.u.	0.10	101	70	130			
Sample ID: H13110098-010Adup	Sample Duplicate				Run: MISC SOILS_131216B				12/17/13 09:29
Conductivity, CaCl2	1.65	mmhos/cm	0.10						
Millivolts	94.0	mV							
pCu, Measured	3.89	s.u.	0.010						
ph, CaCl2	4.64	s.u.	0.10						
Sample ID: H13110098-020Adup	Sample Duplicate				Run: MISC SOILS_131216B				12/17/13 09:44
Conductivity, CaCl2	1.51	mmhos/cm	0.10						
Millivolts	-32.9	mV							
pCu, Measured	8.90	s.u.	0.010						
ph, CaCl2	6.51	s.u.	0.10						
Sample ID: LCS-22739	Laboratory Control Sample				Run: MISC SOILS_131216B				12/17/13 09:47
Conductivity, CaCl2	2.49	mmhos/cm	0.10	95	70	130			
pCu, Measured	9.15	s.u.	0.010	105	70	130			
ph, CaCl2	7.02	s.u.	0.10	97	70	130			
Sample ID: H13110098-030Adup	Sample Duplicate				Run: MISC SOILS_131216B				12/17/13 09:59
Conductivity, CaCl2	1.77	mmhos/cm	0.10						
Millivolts	85.3	mV							
pCu, Measured	4.24	s.u.	0.010						
ph, CaCl2	3.43	s.u.	0.10						
Sample ID: H13110098-036Adup	Sample Duplicate				Run: MISC SOILS_131216B				12/17/13 10:07
Millivolts	-10.1	mV	0.10						
pCu, Measured	8.00	s.u.							
Sample ID: H13120008-002Adup	Sample Duplicate				Run: MISC SOILS_131216B				12/17/13 10:10
Conductivity, CaCl2	1.59	mmhos/cm	0.10						
Millivolts	120	mV							
pCu, Measured	2.87	s.u.	0.010						
ph, CaCl2	4.24	s.u.	0.10						

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: Chino Mine Company
Report Date: 12/24/13
Project: Phytotoxicity
Work Order: H13120008

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: ASA10-3									Batch: 22722
Sample ID: MB-22722	Method Blank				Run: MAN-TECH_131209B				12/09/13 19:30
Alkalinity, sat paste	1	mg/L	0.1						
Bicarbonate, sat paste	1	mg/L	0.5						
Alkalinity, sat. paste	0.02	meq/L	0.002						
Bicarbonate, sat. paste	0.02	meq/L	0.008						
Sample ID: LCS-22722	Laboratory Control Sample				Run: MAN-TECH_131209B				12/09/13 19:36
Alkalinity, sat paste	226	mg/L	1.0	96	70	130			
Bicarbonate, sat paste	276	mg/L	1.0	96	70	130			
Alkalinity, sat. paste	4.53	meq/L	0.020	96	70	130			
Bicarbonate, sat. paste	4.53	meq/L	0.016	96	70	130			
Sample ID: H13120008-003ADUP	Sample Duplicate				Run: MAN-TECH_131209B				12/09/13 19:58
Alkalinity, sat paste	211	mg/L	1.0				0.1	30	
Bicarbonate, sat paste	258	mg/L	1.0				0.1	30	
Alkalinity, sat. paste	4.22	meq/L	0.020				0.1	30	
Bicarbonate, sat. paste	4.22	meq/L	0.016				0.1	30	

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: Chino Mine Company **Report Date:** 12/24/13
Project: Phytotoxicity **Work Order:** H13120008

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: ASA15-5								Batch: R93500	
Sample ID: H13110403-030ADUP	Sample Duplicate				Run: MISC SOILS_131212A			12/09/13 16:46	
Sand	32.0	%	1.0				0.0	20	
Silt	39.0	%	1.0				0.0	20	
Clay	29.0	%	1.0				0.0	20	
Texture	ND	%	1.0						
Sample ID: LCS-22751	Laboratory Control Sample				Run: MISC SOILS_131212A			12/09/13 16:46	
Sand	38.0	%	1.0	112	70	130			
Silt	33.0	%	1.0	94	70	130			
Clay	29.0	%	1.0	94	70	130			
Sample ID: H13110404-045ADUP	Sample Duplicate				Run: MISC SOILS_131212A			12/11/13 16:48	
Sand	40.0	%	1.0				0.0	20	
Silt	33.0	%	1.0				0.0	20	
Clay	27.0	%	1.0				0.0	20	
Texture	ND	%	1.0						

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: Chino Mine Company
Project: Phytotoxicity

Report Date: 12/24/13
Work Order: H13120008

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: ASA24-5									Analytical Run: FIA202-HE_131217A
Sample ID: ICV	Initial Calibration Verification Standard								12/17/13 09:32
Phosphorus	5.1	mg/kg	1.0	102	90	110			
Sample ID: ICB	Initial Calibration Blank, Instrument Blank								12/17/13 09:35
Phosphorus	0.027	mg/kg	1.0		0	0			
Method: ASA24-5									Batch: 22789
Sample ID: LCS-22789	Laboratory Control Sample				Run: FIA202-HE_131217A				12/17/13 09:36
Phosphorus	102	mg/kg	2.0	101	80	120			
Sample ID: MB-22789	Method Blank				Run: FIA202-HE_131217A				12/17/13 09:37
Phosphorus	ND	mg/kg	0.5						
Sample ID: H13120008-001ADUP	Sample Duplicate				Run: FIA202-HE_131217A				12/17/13 09:39
Phosphorus	55.2	mg/kg	1.0				0.3	30	
Sample ID: H13120008-002AMS	Sample Matrix Spike				Run: FIA202-HE_131217A				12/17/13 09:41
Phosphorus	62.8	mg/kg	1.0	82	70	130			

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: Chino Mine Company **Report Date:** 12/24/13
Project: Phytotoxicity **Work Order:** H13120008

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: ASA24-5.3									Analytical Run: FIA202-HE_131221A
Sample ID: ICV	Initial Calibration Verification Standard								12/21/13 09:45
Phosphate, Soluble	0.247	mg/kg	0.10	99	90	110			
Sample ID: CCV	Continuing Calibration Verification Standard								12/21/13 09:48
Phosphate, Soluble	0.0975	mg/kg	0.10	98	90	110			
Method: ASA24-5.3									Batch: 22906
Sample ID: MB-22906	Method Blank				Run: FIA202-HE_131221A				12/21/13 09:50
Phosphate, Soluble	ND	mg/kg	0.1						
Sample ID: LCS-0812	Laboratory Control Sample				Run: FIA202-HE_131221A				12/21/13 09:51
Phosphate, Soluble	0.426	mg/kg	0.10	114	70	130			
Sample ID: H13120008-003AMS	Sample Matrix Spike				Run: FIA202-HE_131221A				12/21/13 09:57
Phosphate, Soluble	4.05	mg/kg	1.0	101	70	130			
Sample ID: H13120008-002ADUP	Sample Duplicate				Run: FIA202-HE_131221A				12/21/13 10:02
Phosphate, Soluble	2.90	mg/kg	1.0				32	30	R

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

R - RPD exceeds advisory limit.

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: Chino Mine Company

Project: Phytotoxicity

Report Date: 12/24/13

Work Order: H13120008

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: ASA29-3									Batch: 22850
Sample ID: LCS-228501312181502	Laboratory Control Sample				Run: MISC SOILS_131216C				12/18/13 15:02
Organic Matter	1.48	%	0.17	108	70	130			
Sample ID: H13120008-003ADUP	Sample Duplicate				Run: MISC SOILS_131216C				12/18/13 15:02
Organic Matter	1.26	%	0.17						

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: Chino Mine Company **Report Date:** 12/24/13

Project: Phytotoxicity **Work Order:** H13120008

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: ASA33-8									Analytical Run: FIA203-HE_131219A
Sample ID: ICV	Initial Calibration Verification Standard								12/19/13 11:44
Nitrate as N, KCL Extract	1.1	mg/kg	1.0	105	90	110			
Sample ID: CCV	Continuing Calibration Verification Standard								12/19/13 11:47
Nitrate as N, KCL Extract	0.47	mg/kg	1.0	94	90	110			
Sample ID: ICB	Initial Calibration Blank, Instrument Blank								12/19/13 11:48
Nitrate as N, KCL Extract	-0.0038	mg/kg	1.0		0	0			
Method: ASA33-8									Batch: 22739
Sample ID: LCS-22872	Laboratory Control Sample				Run: FIA203-HE_131219A				12/19/13 11:52
Nitrate as N, KCL Extract	3.4	mg/kg	1.0	107	70	130			
Sample ID: MB-22872	Method Blank				Run: FIA203-HE_131219A				12/19/13 11:53
Nitrate as N, KCL Extract	ND	mg/kg	0.1						
Sample ID: H13120008-001AMS	Sample Matrix Spike				Run: FIA203-HE_131219A				12/19/13 11:55
Nitrate as N, KCL Extract	4.0	mg/kg	1.1	101	80	120			
Sample ID: H13120008-001AMSD	Sample Matrix Spike Duplicate				Run: FIA203-HE_131219A				12/19/13 11:57
Nitrate as N, KCL Extract	4.0	mg/kg	1.1	98	80	120	1.5	30	
Sample ID: H13120008-002ADUP	Sample Duplicate				Run: FIA203-HE_131219A				12/19/13 11:59
Nitrate as N, KCL Extract	2.2	mg/kg	1.0				2.9	30	

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: Chino Mine Company **Report Date:** 12/24/13
Project: Phytotoxicity **Work Order:** H13120008

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: ASAM10-3					Analytical Run: SOIL EC_131206A				
Sample ID: ICV_1_131205_1	Initial Calibration Verification Standard								12/06/13 10:04
Conductivity, sat. paste	19.3	mmhos/cm	0.10	97	90	110			
Sample ID: CCV_1_131205_1	Continuing Calibration Verification Standard								12/06/13 09:53
Conductivity, sat. paste	1.44	mmhos/cm	0.10	102	90	110			
Sample ID: CCV1_1_131205_1	Continuing Calibration Verification Standard								12/06/13 09:53
Conductivity, sat. paste	4.93	mmhos/cm	0.10	99	90	110			
Sample ID: ICV_1_131205_1	Initial Calibration Verification Standard								12/06/13 09:54
Conductivity, sat. paste	19.6	mmhos/cm	0.10	98	90	110			
Method: ASAM10-3					Batch: 131205_1_COND-S-PASTE				
Sample ID: LCS-22726	Laboratory Control Sample				Run: SOIL EC_131206A				12/06/13 10:05
Conductivity, sat. paste	5.14	mmhos/cm	0.10	85	80	120			
Sample ID: H13120008-003ADUP	Sample Duplicate				Run: SOIL EC_131206A				12/06/13 09:59
Conductivity, sat. paste	2.70	mmhos/cm	0.10				3.0	20	
Method: ASAM10-3					Analytical Run: SOIL EC_131213A				
Sample ID: CCV_1_131211_1	Continuing Calibration Verification Standard								12/12/13 09:18
Conductivity, sat. paste	1.39	mmhos/cm	0.10	99	90	110			
Sample ID: CCV1_1_131211_1	Continuing Calibration Verification Standard								12/12/13 09:19
Conductivity, sat. paste	4.84	mmhos/cm	0.10	97	90	110			
Sample ID: ICV_1_131211_1	Initial Calibration Verification Standard								12/12/13 09:19
Conductivity, sat. paste	19.3	mmhos/cm	0.10	96	90	110			
Sample ID: ICV_1_131211_1	Initial Calibration Verification Standard								12/12/13 10:09
Conductivity, sat. paste	19.3	mmhos/cm	0.10	97	90	110			
Method: ASAM10-3					Batch: 131211_1_COND-S-PASTE				
Sample ID: LCS-22793	Laboratory Control Sample				Run: SOIL EC_131213A				12/12/13 09:20
Conductivity, sat. paste	5.16	mmhos/cm	0.10	85	80	120			
Sample ID: H13120061-009ADUP	Sample Duplicate				Run: SOIL EC_131213A				12/12/13 10:17
Conductivity, sat. paste	12.6	mmhos/cm	0.10				0.3	20	

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: Chino Mine Company **Report Date:** 12/24/13

Project: Phytotoxicity **Work Order:** H13120008

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: ASAM10-3.2									Analytical Run: SOIL PH METER_131206A
Sample ID: ICV_1_131205_1	Initial Calibration Verification Standard								12/06/13 07:55
pH, sat. paste	10.0	s.u.	0.10	100	99	101			
Sample ID: CCV_1_131205_1	Continuing Calibration Verification Standard								12/06/13 07:38
pH, sat. paste	7.00	s.u.	0.10	100	98.6	101.4			
Sample ID: CCV1_1_131205_1	Continuing Calibration Verification Standard								12/06/13 07:39
pH, sat. paste	4.00	s.u.	0.10	100	97.5	102.5			
Sample ID: ICV_1_131205_1	Initial Calibration Verification Standard								12/06/13 07:40
pH, sat. paste	10.0	s.u.	0.10	100	99	101			
Method: ASAM10-3.2									Batch: 22722
Sample ID: LCS-22722	Laboratory Control Sample				Run: SOIL PH METER_131206A				12/06/13 07:40
pH, sat. paste	7.59	s.u.	0.10	100	95	105			
Sample ID: H13120008-003ADUP	Sample Duplicate				Run: SOIL PH METER_131206A				12/06/13 07:43
pH, sat. paste	5.86	s.u.	0.10				0.2	30	
Method: ASAM10-3.2									Analytical Run: SOIL PH METER_131213A
Sample ID: CCV_1_131211_1	Continuing Calibration Verification Standard								12/11/13 09:06
pH, sat. paste	7.01	s.u.	0.10	100	98.6	101.4			
Sample ID: CCV1_1_131211_1	Continuing Calibration Verification Standard								12/11/13 09:07
pH, sat. paste	4.01	s.u.	0.10	100	97.5	102.5			
Sample ID: ICV_1_131211_1	Initial Calibration Verification Standard								12/11/13 09:08
pH, sat. paste	10.0	s.u.	0.10	100	99	101			
Sample ID: ICV_1_131211_1	Initial Calibration Verification Standard								12/12/13 08:08
pH, sat. paste	10.0	s.u.	0.10	100	99	101			
Sample ID: ICV_1_131209_1	Initial Calibration Verification Standard								12/10/13 07:51
pH, sat. paste	10.0	s.u.	0.10	100	99	101			
Sample ID: ICV_1_131209_1	Initial Calibration Verification Standard								12/10/13 08:13
pH, sat. paste	10.0	s.u.	0.10	100	99	101			
Sample ID: ICV_1_131211_1	Initial Calibration Verification Standard								12/11/13 09:45
pH, sat. paste	10.0	s.u.	0.10	100	99	101			

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: Chino Mine Company
Report Date: 12/24/13
Project: Phytotoxicity
Work Order: H13120008

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: **Calculation**									Batch: R93691
Sample ID: **H13120061-009ADUP**	Sample Duplicate				Run: MISC SOILS_131220A				12/20/13 13:07
Exchangeable Calcium	32.5	meq/100g	0.10					30	
Exchangeable Magnesium	3.12	meq/100g	0.10				2.3	30	
Exchangeable Potassium	2.42	meq/100g	0.10					30	
Exchangeable Sodium	2.18	meq/100g	0.10				8.4	30	
Sample ID: **H13120008-002ADUP**	Sample Duplicate				Run: MISC SOILS_131220A				11/19/13 13:19
Exchangeable Calcium	6.41	meq/100g	0.10				0.2	30	
Exchangeable Magnesium	1.19	meq/100g	0.10				0.0	30	
Exchangeable Potassium	0.720	meq/100g	0.10				0.0	30	
Exchangeable Sodium	0.0900	meq/100g	0.10					30	
Exchangeable Copper	1.81	meq/100g	0.10						

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: Chino Mine Company
Project: Phytotoxicity

Report Date: 12/24/13
Work Order: H13120008

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: D2974								Batch: R93279	
Sample ID: H13120008-003ADUP	Sample Duplicate				Run: SOIL DRYING OVEN 2_13120			12/04/13 09:50	
Moisture (As Received)	7.88	wt%	0.20				4.0	20	

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: Chino Mine Company **Report Date:** 12/24/13
Project: Phytotoxicity **Work Order:** H13120008

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: E200.7									Analytical Run: ICP2-HE_131209B
Sample ID: ICV	Initial Calibration Verification Standard								12/09/13 10:19
Calcium	39.5	mg/L	1.0	99	90	110			
Magnesium	40.3	mg/L	1.0	101	90	110			
Sodium	39.7	mg/L	1.0	99	90	110			
Sample ID: ICSA	Interference Check Sample A								12/09/13 10:34
Calcium	458	mg/L	1.0	92	80	120			
Magnesium	408	mg/L	1.0	82	80	120			
Sodium	0.0529	mg/L	1.0		0	0			
Sample ID: ICSAB	Interference Check Sample AB								12/09/13 10:38
Calcium	450	mg/L	1.0	90	80	120			
Magnesium	406	mg/L	1.0	81	80	120			
Sodium	19.0	mg/L	1.0	95	80	120			
Method: E200.7									Analytical Run: ICP2-HE_131210A
Sample ID: ICV	Initial Calibration Verification Standard								12/10/13 09:21
Copper	0.804	mg/L	0.010	101	90	110			
Potassium	38.3	mg/L	1.0	96	90	110			
Sample ID: ICSA	Interference Check Sample A								12/10/13 09:35
Copper	-0.00476	mg/L	0.010		0	0			
Potassium	-0.0877	mg/L	1.0		0	0			
Sample ID: ICSAB	Interference Check Sample AB								12/10/13 09:39
Copper	0.510	mg/L	0.010	102	80	120			
Potassium	18.2	mg/L	1.0	91	80	120			

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: Chino Mine Company **Report Date:** 12/24/13

Project: Phytotoxicity **Work Order:** H13120008

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: E200.7									Analytical Run: ICP2-HE_131213C
Sample ID: ICV	Initial Calibration Verification Standard								12/13/13 11:10
Calcium	39.4	mg/L	1.0	99	90	110			
Copper	0.789	mg/L	0.010	99	90	110			
Magnesium	39.6	mg/L	1.0	99	90	110			
Potassium	39.1	mg/L	1.0	98	90	110			
Sodium	39.2	mg/L	1.0	98	90	110			
Sample ID: ICSA	Interference Check Sample A								12/13/13 11:25
Calcium	478	mg/L	1.0	96	80	120			
Copper	0.00698	mg/L	0.010		0	0			
Magnesium	533	mg/L	1.0	107	80	120			
Potassium	-0.0652	mg/L	1.0		0	0			
Sodium	0.0127	mg/L	1.0		0	0			
Sample ID: ICSAB	Interference Check Sample AB								12/13/13 11:29
Calcium	473	mg/L	1.0	95	80	120			
Copper	0.502	mg/L	0.010	100	80	120			
Magnesium	520	mg/L	1.0	104	80	120			
Potassium	19.3	mg/L	1.0	96	80	120			
Sodium	19.2	mg/L	1.0	96	80	120			
Method: E200.7									Analytical Run: ICP2-HE_131224A
Sample ID: ICV	Initial Calibration Verification Standard								12/24/13 09:40
Aluminum	4.10	mg/L	0.10	102	90	110			
Sample ID: ICSA	Interference Check Sample A								12/24/13 09:55
Aluminum	524	mg/L	0.10	105	80	120			
Sample ID: ICSAB	Interference Check Sample AB								12/24/13 09:59
Aluminum	512	mg/L	0.10	102	80	120			

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: Chino Mine Company **Report Date:** 12/24/13
Project: Phytotoxicity **Work Order:** H13120008

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual

Method: **E300.0** Analytical Run: IC102-H_131206A

Sample ID: **ICV** Initial Calibration Verification Standard 12/06/13 18:16

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Chloride	110	mg/L	1.0	106	90	110			
Sulfate	410	mg/L	1.0	103	90	110			
Fluoride	53	mg/L	0.10	105	90	110			

Sample ID: **CCB120613-1** Continuing Calibration Blank 12/06/13 21:39

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Chloride	0.024	mg/L	1.0						
Sulfate	0.10	mg/L	1.0						
Fluoride	0.041	mg/L	0.10						

Sample ID: **CCV120613-2** Continuing Calibration Verification Standard 12/07/13 00:10

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Chloride	100	mg/L	1.0	104	90	110			
Sulfate	410	mg/L	1.0	103	90	110			
Fluoride	52	mg/L	0.10	104	90	110			

Method: **E300.0** Batch: 22722

Sample ID: **LCS-22722** Laboratory Control Sample Run: IC102-H_131206A 12/06/13 20:28

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Sulfate, sat. paste	56.6	meq/L	0.42	94	70	130			
Chloride, sat. paste	2.94	meq/L	0.14	95	70	130			

Sample ID: **H13120008-003AMS** Sample Matrix Spike Run: IC102-H_131206A 12/06/13 21:08

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Fluoride	255	mg/L	1.1	102	90	110			
Sulfate, sat. paste	74.3	meq/L	0.24	102	90	110			
Chloride, sat. paste	14.3	meq/L	0.080	98	90	110			

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: Chino Mine Company **Report Date:** 12/24/13
Project: Phytotoxicity **Work Order:** H13120008

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: SW6010B									Batch: 22678
Sample ID: MB-22678	Method Blank				Run: ICP2-HE_131209B				12/09/13 12:20
Copper	ND	mg/kg	0.3						
Sample ID: LFB-22678	Laboratory Fortified Blank				Run: ICP2-HE_131209B				12/09/13 12:23
Copper	49.1	mg/kg	1.0	98	80	120			
Sample ID: LCS-22678	Laboratory Control Sample				Run: ICP2-HE_131209B				12/09/13 12:27
Copper	248	mg/kg	1.3	88	77.5	109.6			
Sample ID: H13120008-003AMS	Sample Matrix Spike				Run: ICP2-HE_131209B				12/09/13 12:56
Copper	3330	mg/kg	1.3		75	125			A
Sample ID: H13120008-003AMSD	Sample Matrix Spike Duplicate				Run: ICP2-HE_131209B				12/09/13 12:59
Copper	3160	mg/kg	1.3		75	125	5.3	20	A
Method: SW6010B									Batch: 22722
Sample ID: MB-22722	Method Blank				Run: ICP2-HE_131209B				12/09/13 14:47
Calcium	0.05	mg/L	0.03						
Magnesium	ND	mg/L	0.02						
Potassium	ND	mg/L	0.03						
Sodium	ND	mg/L	0.03						
Calcium, sat. paste	0.002	meq/L	0.001						
Magnesium, sat. paste	ND	meq/L	0.001						
Potassium, sat. paste	ND	meq/L	0.0007						
Sodium, sat. paste	ND	meq/L	0.001						
Sample ID: H13120010-001AMS2	Sample Matrix Spike				Run: ICP2-HE_131209B				12/09/13 15:25
Calcium	167	mg/L	1.0	101	75	125			
Magnesium	120	mg/L	1.0	104	75	125			
Potassium	124	mg/L	1.0	101	75	125			
Sodium	113	mg/L	1.0	102	75	125			
Calcium, sat. paste	8.35	meq/L	0.050	101	75	125			
Magnesium, sat. paste	9.87	meq/L	0.082	104	75	125			
Potassium, sat. paste	3.16	meq/L	0.026	124	75	125			
Sodium, sat. paste	4.92	meq/L	0.044	102	75	125			
Sample ID: H13120010-001AMSD2	Sample Matrix Spike Duplicate				Run: ICP2-HE_131209B				12/09/13 15:28
Calcium	167	mg/L	1.0	101	75	125	0.0	20	
Magnesium	119	mg/L	1.0	104	75	125	0.5	20	
Potassium	122	mg/L	1.0	100	75	125	0.9	20	
Sodium	112	mg/L	1.0	101	75	125	1.0	20	
Calcium, sat. paste	8.35	meq/L	0.050	101	75	125	0.0	20	
Magnesium, sat. paste	9.82	meq/L	0.082	104	75	125	0.5	20	
Potassium, sat. paste	3.13	meq/L	0.026	122	75	125	0.9	20	
Sodium, sat. paste	4.87	meq/L	0.044	101	75	125	1.0	20	

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

A - The analyte level was greater than four times the spike level. In accordance with the method % recovery is not calculated.

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: Chino Mine Company
Project: Phytotoxicity

Report Date: 12/24/13
Work Order: H13120008

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: **SW6010B**									Batch: 22722
Sample ID: **H13120010-001AMSD2**	Sample Matrix Spike Duplicate				Run: ICP2-HE_131209B				12/09/13 15:28
Method: **SW6010B**									Batch: 22678
Sample ID: **MB-22678**	Method Blank				Run: ICP2-HE_131210A				12/10/13 09:55
Copper	ND	mg/kg	0.3						
Sample ID: **H13120008-003AMS**	Sample Matrix Spike				Run: ICP2-HE_131210A				12/10/13 10:24
Copper	3550	mg/kg	2.6		75	125			A
Sample ID: **H13120008-003AMSD**	Sample Matrix Spike Duplicate				Run: ICP2-HE_131210A				12/10/13 10:27
Copper	3440	mg/kg	2.6		75	125	3.2	20	A
Method: **SW6010B**									Batch: 22722
Sample ID: **MB-22722**	Method Blank				Run: ICP2-HE_131210A				12/10/13 10:31
Calcium	ND	mg/L	0.03						
Magnesium	ND	mg/L	0.02						
Potassium	ND	mg/L	0.03						
Sodium	ND	mg/L	0.03						
Calcium, sat. paste	ND	meq/L	0.001						
Magnesium, sat. paste	ND	meq/L	0.001						
Potassium, sat. paste	ND	meq/L	0.0007						
Sodium, sat. paste	ND	meq/L	0.001						
Sample ID: **LCS-22722**	Laboratory Control Sample				Run: ICP2-HE_131210A				12/10/13 10:35
Calcium	473	mg/L	1.0	114	70	130			
Magnesium	152	mg/L	1.0	111	70	130			
Potassium	14.2	mg/L	1.0	108	70	130			
Sodium	730	mg/L	1.0	101	70	130			
Calcium, sat. paste	23.6	meq/L	0.050	114	70	130			
Magnesium, sat. paste	12.5	meq/L	0.082	111	70	130			
Potassium, sat. paste	0.362	meq/L	0.026	108	70	130			
Sodium, sat. paste	31.7	meq/L	0.043	101	70	130			
Sample ID: **H13120008-003Adup**	Sample Duplicate				Run: ICP2-HE_131210A				12/10/13 10:50
Calcium	642	mg/L	1.0				0.7	30	
Magnesium	59.9	mg/L	1.0				1.8	30	
Potassium	7.20	mg/L	1.0				0.1	30	
Sodium	11.7	mg/L	1.0				2.3	30	
Calcium, sat. paste	32.1	meq/L	0.050				0.7	30	
Magnesium, sat. paste	4.93	meq/L	0.082				1.8	30	
Potassium, sat. paste	0.184	meq/L	0.026				0.1	30	
Sodium, sat. paste	0.510	meq/L	0.043				2.3	30	

Qualifiers:

RL - Analyte reporting limit.

A - The analyte level was greater than four times the spike level. In accordance with the method % recovery is not calculated.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: Chino Mine Company **Report Date:** 12/24/13

Project: Phytotoxicity **Work Order:** H13120008

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: SW6010B									Batch: 22801
Sample ID: MB-22801	Method Blank				Run: ICP2-HE_131213C				12/13/13 20:37
Calcium	30	mg/kg	0.1						
Copper	1	mg/kg	0.02						
Magnesium	7	mg/kg	0.08						
Sodium	10	mg/kg	0.1						
Potassium	ND	mg/kg	0.1						
Calcium, Extractable	0.1	meq/100g	0.0007						
Magnesium, Extractable	0.06	meq/100g	0.0007						
Potassium, Extractable	ND	meq/100g	0.0004						
Sodium, Extractable	0.05	meq/100g	0.0006						
Sample ID: LCS-22801	Laboratory Control Sample				Run: ICP2-HE_131213C				12/13/13 20:41
Calcium	6510	mg/kg	1.0	125	70	130			
Magnesium	741	mg/kg	1.0	112	70	130			
Sodium	817	mg/kg	1.0	103	70	130			
Potassium	217	mg/kg	1.0	102	70	130			
Calcium, Extractable	32.5	meq/100g	0.0050	125	70	130			
Magnesium, Extractable	6.15	meq/100g	0.0083	112	70	130			
Potassium, Extractable	0.555	meq/100g	0.0026	102	70	130			
Sodium, Extractable	3.55	meq/100g	0.0044	103	70	130			
Sample ID: H13120008-002AMS2	Sample Matrix Spike				Run: ICP2-HE_131213C				12/13/13 20:59
Calcium	3810	mg/kg	1.0	101	75	125			
Copper	721	mg/kg	1.0		75	125			A
Magnesium	2590	mg/kg	1.0	98	75	125			
Sodium	2540	mg/kg	1.0	101	75	125			
Potassium	2750	mg/kg	1.0	98	75	125			
Calcium, Extractable	19.0	meq/100g	0.0050	101	75	125			
Magnesium, Extractable	21.5	meq/100g	0.0083	99	75	125			
Potassium, Extractable	7.03	meq/100g	0.0026	99	75	125			
Sodium, Extractable	11.1	meq/100g	0.0044	101	75	125			
Sample ID: H13120008-002AMSD2	Sample Matrix Spike Duplicate				Run: ICP2-HE_131213C				12/13/13 21:03
Calcium	3990	mg/kg	1.0	108	75	125	4.4	20	
Copper	771	mg/kg	1.0		75	125	6.7	20	A
Magnesium	2690	mg/kg	1.0	102	75	125	3.7	20	
Sodium	2710	mg/kg	1.0	107	75	125	6.3	20	
Potassium	2890	mg/kg	1.0	104	75	125	5.1	20	
Calcium, Extractable	19.9	meq/100g	0.0050	108	75	125	4.4	20	
Magnesium, Extractable	22.3	meq/100g	0.0083	103	75	125	3.7	20	
Potassium, Extractable	7.40	meq/100g	0.0026	104	75	125	5.1	20	
Sodium, Extractable	11.8	meq/100g	0.0044	107	75	125	6.3	20	
Sample ID: H13120006-006AMS2	Sample Matrix Spike				Run: ICP2-HE_131213C				12/13/13 21:25
Calcium	6950	mg/L	1.0	62	75	125			S

Qualifiers:

RL - Analyte reporting limit.

A - The analyte level was greater than four times the spike level. In accordance with the method % recovery is not calculated.

ND - Not detected at the reporting limit.

S - Spike recovery outside of advisory limits.

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: Chino Mine Company **Report Date:** 12/24/13
Project: Phytotoxicity **Work Order:** H13120008

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: SW6010B									Batch: 22801
Sample ID: H13120006-006AMS2	Sample Matrix Spike				Run: ICP2-HE_131213C				12/13/13 21:25
Magnesium	2520	mg/L	1.0	77	75	125			
Sodium	2630	mg/L	1.0	102	75	125			
Potassium	2700	mg/L	1.0	97	75	125			
Calcium, Extractable	34.7	meq/100g	0.0050	62	75	125			S
Magnesium, Extractable	21.0	meq/100g	0.0083	78	75	125			
Potassium, Extractable	6.91	meq/100g	0.0026	97	75	125			
Sodium, Extractable	11.5	meq/100g	0.0044	102	75	125			
Sample ID: H13120006-006AMSD2	Sample Matrix Spike Duplicate				Run: ICP2-HE_131213C				12/13/13 21:29
Calcium	7090	mg/L	1.0	68	75	125	2.1	20	S
Magnesium	2570	mg/L	1.0	79	75	125	1.8	20	
Sodium	2650	mg/L	1.0	103	75	125	0.6	20	
Potassium	2700	mg/L	1.0	97	75	125	0.1	20	
Calcium, Extractable	35.4	meq/100g	0.0050	68	75	125	2.1	20	S
Magnesium, Extractable	21.3	meq/100g	0.0083	80	75	125	1.8	20	
Potassium, Extractable	6.92	meq/100g	0.0026	97	75	125	0.1	20	
Sodium, Extractable	11.5	meq/100g	0.0044	103	75	125	0.6	20	
Method: SW6010B									Batch: 22854
Sample ID: MB-22854	Method Blank				Run: ICP2-HE_131224A				12/24/13 11:31
Aluminum	0.05	mg/kg	0.04						
Sample ID: LCS-22854	Laboratory Control Sample				Run: ICP2-HE_131224A				12/24/13 11:35
Aluminum	0.578	mg/kg	0.10	94	70	130			
Sample ID: H13120008-001AMS2	Sample Matrix Spike				Run: ICP2-HE_131224A				12/24/13 11:49
Aluminum	113	mg/kg	0.10	103	75	125			
Sample ID: H13120008-001AMSD2	Sample Matrix Spike Duplicate				Run: ICP2-HE_131224A				12/24/13 11:53
Aluminum	113	mg/kg	0.10	103	75	125	0.1	20	

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

S - Spike recovery outside of advisory limits.

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: Chino Mine Company
Project: Phytotoxicity
Report Date: 12/24/13
Work Order: H13120008

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: SW6020									Batch: 22739
Sample ID: MB-22739	Method Blank				Run: ICPMS204-B_131210B				12/11/13 03:55
Copper	0.08	mg/kg	0.0003						
Sample ID: LFB-22739	Laboratory Fortified Blank				Run: ICPMS204-B_131210B				12/11/13 04:04
Copper	0.548	mg/kg	0.10	93	80	120			
Sample ID: H13110098-021AMS	Sample Matrix Spike				Run: ICPMS204-B_131210B				12/11/13 04:31
Copper	2.66	mg/kg	0.10		0	0			A
Sample ID: H13110098-030Adup	Sample Duplicate				Run: ICPMS204-B_131210B				12/11/13 05:28
Copper	3.49	mg/kg	0.10						
Method: SW6020									Analytical Run: ICPMS204-B_131211B
Sample ID: ICV STD	Initial Calibration Verification Standard								12/11/13 09:25
Copper	0.0602	mg/L	0.0010	100	90	110			
Method: SW6020									Batch: 22739
Sample ID: MB-22739	Method Blank				Run: ICPMS204-B_131211B				12/12/13 00:01
Copper	0.009	mg/kg	0.0003						

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

A - The analyte level was greater than four times the spike level. In accordance with the method % recovery is not calculated.

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: Chino Mine Company **Report Date:** 12/24/13
Project: Phytotoxicity **Work Order:** H13120008

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: SW6020									Analytical Run: ICPMS204-B_131220C
Sample ID: ICV STD	Initial Calibration Verification Standard								12/20/13 09:35
Iron	0.314	mg/L	0.0010	105	90	110			
Manganese	0.300	mg/L	0.0010	100	90	110			
Sample ID: ICV STD	Initial Calibration Verification Standard								12/20/13 09:53
Iron	0.329	mg/L	0.0010	110	90	110			
Manganese	0.288	mg/L	0.0010	96	90	110			
Sample ID: ICV STD	Initial Calibration Verification Standard								12/20/13 17:42
Iron	0.305	mg/L	0.0010	102	90	110			
Manganese	0.291	mg/L	0.0010	97	90	110			
Sample ID: ICV STD	Initial Calibration Verification Standard								12/21/13 00:52
Iron	0.310	mg/L	0.0010	103	90	110			
Manganese	0.291	mg/L	0.0010	97	90	110			
Method: SW6020									Batch: 22854
Sample ID: MB-22854	Method Blank				Run: ICPMS204-B_131220C				12/21/13 09:19
Iron	0.3	mg/kg	0.04						
Manganese	0.2	mg/kg	0.02						
Sample ID: LCS-22854	Laboratory Control Sample				Run: ICPMS204-B_131220C				12/21/13 09:24
Iron	17.9	mg/kg	1.0	120	70	130			
Manganese	6.54	mg/kg	0.10	112	70	130			
Sample ID: H13120008-001AMS	Sample Matrix Spike				Run: ICPMS204-B_131220C				12/21/13 09:46
Iron	119	mg/kg	1.0	92	70	130			
Manganese	37.4	mg/kg	0.10	91	70	130			
Sample ID: H13120008-003Adup	Sample Duplicate				Run: ICPMS204-B_131220C				12/21/13 10:04
Iron	2.71	mg/kg	1.0				0.8	30	
Manganese	2.61	mg/kg	0.10				2.3	30	

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: Chino Mine Company
Report Date: 12/24/13
Project: Phytotoxicity
Work Order: H13120008

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: USDA23c									Batch: 22720
Sample ID: MB-22720	Method Blank				Run: MAN-TECH_131206A				12/06/13 07:15
Neutralization Potential	0.4	Tons/1000T	0.05						
Lime as CaCO3	0.04	%	0.005						
Sample ID: LCS-22720	Laboratory Control Sample				Run: MAN-TECH_131206A				12/06/13 07:21
Neutralization Potential	55.5	Tons/1000T	0.10	112	80	120			
Lime as CaCO3	5.55	%	0.010	112	80	120			
Sample ID: H13120008-003ADUP	Sample Duplicate				Run: MAN-TECH_131206A				12/06/13 07:59
Neutralization Potential	12.4	Tons/1000T	0.10				11	20	
Lime as CaCO3	1.24	%	0.010				11	20	

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: Chino Mine Company **Report Date:** 12/24/13
Project: Phytotoxicity **Work Order:** H13120008

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: USDA27a								Batch: 22722	
Sample ID: LCS_1_131205_1	Laboratory Control Sample				Run: SOIL ROOM BALANCE_13121			12/06/13 07:47	
Saturation	43.1	%	0.10	95	80	120			
Sample ID: H13120008-003ADUP	Sample Duplicate				Run: SOIL ROOM BALANCE_13121			12/06/13 07:47	
Saturation	33.0	%	0.10				0.1	20	

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

Workorder Receipt Checklist

Chino Mine Company

H13120008

Login completed by: Skyler T. Pester

Reviewed by: BL2000\sdull

Reviewed Date: 12/10/2013

Date Received: 11/26/2013

Received by: SRW

Carrier name: UPS Ground

Shipping container/cooler in good condition?	Yes ☑	No ☐	Not Present ☐
Custody seals intact on all shipping container(s)/cooler(s)?	Yes ☑	No ☐	Not Present ☐
Custody seals intact on all sample bottles?	Yes ☐	No ☐	Not Present ☑
Chain of custody present?	Yes ☑	No ☐	
Chain of custody signed when relinquished and received?	Yes ☑	No ☐	
Chain of custody agrees with sample labels?	Yes ☐	No ☑	
Samples in proper container/bottle?	Yes ☑	No ☐	
Sample containers intact?	Yes ☑	No ☐	
Sufficient sample volume for indicated test?	Yes ☑	No ☐	
All samples received within holding time? (Exclude analyses that are considered field parameters such as pH, DO, Res Cl, Sulfite, Ferrous Iron, etc.)	Yes ☑	No ☐	
Temp Blank received in all shipping container(s)/cooler(s)?	Yes ☐	No ☑	Not Applicable ☐
Container/Temp Blank temperature:	11.6℃ No Ice		
Water - VOA vials have zero headspace?	Yes ☐	No ☐	No VOA vials submitted ☑
Water - pH acceptable upon receipt?	Yes ☐	No ☐	Not Applicable ☑

Standard Reporting Procedures:

Lab measurement of analytes considered field parameters that require analysis within 15 minutes of sampling such as pH, Dissolved Oxygen and Residual Chlorine, are qualified as being analyzed outside of recommended holding time.

Solid/soil samples are reported on a wet weight basis (as received) unless specifically indicated. If moisture corrected, data units are typically noted as –dry. For agricultural and mining soil parameters/characteristics, all samples are dried and ground prior to sample analysis.

Contact and Corrective Action Comments:

Collection times taken from sample bags. 12/1/2013 STP.

ENERGY LABORATORIES

Chain of Custody and Analytical Request Record

Page 1 of 1

PLEASE PRINT (Provide as much information as possible.)

Company Name: Chino Mines Co

Report Mail Address (Required): PO Box 10 Bayard NM 88043

☐ No Hard Copy Email:

Invoice Address (Required): ↓

☐ No Hard Copy Email:

Project Name, PWS, Permit, Etc.: Phytotoxicity

Sample Origin State: NM

EPA/State Compliance: Yes ☐ No ☒

Contact Name: Pam Pinson

Phone/Fax: 575 912-5213

Cell:

Sampler: (Please Print) Pam Pinson

Invoice Contact & Phone: ↓

Purchase Order: 2N00000 2U3

Quote/Bottle Order:

Special Report/Formats:

☐ DW
☐ POTW/WWTP
☐ State: ______
☐ Other: ______
☐ EDD/EDT (Electronic Data)
Format: ______
☐ LEVEL IV
☐ NELAC

Number of Containers
Sample Type: A W S V B O DW
Air Water Soils/Solids
Vegetation Bioassay Other
DW - Drinking Water

ANALYSIS REQUESTED

Standard Turnaround (TAT)

R U S H

➡ Contact ELI prior to **RUSH** sample submittal for charges and scheduling – See Instruction Page

Comments: Call Matthew Barkley ARCADIS 303-231-9115 ext 157

	SAMPLE IDENTIFICATION (Name, Location, Interval, etc.)	Collection Date	Collection Time	MATRIX	SEE ATTACHED		
1	STS – PT-203-34	11-21-13	see bags	Soil	X		
2	STS – PT-203 35	11-21-13	↓	Soil	X		
3	STS – PT-2013 36	11-21-13		Soil	X		H13110008
4							
5							
6							
7							
8							
9							
10							

Shipped by: UPS G

Cooler ID(s): Y

Receipt Temp 11.6 °C

On Ice: Y [✓ N]

Custody Seal On Bottle Y [✓ N]

On Cooler [✓ Y] N

Intact [✓ Y] N

Signature Match [✓ Y] N

LABORATORY USE ONLY

Custody Record MUST be Signed

Relinquished by (print): Pam Pinson Date/Time: 11-21-13/ 3:30pm Signature: Pam Pinson

Relinquished by (print): Date/Time: Signature:

Received by (print): Date/Time: Signature:

Received by (print): Date/Time: Signature:

Received by Laboratory: Scott Wunderlich Date/Time: 11/26/13 10:15 Signature:

Sample Disposal: Return to Client: ______ Lab Disposal: ______

In certain circumstances, samples submitted to Energy Laboratories, Inc. may be subcontracted to other certified laboratories in order to complete the analysis requested. This serves as notice of this possibility. All sub-contract data will be clearly notated on your analytical report.

Visit our web site at www.energylab.com for additional information, downloadable fee schedule, forms, and links.

TABLE 4
SOIL SAMPLE ANALYTICAL ANALYSES

FREEPORT-MCMORAN CHINO MINES COMPANY
VANADIUM, NEW MEXICO
SMELTER/TAILING SOILS IU - PHYTOTOXICITY AND VEGETATION COMMUNITY STUDY

Parameter	Extraction Method	Analytical Method
Alkalinity (total)	ASA Mono #9, Part 2, 10-2.3.1	A 2320B
Chloride	ASA Mono #9, Part 2, 10-3.2	E300.0
Fluoride	ASA Mono #9, Part 2, 10-3.2	A 4500 F-C/Technicon 380-7WE
Exchangeable Calcium (NH4Oac)	ASA Mono #9, Part 2, 13-4	6010/6020
Exchangeable Copper (NH4Oac)	ASA Mono #9, Part 2, 13-4	6010/6020
Exchangeable Magnesium (NH4Oac)	ASA Mono #9, Part 2, 13-4	6010/6020
Exchangeable Potassium (NH4Oac)	ASA Mono #9, Part 2, 13-4	6010/6020
Exchangeable Sodium (NH4Oac)	ASA Mono #9, Part 2, 13-4	6010/6020
Sulfate (soluble)	ASA Mono #9, Part 2, 10-3.2	6010/6020
Copper (total)	3050	6010B
Copper (soluble), CaCl$_2$	ARCADIS SOP	ARCADIS SOP
Aluminum (soluble)	ASA Mono. #9, Part 2, Method 19-3.3	6010/6020
Iron (soluble)	ASA Mono. #9, Part 2, Method 19-3.3	6010/6020
Manganese (soluble)	ASA Mono. #9, Part 2, Method 19-3.3	6010/6020
Nitrate/Nitrite, CaCl$_2$	ASA Mono. #9, Part 2, Method 38-8.1	350.1, 353.2, 351.4
pH (saturated paste with saturated %)	ASA Mono #9, Part 2, 10-3.2	9045C
pH, CaCl$_2$	ARCADIS SOP	ARCADIS SOP
Plant Available Phosphorus (Bray/Olsen)	ASA Mono. #9, Part 2, Method 24-5.1	365.1
Phosphate	ASA Mono. #9, Part 2, Method 24-5.3	365.1
Electrical Conductivity, saturated paste	ASA Mono. #9, Part 2,Method 10-3.3	ASA Mono #9 Part 2
Electrical Conductivity, CaCl$_2$	ARCADIS SOP	ARCADIS SOP
Total Organic Matter	ASA Mono. #9, Part 2, Method 29-3.5.2	Handbook 60
DOC	ASA Mono. #9, Part 2, Method 10-3	ASA Mono #9 Part 2
Soil Texture	ASA Mono. #9, Part 1, Method 15-4	NAPT S-10.10^1
CaCO$_3$	USDA Handbook 60, Method 23C	Handbook 60
Measured pCu	ARCADIS SOP	ARCADIS SOP
Moisture (dry basis)	USDA Handbook 60,Method 26	

H13120008

ACZ Laboratories, Inc.
2773 Downhill Drive Steamboat Springs, CO 80487 (800) 334-5493

Analytical Report

August 14, 2013

Report to:
Pam Pinson
Freeport-McMoRan - Chino Mines Company
PO Box 10
Bayard, NM 88023

Bill to:
Pam Pinson
Freeport-McMoRan - Chino Mines Company
P.O. Box 13308
Phoenix, AZ 85002-3308

cc: Matthew Barkley

Project ID: ZN000001N6
ACZ Project ID: L13428

Pam Pinson:

Enclosed are the analytical results for sample(s) submitted to ACZ Laboratories, Inc. (ACZ) on July 23, 2013. This project has been assigned to ACZ's project number, L13428. Please reference this number in all future inquiries.

All analyses were performed according to ACZ's Quality Assurance Plan. The enclosed results relate only to the samples received under L13428. Each section of this report has been reviewed and approved by the appropriate Laboratory Supervisor, or a qualified substitute.

Except as noted, the test results for the methods and parameters listed on ACZ's current NELAC certificate letter (#ACZ) meet all requirements of NELAC.

This report shall be used or copied only in its entirety. ACZ is not responsible for the consequences arising from the use of a partial report.

All samples and sub-samples associated with this project will be disposed of after September 13, 2013. If the samples are determined to be hazardous, additional charges apply for disposal (typically $11/sample). If you would like the samples to be held longer than ACZ's stated policy or to be returned, please contact your Project Manager or Customer Service Representative for further details and associated costs. ACZ retains analytical raw data reports for ten years.

If you have any questions or other needs, please contact your Project Manager.

S. Habermehl

Scott Habermehl has reviewed
and approved this report.

ACZ Laboratories, Inc.
2773 Downhill Drive Steamboat Springs, CO 80487 (800) 334-5493

Case Narrative

Freeport-McMoRan - Chino Mines Company

August 14, 2013

Project ID: ZN000001N6
ACZ Project ID: L13428

Sample Receipt

ACZ Laboratories, Inc. (ACZ) received 20 soil samples from Freeport-McMoRan - Chino Mines Company on July 23, 2013. The samples were received in good condition. Upon receipt, the sample custodian removed the samples from the cooler, inspected the contents, and logged the samples into ACZ's computerized Laboratory Information Management System (LIMS). The samples were assigned ACZ LIMS project number L13428. The custodian verified the sample information entered into the computer against the chain of custody (COC) forms and sample bottle labels.

Holding Times

All analyses were performed within EPA recommended holding times.

Sample Analysis

These samples were analyzed for inorganic parameters. The individual methods are referenced on both, the ACZ invoice and the analytical reports. The extended qualifier reports may contain footnotes qualifying specific elements due to QC failures. In addition the following has been noted with this specific project:

1. The water extraction on L13428-07 was qualified with the N1 flag. The chemist mentioned that the sample had limited sample volume. The volume utilized was reduced to maintain the same dilution factor.

Freeport-McMoRan - Chino Mines Company
Project ID: ZN000001N6
Sample ID: STS-RWU-2011-4 0-6

ACZ Sample ID: ***L13428-01***
Date Sampled: *07/15/13 10:15*
Date Received: *07/23/13*
Sample Matrix: *Soil*

Metals Analysis

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Calcium, total (3050)	M6010B ICP	102	5320		*	mg/Kg	20	100	08/07/13 13:01	jjc
Copper, total (3050)	M6010B ICP	102	427		*	mg/Kg	1	5	08/07/13 13:01	jjc
Magnesium, total (3050)	M6010B ICP	102	3350		*	mg/Kg	20	100	08/07/13 13:01	jjc
Potassium, total (3050)	M6010B ICP	102	3860			mg/Kg	30	200	08/07/13 13:01	jjc
Sodium, total (3050)	M6010B ICP	102	70	B		mg/Kg	30	200	08/07/13 13:01	jjc

Soil Analysis

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Conductivity @25C	SM2510B									
Conductivity		1	0.741		*	mmhos/cm	0.001	0.01	08/08/13 0:00	cdb
Max Particle Size		1	2000		*	um			08/08/13 0:00	cdb
pH, Corrosivity	M9045D/M9040C									
pH		1	7.2			units	0.1	0.1	08/08/13 0:00	cdb
pH measured at		1	21.1			C	0.1	0.1	08/08/13 0:00	cdb
Solids, Percent	CLPSOW390, PART F, D-98	1	94.0		*	%	0.1	0.5	07/25/13 19:28	mss2

Soil Preparation

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972								07/25/13 15:10	njj/mss
Digestion - Hot Plate	M3050B ICP								08/06/13 13:16	cdb
Saturated Paste Extraction	USDA No. 60 (2)								08/07/13 17:15	cdb
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2								08/06/13 11:00	cdb
Water Extraction	ASA No. 9 10-2.3.2								08/08/13 10:17	brd

Wet Chemistry

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Sulfate, soluble (Water)	D516-02 - Turbidimetric	50	755		*	mg/Kg	50	250	08/09/13 13:21	bsu

Inorganic Analytical Results

Freeport-McMoRan - Chino Mines Company
Project ID: ZN000001N6
Sample ID: 1# WEST 0-6

ACZ Sample ID: ***L13428-02***
Date Sampled: *07/15/13 10:57*
Date Received: *07/23/13*
Sample Matrix: *Soil*

Metals Analysis

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Calcium, total (3050)	M6010B ICP	102	14000		*	mg/Kg	20	100	08/07/13 13:10	jjc
Copper, total (3050)	M6010B ICP	102	372		*	mg/Kg	1	5	08/07/13 13:10	jjc
Magnesium, total (3050)	M6010B ICP	102	3810		*	mg/Kg	20	100	08/07/13 13:10	jjc
Potassium, total (3050)	M6010B ICP	102	3030			mg/Kg	30	200	08/07/13 13:10	jjc
Sodium, total (3050)	M6010B ICP	102	100	B		mg/Kg	30	200	08/07/13 13:10	jjc

Soil Analysis

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Conductivity @25C	SM2510B									
Conductivity		1	0.599		*	mmhos/cm	0.001	0.01	08/08/13 0:00	cdb
Max Particle Size		1	2000		*	um			08/08/13 0:00	cdb
pH, Corrosivity	M9045D/M9040C									
pH		1	7.8			units	0.1	0.1	08/08/13 0:00	cdb
pH measured at		1	21.1			C	0.1	0.1	08/08/13 0:00	cdb
Solids, Percent	CLPSOW390, PART F, D-98	1	93.6		*	%	0.1	0.5	07/26/13 4:25	mss2

Soil Preparation

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972								07/25/13 15:13	mjj/mss
Digestion - Hot Plate	M3050B ICP								08/06/13 14:03	cdb
Saturated Paste Extraction	USDA No. 60 (2)								08/07/13 17:17	cdb
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2								08/06/13 11:03	cdb
Water Extraction	ASA No. 9 10-2.3.2								08/08/13 10:51	brd

Wet Chemistry

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Sulfate, soluble (Water)	D516-02 - Turbidimetric	50	646		*	mg/Kg	50	250	08/09/13 13:21	bsu

Inorganic Analytical Results

Freeport-McMoRan - Chino Mines Company
Project ID: ZN000001N6
Sample ID: STS-RWU-2011-15 0-6

ACZ Sample ID: ***L13428-03***
Date Sampled: *07/15/13 11:30*
Date Received: *07/23/13*
Sample Matrix: *Soil*

Metals Analysis

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Calcium, total (3050)	M6010B ICP	101	2860		*	mg/Kg	20	100	08/07/13 13:17	jjc
Copper, total (3050)	M6010B ICP	101	1640		*	mg/Kg	1	5	08/07/13 13:17	jjc
Magnesium, total (3050)	M6010B ICP	101	1850		*	mg/Kg	20	100	08/07/13 13:17	jjc
Potassium, total (3050)	M6010B ICP	101	2910			mg/Kg	30	200	08/07/13 13:17	jjc
Sodium, total (3050)	M6010B ICP	101	60	B		mg/Kg	30	200	08/07/13 13:17	jjc

Soil Analysis

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Conductivity @25C	SM2510B									
Conductivity		1	1.060		*	mmhos/cm	0.001	0.01	08/08/13 0:00	cdb
Max Particle Size		1	2000		*	um			08/08/13 0:00	cdb
pH, Corrosivity	M9045D/M9040C									
pH		1	5.7			units	0.1	0.1	08/08/13 0:00	cdb
pH measured at		1	21.1			C	0.1	0.1	08/08/13 0:00	cdb
Solids, Percent	CLPSOW390, PART F, D-98	1	92.7		*	%	0.1	0.5	07/26/13 8:54	mss2

Soil Preparation

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972								07/25/13 15:16	mjj/mss
Digestion - Hot Plate	M3050B ICP								08/06/13 14:19	cdb
Saturated Paste Extraction	USDA No. 60 (2)								08/07/13 17:19	cdb
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2								08/06/13 11:06	cdb
Water Extraction	ASA No. 9 10-2.3.2								08/08/13 11:08	brd

Wet Chemistry

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Sulfate, soluble (Water)	D516-02 - Turbidimetric	50	315		*	mg/Kg	50	250	08/09/13 13:21	bsu

** Please refer to Qualifier Reports for details.*

Freeport-McMoRan - Chino Mines Company

Project ID:	ZN000001N6
Sample ID:	STS-RWU-2011-6 0-6
ACZ Sample ID:	***L13428-04***
Date Sampled:	*07/15/13 11:57*
Date Received:	*07/23/13*
Sample Matrix:	*Soil*

Metals Analysis

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Calcium, total (3050)	M6010B ICP	103	7330		*	mg/Kg	20	100	08/07/13 13:20	jjc
Copper, total (3050)	M6010B ICP	103	1300		*	mg/Kg	1	5	08/07/13 13:20	jjc
Magnesium, total (3050)	M6010B ICP	103	4640		*	mg/Kg	20	100	08/07/13 13:20	jjc
Potassium, total (3050)	M6010B ICP	103	2650			mg/Kg	30	200	08/07/13 13:20	jjc
Sodium, total (3050)	M6010B ICP	103	200			mg/Kg	30	200	08/07/13 13:20	jjc

Soil Analysis

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Conductivity @25C	SM2510B									
Conductivity		1	0.640		*	mmhos/cm	0.001	0.01	08/08/13 0:00	cdb
Max Particle Size		1	2000		*	um			08/08/13 0:00	cdb
pH, Corrosivity	M9045D/M9040C									
pH		1	7.3			units	0.1	0.1	08/08/13 0:00	cdb
pH measured at		1	21.1			C	0.1	0.1	08/08/13 0:00	cdb
Solids, Percent	CLPSOW390, PART F, D-98	1	86.5		*	%	0.1	0.5	07/26/13 13:22	mss2

Soil Preparation

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972								07/25/13 15:20	mjj/mss
Digestion - Hot Plate	M3050B ICP								08/06/13 14:34	cdb
Saturated Paste Extraction	USDA No. 60 (2)								08/07/13 17:21	cdb
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2								08/06/13 11:09	cdb
Water Extraction	ASA No. 9 10-2.3.2								08/08/13 11:25	brd

Wet Chemistry

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Sulfate, soluble (Water)	D516-02 - Turbidimetric	50	1420		*	mg/Kg	50	250	08/09/13 13:21	bsu

Inorganic Analytical Results

Freeport-McMoRan - Chino Mines Company
Project ID: ZN000001N6
Sample ID: STS-RWU-2011-1 0-6

ACZ Sample ID: ***L13428-05***
Date Sampled: *07/16/13 09:03*
Date Received: *07/23/13*
Sample Matrix: *Soil*

Metals Analysis

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Calcium, total (3050)	M6010B ICP	101	1030		*	mg/Kg	20	100	08/07/13 13:29	jjc
Copper, total (3050)	M6010B ICP	101	338		*	mg/Kg	1	5	08/07/13 13:29	jjc
Magnesium, total (3050)	M6010B ICP	101	2050		*	mg/Kg	20	100	08/07/13 13:29	jjc
Potassium, total (3050)	M6010B ICP	101	1770			mg/Kg	30	200	08/07/13 13:29	jjc
Sodium, total (3050)	M6010B ICP	101	110	B		mg/Kg	30	200	08/07/13 13:29	jjc

Soil Analysis

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Conductivity @25C	SM2510B									
Conductivity		1	0.526		*	mmhos/cm	0.001	0.01	08/08/13 0:00	cdb
Max Particle Size		1	2000		*	um			08/08/13 0:00	cdb
pH, Corrosivity	M9045D/M9040C									
pH		1	5.2			units	0.1	0.1	08/08/13 0:00	cdb
pH measured at		1	21.1			C	0.1	0.1	08/08/13 0:00	cdb
Solids, Percent	CLPSOW390, PART F, D-98	1	84.1		*	%	0.1	0.5	07/26/13 17:51	mss2

Soil Preparation

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972								07/25/13 15:23	njj/mss
Digestion - Hot Plate	M3050B ICP								08/06/13 14:50	cdb
Saturated Paste Extraction	USDA No. 60 (2)								08/07/13 17:24	cdb
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2								08/06/13 11:12	cdb
Water Extraction	ASA No. 9 10-2.3.2								08/08/13 11:42	brd

Wet Chemistry

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Sulfate, soluble (Water)	D516-02 - Turbidimetric	50	458		*	mg/Kg	50	250	08/09/13 13:22	bsu

** Please refer to Qualifier Reports for details.*

Freeport-McMoRan - Chino Mines Company		ACZ Sample ID:	***L13428-06***
Project ID:	ZN000001N6	Date Sampled:	*07/16/13 08:13*
Sample ID:	STS-RWU-2011-3 0-6	Date Received:	*07/23/13*
		Sample Matrix:	*Soil*

Metals Analysis

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Calcium, total (3050)	M6010B ICP	101	1560		*	mg/Kg	20	100	08/07/13 13:32	jjc
Copper, total (3050)	M6010B ICP	101	998		*	mg/Kg	1	5	08/07/13 13:32	jjc
Magnesium, total (3050)	M6010B ICP	101	1670		*	mg/Kg	20	100	08/07/13 13:32	jjc
Potassium, total (3050)	M6010B ICP	101	1590			mg/Kg	30	200	08/07/13 13:32	jjc
Sodium, total (3050)	M6010B ICP	101	120	B		mg/Kg	30	200	08/07/13 13:32	jjc

Soil Analysis

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Conductivity @25C	SM2510B									
Conductivity		1	0.789		*	mmhos/cm	0.001	0.01	08/08/13 0:00	cdb
Max Particle Size		1	2000		*	um			08/08/13 0:00	cdb
pH, Corrosivity	M9045D/M9040C									
pH		1	5.1			units	0.1	0.1	08/08/13 0:00	cdb
pH measured at		1	21.1			C	0.1	0.1	08/08/13 0:00	cdb
Solids, Percent	CLPSOW390, PART F, D-98	1	84.4		*	%	0.1	0.5	07/26/13 22:19	mss2

Soil Preparation

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972								07/25/13 15:26	mjj/mss
Digestion - Hot Plate	M3050B ICP								08/06/13 15:06	cdb
Saturated Paste Extraction	USDA No. 60 (2)								08/07/13 17:26	cdb
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2								08/06/13 11:15	cdb
Water Extraction	ASA No. 9 10-2.3.2								08/08/13 12:00	brd

Wet Chemistry

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Sulfate, soluble (Water)	D516-02 - Turbidimetric	50	204	B	*	mg/Kg	50	250	08/09/13 13:22	bsu

Inorganic Analytical Results

Freeport-McMoRan - Chino Mines Company		ACZ Sample ID:	***L13428-07***
Project ID:	ZN000001N6	Date Sampled:	*07/15/13 13:05*
Sample ID:	STS-RWU-2011-14 0-6	Date Received:	*07/23/13*
		Sample Matrix:	*Soil*

Metals Analysis

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Calcium, total (3050)	M6010B ICP	102	3600		*	mg/Kg	20	100	08/07/13 13:35	jjc
Copper, total (3050)	M6010B ICP	102	1640		*	mg/Kg	1	5	08/07/13 13:35	jjc
Magnesium, total (3050)	M6010B ICP	102	3730		*	mg/Kg	20	100	08/07/13 13:35	jjc
Potassium, total (3050)	M6010B ICP	102	2950			mg/Kg	30	200	08/07/13 13:35	jjc
Sodium, total (3050)	M6010B ICP	102	90	B		mg/Kg	30	200	08/07/13 13:35	jjc

Soil Analysis

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Conductivity @25C	SM2510B									
Conductivity		1	0.675		*	mmhos/cm	0.001	0.01	08/08/13 0:00	cdb
Max Particle Size		1	2000		*	um			08/08/13 0:00	cdb
pH, Corrosivity	M9045D/M9040C									
pH		1	5.3			units	0.1	0.1	08/08/13 0:00	cdb
pH measured at		1	21.1			C	0.1	0.1	08/08/13 0:00	cdb
Solids, Percent	CLPSOW390, PART F, D-98	1	89.6		*	%	0.1	0.5	07/27/13 2:48	mss2

Soil Preparation

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972								07/25/13 15:30	mjj/mss
Digestion - Hot Plate	M3050B ICP								08/06/13 15:21	cdb
Saturated Paste Extraction	USDA No. 60 (2)								08/07/13 17:28	cdb
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2								08/06/13 11:18	cdb
Water Extraction	ASA No. 9 10-2.3.2				*				08/08/13 12:17	brd

Wet Chemistry

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Sulfate, soluble (Water)	D516-02 - Turbidimetric	50	915		*	mg/Kg	50	250	08/09/13 13:23	bsu

** Please refer to Qualifier Reports for details.*

Inorganic Analytical Results

Freeport-McMoRan - Chino Mines Company
Project ID: ZN000001N6
Sample ID: STS-RWU-2011-2 0-6

ACZ Sample ID: ***L13428-08***
Date Sampled: *07/16/13 10:15*
Date Received: *07/23/13*
Sample Matrix: *Soil*

Metals Analysis

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Calcium, total (3050)	M6010B ICP	101	680		*	mg/Kg	20	100	08/07/13 13:38	jjc
Copper, total (3050)	M6010B ICP	101	381		*	mg/Kg	1	5	08/07/13 13:38	jjc
Magnesium, total (3050)	M6010B ICP	101	1760		*	mg/Kg	20	100	08/07/13 13:38	jjc
Potassium, total (3050)	M6010B ICP	101	1460			mg/Kg	30	200	08/07/13 13:38	jjc
Sodium, total (3050)	M6010B ICP	101	90	B		mg/Kg	30	200	08/07/13 13:38	jjc

Soil Analysis

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Conductivity @25C	SM2510B									
Conductivity		1	1.390		*	mmhos/cm	0.001	0.01	08/08/13 0:00	cdb
Max Particle Size		1	2000		*	um			08/08/13 0:00	cdb
pH, Corrosivity	M9045D/M9040C									
pH		1	4.1			units	0.1	0.1	08/08/13 0:00	cdb
pH measured at		1	21.1			C	0.1	0.1	08/08/13 0:00	cdb
Solids, Percent	CLPSOW390, PART F, D-98	1	84.5		*	%	0.1	0.5	07/27/13 7:17	mss2

Soil Preparation

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972								07/25/13 15:33	njj/mss
Digestion - Hot Plate	M3050B ICP								08/06/13 15:37	cdb
Saturated Paste Extraction	USDA No. 60 (2)								08/07/13 17:30	cdb
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2								08/06/13 11:22	cdb
Water Extraction	ASA No. 9 10-2.3.2								08/08/13 12:34	brd

Wet Chemistry

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Sulfate, soluble (Water)	D516-02 - Turbidimetric	25	485		*	mg/Kg	25	125	08/09/13 13:29	bsu

** Please refer to Qualifier Reports for details.*

Inorganic Analytical Results

Freeport-McMoRan - Chino Mines Company
Project ID: ZN000001N6
Sample ID: STS-RWU-2011-8 0-6

ACZ Sample ID: ***L13428-09***
Date Sampled: *07/16/13 13:41*
Date Received: *07/23/13*
Sample Matrix: *Soil*

Metals Analysis

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Calcium, total (3050)	M6010B ICP	101	2360		*	mg/Kg	20	100	08/07/13 13:42	jjc
Copper, total (3050)	M6010B ICP	101	287		*	mg/Kg	1	5	08/07/13 13:42	jjc
Magnesium, total (3050)	M6010B ICP	101	2290		*	mg/Kg	20	100	08/07/13 13:42	jjc
Potassium, total (3050)	M6010B ICP	101	1970			mg/Kg	30	200	08/07/13 13:42	jjc
Sodium, total (3050)	M6010B ICP	101	90	B		mg/Kg	30	200	08/07/13 13:42	jjc

Soil Analysis

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Conductivity @25C	SM2510B									
Conductivity		1	0.420		*	mmhos/cm	0.001	0.01	08/08/13 0:00	cdb
Max Particle Size		1	2000		*	um			08/08/13 0:00	cdb
pH, Corrosivity	M9045D/M9040C									
pH		1	5.6			units	0.1	0.1	08/08/13 0:00	cdb
pH measured at		1	21.1			C	0.1	0.1	08/08/13 0:00	cdb
Solids, Percent	CLPSOW390, PART F, D-98	1	84.9		*	%	0.1	0.5	07/27/13 11:45	mss2

Soil Preparation

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972								07/25/13 15:36	njj/mss
Digestion - Hot Plate	M3050B ICP								08/06/13 15:52	cdb
Saturated Paste Extraction	USDA No. 60 (2)								08/07/13 17:33	cdb
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2								08/06/13 11:25	cdb
Water Extraction	ASA No. 9 10-2.3.2								08/08/13 12:51	brd

Wet Chemistry

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Sulfate, soluble (Water)	D516-02 - Turbidimetric	50	1250		*	mg/Kg	50	250	08/09/13 13:23	bsu

** Please refer to Qualifier Reports for details.*

Freeport-McMoRan - Chino Mines Company

Project ID:	ZN000001N6	ACZ Sample ID:	***L13428-10***
Sample ID:	STS-RWU-2011-5 0-6	Date Sampled:	*07/16/13 12:59*
		Date Received:	*07/23/13*
		Sample Matrix:	*Soil*

Metals Analysis

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Calcium, total (3050)	M6010B ICP	101	1250		*	mg/Kg	20	100	08/07/13 13:45	jjc
Copper, total (3050)	M6010B ICP	101	779		*	mg/Kg	1	5	08/07/13 13:45	jjc
Magnesium, total (3050)	M6010B ICP	101	1820		*	mg/Kg	20	100	08/07/13 13:45	jjc
Potassium, total (3050)	M6010B ICP	101	2170			mg/Kg	30	200	08/07/13 13:45	jjc
Sodium, total (3050)	M6010B ICP	101	80	B		mg/Kg	30	200	08/07/13 13:45	jjc

Soil Analysis

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Conductivity @25C	SM2510B									
Conductivity		1	0.621		*	mmhos/cm	0.001	0.01	08/08/13 0:00	cdb
Max Particle Size		1	2000		*	um			08/08/13 0:00	cdb
pH, Corrosivity	M9045D/M9040C									
pH		1	4.6			units	0.1	0.1	08/08/13 0:00	cdb
pH measured at		1	21.1			C	0.1	0.1	08/08/13 0:00	cdb
Solids, Percent	CLPSOW390, PART F, D-98	1	87.2		*	%	0.1	0.5	07/27/13 16:14	mss2

Soil Preparation

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972								07/25/13 15:40	mjj/mss
Digestion - Hot Plate	M3050B ICP								08/06/13 16:08	cdb
Saturated Paste Extraction	USDA No. 60 (2)								08/07/13 17:35	cdb
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2								08/06/13 11:28	cdb
Water Extraction	ASA No. 9 10-2.3.2								08/08/13 13:08	brd

Wet Chemistry

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Sulfate, soluble (Water)	D516-02 - Turbidimetric	50	396		*	mg/Kg	50	250	08/09/13 13:23	bsu

** Please refer to Qualifier Reports for details.*

Freeport-McMoRan - Chino Mines Company
Project ID: ZN000001N6
Sample ID: STS-RWU-2011-16 0-6

ACZ Sample ID: ***L13428-11***
Date Sampled: *07/16/13 14:31*
Date Received: *07/23/13*
Sample Matrix: *Soil*

Metals Analysis

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Calcium, total (3050)	M6010B ICP	101	1390		*	mg/Kg	20	100	08/07/13 13:48	jjc
Copper, total (3050)	M6010B ICP	101	395		*	mg/Kg	1	5	08/07/13 13:48	jjc
Magnesium, total (3050)	M6010B ICP	101	1840		*	mg/Kg	20	100	08/07/13 13:48	jjc
Potassium, total (3050)	M6010B ICP	101	1810			mg/Kg	30	200	08/07/13 13:48	jjc
Sodium, total (3050)	M6010B ICP	101	100	B		mg/Kg	30	200	08/07/13 13:48	jjc

Soil Analysis

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Conductivity @25C	SM2510B									
Conductivity		1	0.471		*	mmhos/cm	0.001	0.01	08/08/13 0:00	cdb
Max Particle Size		1	2000		*	um			08/08/13 0:00	cdb
pH, Corrosivity	M9045D/M9040C									
pH		1	4.9			units	0.1	0.1	08/08/13 0:00	cdb
pH measured at		1	21.1			C	0.1	0.1	08/08/13 0:00	cdb
Solids, Percent	CLPSOW390, PART F, D-98	1	87.1		*	%	0.1	0.5	07/27/13 20:42	mss2

Soil Preparation

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972								07/25/13 15:43	njj/mss
Digestion - Hot Plate	M3050B ICP								08/06/13 16:24	cdb
Saturated Paste Extraction	USDA No. 60 (2)								08/07/13 17:37	cdb
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2								08/06/13 11:31	cdb
Water Extraction	ASA No. 9 10-2.3.2								08/08/13 13:25	brd

Wet Chemistry

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Sulfate, soluble (Water)	D516-02 - Turbidimetric	50	1050		*	mg/Kg	50	250	08/09/13 13:49	bsu

** Please refer to Qualifier Reports for details.*

Freeport-McMoRan - Chino Mines Company		ACZ Sample ID:	***L13428-12***
Project ID:	ZN000001N6	Date Sampled:	*07/15/13 17:27*
Sample ID:	STS-RWU-2011-7 0-6	Date Received:	*07/23/13*
		Sample Matrix:	*Soil*

Metals Analysis

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Calcium, total (3050)	M6010B ICP	100	670		*	mg/Kg	20	100	08/07/13 13:51	jjc
Copper, total (3050)	M6010B ICP	100	529		*	mg/Kg	1	5	08/07/13 13:51	jjc
Magnesium, total (3050)	M6010B ICP	100	1240		*	mg/Kg	20	100	08/07/13 13:51	jjc
Potassium, total (3050)	M6010B ICP	100	1110			mg/Kg	30	200	08/07/13 13:51	jjc
Sodium, total (3050)	M6010B ICP	100	90	B		mg/Kg	30	200	08/07/13 13:51	jjc

Soil Analysis

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Conductivity @25C	SM2510B									
Conductivity		1	0.388		*	mmhos/cm	0.001	0.01	08/08/13 0:00	cdb
Max Particle Size		1	2000		*	um			08/08/13 0:00	cdb
pH, Corrosivity	M9045D/M9040C									
pH		1	4.9			units	0.1	0.1	08/08/13 0:00	cdb
pH measured at		1	21.1			C	0.1	0.1	08/08/13 0:00	cdb
Solids, Percent	CLPSOW390, PART F, D-98	1	84.6		*	%	0.1	0.5	07/28/13 1:11	mss2

Soil Preparation

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972								07/25/13 15:46	mjj/mss
Digestion - Hot Plate	M3050B ICP								08/06/13 16:39	cdb
Saturated Paste Extraction	USDA No. 60 (2)								08/07/13 17:39	cdb
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2								08/06/13 11:34	cdb
Water Extraction	ASA No. 9 10-2.3.2								08/08/13 13:42	brd

Wet Chemistry

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Sulfate, soluble (Water)	D516-02 - Turbidimetric	50	124	B	*	mg/Kg	50	250	08/09/13 13:49	bsu

Inorganic Analytical Results

Freeport-McMoRan - Chino Mines Company

Project ID:	ZN000001N6	ACZ Sample ID:	***L13428-13***
Sample ID:	STS-RWU-2011-9 0-6	Date Sampled:	*07/16/13 12:07*
		Date Received:	*07/23/13*
		Sample Matrix:	*Soil*

Metals Analysis

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Calcium, total (3050)	M6010B ICP	101	650		*	mg/Kg	20	100	08/07/13 13:54	jjc
Copper, total (3050)	M6010B ICP	101	560		*	mg/Kg	1	5	08/07/13 13:54	jjc
Magnesium, total (3050)	M6010B ICP	101	1980		*	mg/Kg	20	100	08/07/13 13:54	jjc
Potassium, total (3050)	M6010B ICP	101	1700			mg/Kg	30	200	08/07/13 13:54	jjc
Sodium, total (3050)	M6010B ICP	101	90	B		mg/Kg	30	200	08/07/13 13:54	jjc

Soil Analysis

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Conductivity @25C	SM2510B									
Conductivity		1	0.614		*	mmhos/cm	0.001	0.01	08/08/13 0:00	cdb
Max Particle Size		1	2000		*	um			08/08/13 0:00	cdb
pH, Corrosivity	M9045D/M9040C									
pH		1	4.4			units	0.1	0.1	08/08/13 0:00	cdb
pH measured at		1	21.1			C	0.1	0.1	08/08/13 0:00	cdb
Solids, Percent	CLPSOW390, PART F, D-98	1	81.7		*	%	0.1	0.5	07/28/13 5:39	mss2

Soil Preparation

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972								07/25/13 15:50	njj/mss
Digestion - Hot Plate	M3050B ICP								08/06/13 16:55	cdb
Saturated Paste Extraction	USDA No. 60 (2)								08/07/13 17:44	cdb
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2								08/06/13 11:37	cdb
Water Extraction	ASA No. 9 10-2.3.2								08/08/13 14:00	brd

Wet Chemistry

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Sulfate, soluble (Water)	D516-02 - Turbidimetric	5	163		*	mg/Kg	5	25	08/09/13 13:49	bsu

** Please refer to Qualifier Reports for details.*

Freeport-McMoRan - Chino Mines Company		ACZ Sample ID:	***L13428-14***
Project ID:	ZN000001N6	Date Sampled:	*07/16/13 18:01*
Sample ID:	STS-RWU-2011-10 0-6	Date Received:	*07/23/13*
		Sample Matrix:	*Soil*

Metals Analysis

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Calcium, total (3050)	M6010B ICP	101	960		*	mg/Kg	20	100	08/07/13 13:57	jjc
Copper, total (3050)	M6010B ICP	101	96		*	mg/Kg	1	5	08/07/13 13:57	jjc
Magnesium, total (3050)	M6010B ICP	101	1620		*	mg/Kg	20	100	08/07/13 13:57	jjc
Potassium, total (3050)	M6010B ICP	101	1850			mg/Kg	30	200	08/07/13 13:57	jjc
Sodium, total (3050)	M6010B ICP	101	70	B		mg/Kg	30	200	08/07/13 13:57	jjc

Soil Analysis

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Conductivity @25C	SM2510B									
Conductivity		1	0.874		*	mmhos/cm	0.001	0.01	08/08/13 0:00	cdb
Max Particle Size		1	2000		*	um			08/08/13 0:00	cdb
pH, Corrosivity	M9045D/M9040C									
pH		1	4.6			units	0.1	0.1	08/08/13 0:00	cdb
pH measured at		1	21.1			C	0.1	0.1	08/08/13 0:00	cdb
Solids, Percent	CLPSOW390, PART F, D-98	1	93.5		*	%	0.1	0.5	07/28/13 10:08	mss2

Soil Preparation

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972								07/25/13 15:53	mjj/mss
Digestion - Hot Plate	M3050B ICP								08/06/13 17:10	cdb
Saturated Paste Extraction	USDA No. 60 (2)								08/07/13 17:46	cdb
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2								08/06/13 11:40	cdb
Water Extraction	ASA No. 9 10-2.3.2								08/08/13 14:17	brd

Wet Chemistry

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Sulfate, soluble (Water)	D516-02 - Turbidimetric	50	270		*	mg/Kg	50	250	08/09/13 13:49	bsu

Inorganic Analytical Results

Freeport-McMoRan - Chino Mines Company
Project ID: ZN000001N6
Sample ID: STS-RWU-2011-11 0-6

ACZ Sample ID: ***L13428-15***
Date Sampled: *07/15/13 14:55*
Date Received: *07/23/13*
Sample Matrix: *Soil*

Metals Analysis

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Calcium, total (3050)	M6010B ICP	101	480		*	mg/Kg	20	100	08/07/13 14:06	jjc
Copper, total (3050)	M6010B ICP	101	216		*	mg/Kg	1	5	08/07/13 14:06	jjc
Magnesium, total (3050)	M6010B ICP	101	2100		*	mg/Kg	20	100	08/07/13 14:06	jjc
Potassium, total (3050)	M6010B ICP	101	1630			mg/Kg	30	200	08/07/13 14:06	jjc
Sodium, total (3050)	M6010B ICP	101	100	B		mg/Kg	30	200	08/07/13 14:06	jjc

Soil Analysis

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Conductivity @25C	SM2510B									
Conductivity		1	0.567		*	mmhos/cm	0.001	0.01	08/08/13 0:00	cdb
Max Particle Size		1	2000		*	um			08/08/13 0:00	cdb
pH, Corrosivity	M9045D/M9040C									
pH		1	4.3			units	0.1	0.1	08/08/13 0:00	cdb
pH measured at		1	21.1			C	0.1	0.1	08/08/13 0:00	cdb
Solids, Percent	CLPSOW390, PART F, D-98	1	86.7		*	%	0.1	0.5	07/28/13 14:37	mss2

Soil Preparation

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972								07/25/13 15:56	njj/mss
Digestion - Hot Plate	M3050B ICP								08/06/13 17:26	cdb
Saturated Paste Extraction	USDA No. 60 (2)								08/07/13 17:48	cdb
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2								08/06/13 11:44	cdb
Water Extraction	ASA No. 9 10-2.3.2								08/08/13 14:34	brd

Wet Chemistry

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Sulfate, soluble (Water)	D516-02 - Turbidimetric	5	142		*	mg/Kg	5	25	08/09/13 13:49	bsu

** Please refer to Qualifier Reports for details.*

Freeport-McMoRan - Chino Mines Company		ACZ Sample ID:	***L13428-16***
Project ID:	ZN000001N6	Date Sampled:	*07/15/13 16:30*
Sample ID:	STS-RWU-2011-12 0-6	Date Received:	*07/23/13*
		Sample Matrix:	*Soil*

Metals Analysis

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Calcium, total (3050)	M6010B ICP	102	2120		*	mg/Kg	20	100	08/07/13 14:10	jjc
Copper, total (3050)	M6010B ICP	102	316		*	mg/Kg	1	5	08/07/13 14:10	jjc
Magnesium, total (3050)	M6010B ICP	102	3230		*	mg/Kg	20	100	08/07/13 14:10	jjc
Potassium, total (3050)	M6010B ICP	102	3300			mg/Kg	30	200	08/07/13 14:10	jjc
Sodium, total (3050)	M6010B ICP	102	130	B		mg/Kg	30	200	08/07/13 14:10	jjc

Soil Analysis

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Conductivity @25C	SM2510B									
Conductivity		1	1.350		*	mmhos/cm	0.001	0.01	08/08/13 0:00	cdb
Max Particle Size		1	2000		*	um			08/08/13 0:00	cdb
pH, Corrosivity	M9045D/M9040C									
pH		1	3.9			units	0.1	0.1	08/08/13 0:00	cdb
pH measured at		1	21.1			C	0.1	0.1	08/08/13 0:00	cdb
Solids, Percent	CLPSOW390, PART F, D-98	1	87.3		*	%	0.1	0.5	07/28/13 19:05	mss2

Soil Preparation

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972								07/25/13 16:00	mjj/mss
Digestion - Hot Plate	M3050B ICP								08/06/13 17:42	cdb
Saturated Paste Extraction	USDA No. 60 (2)								08/07/13 17:51	cdb
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2								08/06/13 11:47	cdb
Water Extraction	ASA No. 9 10-2.3.2								08/08/13 14:51	brd

Wet Chemistry

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Sulfate, soluble (Water)	D516-02 - Turbidimetric	25	597		*	mg/Kg	25	125	08/09/13 13:55	bsu

** Please refer to Qualifier Reports for details.*

Freeport-McMoRan - Chino Mines Company
Project ID: ZN000001N6
Sample ID: STS-RWU-2011-13 0-6

ACZ Sample ID: ***L13428-17***
Date Sampled: *07/15/13 14:20*
Date Received: *07/23/13*
Sample Matrix: *Soil*

Metals Analysis

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Calcium, total (3050)	M6010B ICP	103	5100		*	mg/Kg	20	100	08/07/13 14:13	jjc
Copper, total (3050)	M6010B ICP	103	305		*	mg/Kg	1	5	08/07/13 14:13	jjc
Magnesium, total (3050)	M6010B ICP	103	5270		*	mg/Kg	20	100	08/07/13 14:13	jjc
Potassium, total (3050)	M6010B ICP	103	3520			mg/Kg	30	200	08/07/13 14:13	jjc
Sodium, total (3050)	M6010B ICP	103	120	B		mg/Kg	30	200	08/07/13 14:13	jjc

Soil Analysis

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Conductivity @25C	SM2510B									
Conductivity		1	1.080		*	mmhos/cm	0.001	0.01	08/08/13 0:00	cdb
Max Particle Size		1	2000		*	um			08/08/13 0:00	cdb
pH, Corrosivity	M9045D/M9040C									
pH		1	5.6			units	0.1	0.1	08/08/13 0:00	cdb
pH measured at		1	21.1			C	0.1	0.1	08/08/13 0:00	cdb
Solids, Percent	CLPSOW390, PART F, D-98	1	84.7		*	%	0.1	0.5	07/28/13 23:34	mss2

Soil Preparation

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972								07/25/13 16:03	mjj/mss
Digestion - Hot Plate	M3050B ICP								08/06/13 17:57	cdb
Saturated Paste Extraction	USDA No. 60 (2)								08/07/13 17:53	cdb
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2								08/06/13 11:50	cdb
Water Extraction	ASA No. 9 10-2.3.2								08/08/13 15:08	brd

Wet Chemistry

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Sulfate, soluble (Water)	D516-02 - Turbidimetric	25	671		*	mg/Kg	25	125	08/09/13 13:49	bsu

** Please refer to Qualifier Reports for details.*

Inorganic Analytical Results

Freeport-McMoRan - Chino Mines Company

Project ID:	ZN000001N6	ACZ Sample ID:	***L13428-18***
Sample ID:	STS-RWU-2011-17 0-6	Date Sampled:	*07/15/13 14:05*
		Date Received:	*07/23/13*
		Sample Matrix:	*Soil*

Metals Analysis

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Calcium, total (3050)	M6010B ICP	101	2900		*	mg/Kg	20	100	08/07/13 14:16	jjc
Copper, total (3050)	M6010B ICP	101	654		*	mg/Kg	1	5	08/07/13 14:16	jjc
Magnesium, total (3050)	M6010B ICP	101	3450		*	mg/Kg	20	100	08/07/13 14:16	jjc
Potassium, total (3050)	M6010B ICP	101	2800			mg/Kg	30	200	08/07/13 14:16	jjc
Sodium, total (3050)	M6010B ICP	101	170	B		mg/Kg	30	200	08/07/13 14:16	jjc

Soil Analysis

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Conductivity @25C	SM2510B									
Conductivity		1	1.130		*	mmhos/cm	0.001	0.01	08/08/13 0:00	cdb
Max Particle Size		1	2000		*	um			08/08/13 0:00	cdb
pH, Corrosivity	M9045D/M9040C									
pH		1	4.6			units	0.1	0.1	08/08/13 0:00	cdb
pH measured at		1	21.1			C	0.1	0.1	08/08/13 0:00	cdb
Solids, Percent	CLPSOW390, PART F, D-98	1	88.2		*	%	0.1	0.5	07/29/13 4:02	mss2

Soil Preparation

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972								07/25/13 16:06	njj/mss
Digestion - Hot Plate	M3050B ICP								08/06/13 18:13	cdb
Saturated Paste Extraction	USDA No. 60 (2)								08/07/13 17:55	cdb
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2								08/06/13 11:53	cdb
Water Extraction	ASA No. 9 10-2.3.2								08/08/13 15:25	brd

Wet Chemistry

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Sulfate, soluble (Water)	D516-02 - Turbidimetric	25	386		*	mg/Kg	25	125	08/09/13 13:55	bsu

** Please refer to Qualifier Reports for details.*

Freeport-McMoRan - Chino Mines Company		ACZ Sample ID:	***L13428-19***
Project ID:	ZN000001N6	Date Sampled:	*07/17/13 09:30*
Sample ID:	STS-RWU-2012-B1 0-6	Date Received:	*07/23/13*
		Sample Matrix:	*Soil*

Metals Analysis

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Calcium, total (3050)	M6010B ICP	101	800		*	mg/Kg	20	100	08/07/13 14:19	jjc
Copper, total (3050)	M6010B ICP	101	182		*	mg/Kg	1	5	08/07/13 14:19	jjc
Magnesium, total (3050)	M6010B ICP	101	2330		*	mg/Kg	20	100	08/07/13 14:19	jjc
Potassium, total (3050)	M6010B ICP	101	1380			mg/Kg	30	200	08/07/13 14:19	jjc
Sodium, total (3050)	M6010B ICP	101	100	B		mg/Kg	30	200	08/07/13 14:19	jjc

Soil Analysis

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Conductivity @25C	SM2510B									
Conductivity		1	0.380		*	mmhos/cm	0.001	0.01	08/08/13 0:00	cdb
Max Particle Size		1	2000		*	um			08/08/13 0:00	cdb
pH, Corrosivity	M9045D/M9040C									
pH		1	4.6			units	0.1	0.1	08/08/13 0:00	cdb
pH measured at		1	21.1			C	0.1	0.1	08/08/13 0:00	cdb
Solids, Percent	CLPSOW390, PART F, D-98	1	82.7		*	%	0.1	0.5	07/29/13 8:31	mss2

Soil Preparation

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972								07/25/13 16:10	mjj/mss
Digestion - Hot Plate	M3050B ICP								08/06/13 18:28	cdb
Saturated Paste Extraction	USDA No. 60 (2)								08/07/13 17:57	cdb
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2								08/06/13 11:56	cdb
Water Extraction	ASA No. 9 10-2.3.2								08/08/13 15:43	brd

Wet Chemistry

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Sulfate, soluble (Water)	D516-02 - Turbidimetric	50	281		*	mg/Kg	50	250	08/09/13 13:49	bsu

Freeport-McMoRan - Chino Mines Company		ACZ Sample ID:	***L13428-20***
Project ID:	ZN000001N6	Date Sampled:	*07/17/13 10:37*
Sample ID:	STS-RWU-2012-B2 0-6	Date Received:	*07/23/13*
		Sample Matrix:	*Soil*

Metals Analysis

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Calcium, total (3050)	M6010B ICP	101	1630		*	mg/Kg	20	100	08/07/13 14:22	jjc
Copper, total (3050)	M6010B ICP	101	344		*	mg/Kg	1	5	08/07/13 14:22	jjc
Magnesium, total (3050)	M6010B ICP	101	2720		*	mg/Kg	20	100	08/07/13 14:22	jjc
Potassium, total (3050)	M6010B ICP	101	1630			mg/Kg	30	200	08/07/13 14:22	jjc
Sodium, total (3050)	M6010B ICP	101	140	B		mg/Kg	30	200	08/07/13 14:22	jjc

Soil Analysis

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Conductivity @25C	SM2510B									
Conductivity		1	0.395		*	mmhos/cm	0.001	0.01	08/08/13 0:00	cdb
Max Particle Size		1	2000		*	um			08/08/13 0:00	cdb
pH, Corrosivity	M9045D/M9040C									
pH		1	4.7			units	0.1	0.1	08/08/13 0:00	cdb
pH measured at		1	21.1			C	0.1	0.1	08/08/13 0:00	cdb
Solids, Percent	CLPSOW390, PART F, D-98	1	90.1		*	%	0.1	0.5	07/29/13 12:59	mss2

Soil Preparation

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972								07/25/13 16:13	njj/mss
Digestion - Hot Plate	M3050B ICP								08/06/13 18:44	cdb
Saturated Paste Extraction	USDA No. 60 (2)								08/07/13 18:00	cdb
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2								08/06/13 11:59	cdb
Water Extraction	ASA No. 9 10-2.3.2								08/08/13 16:00	brd

Wet Chemistry

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Sulfate, soluble (Water)	D516-02 - Turbidimetric	50	160	B	*	mg/Kg	50	250	08/09/13 13:50	bsu

Inorganic Reference

Report Header Explanations

Batch	A distinct set of samples analyzed at a specific time
Found	Value of the QC Type of interest
Limit	Upper limit for RPD, in %.
Lower	Lower Recovery Limit, in % (except for LCSS, mg/Kg)
MDL	Method Detection Limit. Same as Minimum Reporting Limit. Allows for instrument and annual fluctuations.
PCN/SCN	A number assigned to reagents/standards to trace to the manufacturer's certificate of analysis
PQL	Practical Quantitation Limit, typically 5 times the MDL.
QC	True Value of the Control Sample or the amount added to the Spike
Rec	Recovered amount of the true value or spike added, in % (except for LCSS, mg/Kg)
RPD	Relative Percent Difference, calculation used for Duplicate QC Types
Upper	Upper Recovery Limit, in % (except for LCSS, mg/Kg)
Sample	Value of the Sample of interest

QC Sample Types

AS	Analytical Spike (Post Digestion)	*LCSWD*	Laboratory Control Sample - Water Duplicate
ASD	Analytical Spike (Post Digestion) Duplicate	*LFB*	Laboratory Fortified Blank
CCB	Continuing Calibration Blank	*LFM*	Laboratory Fortified Matrix
CCV	Continuing Calibration Verification standard	*LFMD*	Laboratory Fortified Matrix Duplicate
DUP	Sample Duplicate	*LRB*	Laboratory Reagent Blank
ICB	Initial Calibration Blank	*MS*	Matrix Spike
ICV	Initial Calibration Verification standard	*MSD*	Matrix Spike Duplicate
ICSAB	Inter-element Correction Standard - A plus B solutions	*PBS*	Prep Blank - Soil
LCSS	Laboratory Control Sample - Soil	*PBW*	Prep Blank - Water
LCSSD	Laboratory Control Sample - Soil Duplicate	*PQV*	Practical Quantitation Verification standard
LCSW	Laboratory Control Sample - Water	*SDL*	Serial Dilution

QC Sample Type Explanations

Blanks	Verifies that there is no or minimal contamination in the prep method or calibration procedure.
Control Samples	Verifies the accuracy of the method, including the prep procedure.
Duplicates	Verifies the precision of the instrument and/or method.
Spikes/Fortified Matrix	Determines sample matrix interferences, if any.
Standard	Verifies the validity of the calibration.

ACZ Qualifiers (Qual)

B	Analyte concentration detected at a value between MDL and PQL. The associated value is an estimated quantity.
H	Analysis exceeded method hold time. pH is a field test with an immediate hold time.
L	Target analyte response was below the laboratory defined negative threshold.
U	The material was analyzed for, but was not detected above the level of the associated value. The associated value is either the sample quantitation limit or the sample detection limit.

Method References

(1) EPA 600/4-83-020. Methods for Chemical Analysis of Water and Wastes, March 1983.
(2) EPA 600/R-93-100. Methods for the Determination of Inorganic Substances in Environmental Samples, August 1993.
(3) EPA 600/R-94-111. Methods for the Determination of Metals in Environmental Samples - Supplement I, May 1994.
(4) EPA SW-846. Test Methods for Evaluating Solid Waste.
(5) Standard Methods for the Examination of Water and Wastewater.

Comments

(1) QC results calculated from raw data. Results may vary slightly if the rounded values are used in the calculations.
(2) Soil, Sludge, and Plant matrices for Inorganic analyses are reported on a dry weight basis.
(3) Animal matrices for Inorganic analyses are reported on an "as received" basis.
(4) An asterisk in the "XQ" column indicates there is an extended qualifier and/or certification qualifier associated with the result.
(5) If the MDL equals the PQL or the MDL column is omitted, the PQL is the reporting limit.

For a complete list of ACZ's Extended Qualifiers, please click: http://www.acz.com/public/extquallist.pdf

Calcium, total (3050) M6010B ICP

ACZ ID	Type	Analyzed	PCN/SCN	QC	Sample	Found	Units	Rec	Lower	Upper	RPD	Limit	Qual
WG348991													
WG348991ICV	ICV	08/07/13 12:37	II130716-1	100		98.93	mg/L	98.9	90	110			
WG348991ICB	ICB	08/07/13 12:39				U	mg/L		-0.6	0.6			
WG348916PBS	PBS	08/07/13 12:52				U	mg/Kg		-60	60			
WG348916LCSS	LCSS	08/07/13 12:55	PCN42465	7890		8348	mg/Kg		6500	9290			
WG348916LCSSD	LCSSD	08/07/13 12:58	PCN42465	7890		8025	mg/Kg		6500	9290	3.9	20	
L13428-01MS	MS	08/07/13 13:04	II130719-2	6936.2856	5320	11761	mg/Kg	92.9	75	125			
L13428-01MSD	MSD	08/07/13 13:07	II130719-2	6936.2856	5320	11965	mg/Kg	95.8	75	125	1.72	20	

Conductivity SM2510B

ACZ ID	Type	Analyzed	PCN/SCN	QC	Sample	Found	Units	Rec	Lower	Upper	RPD	Limit	Qual
WG349133													
L13428-12DUP	DUP	08/08/13 15:53			.388	.39	nmhos/cn				0.5	20	

Copper, total (3050) M6010B ICP

ACZ ID	Type	Analyzed	PCN/SCN	QC	Sample	Found	Units	Rec	Lower	Upper	RPD	Limit	Qual
WG348991													
WG348991ICV	ICV	08/07/13 12:37	II130716-1	2		1.921	mg/L	96.1	90	110			
WG348991ICB	ICB	08/07/13 12:39				U	mg/L		-0.03	0.03			
WG348916PBS	PBS	08/07/13 12:52				U	mg/Kg		-3	3			
WG348916LCSS	LCSS	08/07/13 12:55	PCN42465	162		170.8	mg/Kg		135	190			
WG348916LCSSD	LCSSD	08/07/13 12:58	PCN42465	162		158.7	mg/Kg		135	190	7.3	20	
L13428-01MS	MS	08/07/13 13:04	II130719-2	51	427	505.4	mg/Kg	153.7	75	125			M3
L13428-01MSD	MSD	08/07/13 13:07	II130719-2	51	427	463.5	mg/Kg	71.6	75	125	8.65	20	M3

Magnesium, total (3050) M6010B ICP

ACZ ID	Type	Analyzed	PCN/SCN	QC	Sample	Found	Units	Rec	Lower	Upper	RPD	Limit	Qual
WG348991													
WG348991ICV	ICV	08/07/13 12:37	II130716-1	100		96.88	mg/L	96.9	90	110			
WG348991ICB	ICB	08/07/13 12:39				U	mg/L		-0.6	0.6			
WG348916PBS	PBS	08/07/13 12:52				U	mg/Kg		-60	60			
WG348916LCSS	LCSS	08/07/13 12:55	PCN42465	3520		3626	mg/Kg		2640	4410			
WG348916LCSSD	LCSSD	08/07/13 12:58	PCN42465	3520		3604	mg/Kg		2640	4410	0.6	20	
L13428-01MS	MS	08/07/13 13:04	II130719-2	5099.74704	3350	8015	mg/Kg	91.5	75	125			
L13428-01MSD	MSD	08/07/13 13:07	II130719-2	5099.74704	3350	7897	mg/Kg	89.2	75	125	1.48	20	

Ph M9045D/M9040C

ACZ ID	Type	Analyzed	PCN/SCN	QC	Sample	Found	Units	Rec	Lower	Upper	RPD	Limit	Qual
WG349086													
WG349086ICV	ICV	08/08/13 10:05	PCN40669	4		3.96	units	99	97	103			
L13428-01DUP	DUP	08/08/13 10:18			7.2	7.16	units				0.6	20	

Potassium, total (3050) M6010B ICP

ACZ ID	Type	Analyzed	PCN/SCN	QC	Sample	Found	Units	Rec	Lower	Upper	RPD	Limit	Qual
WG348991													
WG348991ICV	ICV	08/07/13 12:37	II130716-1	20		19.67	mg/L	98.4	90	110			
WG348991ICB	ICB	08/07/13 12:39				U	mg/L		-0.9	0.9			
WG348916PBS	PBS	08/07/13 12:52				U	mg/Kg		-90	90			
WG348916LCSS	LCSS	08/07/13 12:55	PCN42465	2600		2801	mg/Kg		1720	3470			
WG348916LCSSD	LCSSD	08/07/13 12:58	PCN42465	2600		2806	mg/Kg		1720	3470	0.2	20	
L13428-01MS	MS	08/07/13 13:04	II130719-2	10196.03424	3860	13556	mg/Kg	95.1	75	125			
L13428-01MSD	MSD	08/07/13 13:07	II130719-2	10196.03424	3860	13372	mg/Kg	93.3	75	125	1.37	20	

Sodium, total (3050) M6010B ICP

ACZ ID	Type	Analyzed	PCN/SCN	QC	Sample	Found	Units	Rec	Lower	Upper	RPD	Limit	Qual
WG348991													
WG348991ICV	ICV	08/07/13 12:37	II130716-1	100		98.94	mg/L	98.9	90	110			
WG348991ICB	ICB	08/07/13 12:39				U	mg/L		-0.9	0.9			
WG348916PBS	PBS	08/07/13 12:52				U	mg/Kg		-90	90			
WG348916LCSS	LCSS	08/07/13 12:55	PCN42465	517		534	mg/Kg		381	653			
WG348916LCSSD	LCSSD	08/07/13 12:58	PCN42465	517		509	mg/Kg		381	653	4.8	20	
L13428-01MS	MS	08/07/13 13:04	II130719-2	10205.049	70	8947	mg/Kg	87	75	125			
L13428-01MSD	MSD	08/07/13 13:07	II130719-2	10205.049	70	8903	mg/Kg	86.6	75	125	0.49	20	

Solids, Percent CLPSOW390, PART F, D-98

ACZ ID	Type	Analyzed	PCN/SCN	QC	Sample	Found	Units	Rec	Lower	Upper	RPD	Limit	Qual
WG348268													
WG348268PBS	PBS	07/25/13 15:00				U	%		99.9	100.1			
L13428-01DUP	DUP	07/25/13 23:57			94	94.32	%				0.3	20	

Sulfate, soluble (Water) D516-02 - Turbidimetric

ACZ ID	Type	Analyzed	PCN/SCN	QC	Sample	Found	Units	Rec	Lower	Upper	RPD	Limit	Qual
WG349205													
WG349205ICB	ICB	08/09/13 10:48				U	mg/L		-3	3			
WG349205ICV	ICV	08/09/13 10:48	WI130808-1	20		20	mg/L	100	90	110			
WG349205LFB	LFB	08/09/13 13:21	WI130416-3	9.99		9.7	mg/L	97.1	90	110			
WG349095PBS	PBS	08/09/13 13:21				U	mg/L		-15	15			
L13428-01DUP	DUP	08/09/13 13:21			755	759	mg/L				0.5	20	
L13428-02AS	AS	08/09/13 13:21	WI130416-3	499.5	646	1280	mg/L	126.9	90	110			M3

Inorganic Extended Qualifier Report

Freeport-McMoRan - Chino Mines Company

ACZ Project ID: ***L13428***

ACZ ID	WORKNUM	PARAMETER	METHOD	QUAL	DESCRIPTION
L13428-01	WG348991	Calcium, total (3050)	M6010B ICP	ZH	Serial Dilution exceeded the acceptance criteria. Matrix interference [physical or chemical] is suspected.
		Copper, total (3050)	M6010B ICP	M3	The spike recovery value is unusable since the analyte concentration in the sample is disproportionate to the spike level. The recovery of the associated control sample (LCS or LFB) was acceptable.
			M6010B ICP	ZH	Serial Dilution exceeded the acceptance criteria. Matrix interference [physical or chemical] is suspected.
		Magnesium, total (3050)	M6010B ICP	ZH	Serial Dilution exceeded the acceptance criteria. Matrix interference [physical or chemical] is suspected.
	WG349205	Sulfate, soluble (Water)	D516-02 - Turbidimetric	HD	Analysis is outside the intended scope of the method, which does not provide hold time information for soil extracts. No hold time is observed for collection to extraction. The referenced method hold time is observed for extraction-to-analysis.
			D516-02 - Turbidimetric	M3	The spike recovery value is unusable since the analyte concentration in the sample is disproportionate to the spike level. The recovery of the associated control sample (LCS or LFB) was acceptable.
L13428-02	WG348991	Calcium, total (3050)	M6010B ICP	ZH	Serial Dilution exceeded the acceptance criteria. Matrix interference [physical or chemical] is suspected.
		Copper, total (3050)	M6010B ICP	M3	The spike recovery value is unusable since the analyte concentration in the sample is disproportionate to the spike level. The recovery of the associated control sample (LCS or LFB) was acceptable.
			M6010B ICP	ZH	Serial Dilution exceeded the acceptance criteria. Matrix interference [physical or chemical] is suspected.
		Magnesium, total (3050)	M6010B ICP	ZH	Serial Dilution exceeded the acceptance criteria. Matrix interference [physical or chemical] is suspected.
	WG349205	Sulfate, soluble (Water)	D516-02 - Turbidimetric	HD	Analysis is outside the intended scope of the method, which does not provide hold time information for soil extracts. No hold time is observed for collection to extraction. The referenced method hold time is observed for extraction-to-analysis.
			D516-02 - Turbidimetric	M3	The spike recovery value is unusable since the analyte concentration in the sample is disproportionate to the spike level. The recovery of the associated control sample (LCS or LFB) was acceptable.
L13428-03	WG348991	Calcium, total (3050)	M6010B ICP	ZH	Serial Dilution exceeded the acceptance criteria. Matrix interference [physical or chemical] is suspected.
		Copper, total (3050)	M6010B ICP	M3	The spike recovery value is unusable since the analyte concentration in the sample is disproportionate to the spike level. The recovery of the associated control sample (LCS or LFB) was acceptable.
			M6010B ICP	ZH	Serial Dilution exceeded the acceptance criteria. Matrix interference [physical or chemical] is suspected.
		Magnesium, total (3050)	M6010B ICP	ZH	Serial Dilution exceeded the acceptance criteria. Matrix interference [physical or chemical] is suspected.
	WG349205	Sulfate, soluble (Water)	D516-02 - Turbidimetric	HD	Analysis is outside the intended scope of the method, which does not provide hold time information for soil extracts. No hold time is observed for collection to extraction. The referenced method hold time is observed for extraction-to-analysis.
			D516-02 - Turbidimetric	M3	The spike recovery value is unusable since the analyte concentration in the sample is disproportionate to the spike level. The recovery of the associated control sample (LCS or LFB) was acceptable.

ACZ ID	WORKNUM	PARAMETER	METHOD	QUAL	DESCRIPTION
L13428-04	WG348991	Calcium, total (3050)	M6010B ICP	ZH	Serial Dilution exceeded the acceptance criteria. Matrix interference [physical or chemical] is suspected.
		Copper, total (3050)	M6010B ICP	M3	The spike recovery value is unusable since the analyte concentration in the sample is disproportionate to the spike level. The recovery of the associated control sample (LCS or LFB) was acceptable.
			M6010B ICP	ZH	Serial Dilution exceeded the acceptance criteria. Matrix interference [physical or chemical] is suspected.
		Magnesium, total (3050)	M6010B ICP	ZH	Serial Dilution exceeded the acceptance criteria. Matrix interference [physical or chemical] is suspected.
	WG349205	Sulfate, soluble (Water)	D516-02 - Turbidimetric	HD	Analysis is outside the intended scope of the method, which does not provide hold time information for soil extracts. No hold time is observed for collection to extraction. The referenced method hold time is observed for extraction-to-analysis.
			D516-02 - Turbidimetric	M3	The spike recovery value is unusable since the analyte concentration in the sample is disproportionate to the spike level. The recovery of the associated control sample (LCS or LFB) was acceptable.
L13428-05	WG348991	Calcium, total (3050)	M6010B ICP	ZH	Serial Dilution exceeded the acceptance criteria. Matrix interference [physical or chemical] is suspected.
		Copper, total (3050)	M6010B ICP	M3	The spike recovery value is unusable since the analyte concentration in the sample is disproportionate to the spike level. The recovery of the associated control sample (LCS or LFB) was acceptable.
			M6010B ICP	ZH	Serial Dilution exceeded the acceptance criteria. Matrix interference [physical or chemical] is suspected.
		Magnesium, total (3050)	M6010B ICP	ZH	Serial Dilution exceeded the acceptance criteria. Matrix interference [physical or chemical] is suspected.
	WG349205	Sulfate, soluble (Water)	D516-02 - Turbidimetric	HD	Analysis is outside the intended scope of the method, which does not provide hold time information for soil extracts. No hold time is observed for collection to extraction. The referenced method hold time is observed for extraction-to-analysis.
			D516-02 - Turbidimetric	M3	The spike recovery value is unusable since the analyte concentration in the sample is disproportionate to the spike level. The recovery of the associated control sample (LCS or LFB) was acceptable.
L13428-06	WG348991	Calcium, total (3050)	M6010B ICP	ZH	Serial Dilution exceeded the acceptance criteria. Matrix interference [physical or chemical] is suspected.
		Copper, total (3050)	M6010B ICP	M3	The spike recovery value is unusable since the analyte concentration in the sample is disproportionate to the spike level. The recovery of the associated control sample (LCS or LFB) was acceptable.
			M6010B ICP	ZH	Serial Dilution exceeded the acceptance criteria. Matrix interference [physical or chemical] is suspected.
		Magnesium, total (3050)	M6010B ICP	ZH	Serial Dilution exceeded the acceptance criteria. Matrix interference [physical or chemical] is suspected.
	WG349205	Sulfate, soluble (Water)	D516-02 - Turbidimetric	DD	Sample required dilution due to matrix color or odor.
			D516-02 - Turbidimetric	HD	Analysis is outside the intended scope of the method, which does not provide hold time information for soil extracts. No hold time is observed for collection to extraction. The referenced method hold time is observed for extraction-to-analysis.
			D516-02 - Turbidimetric	M3	The spike recovery value is unusable since the analyte concentration in the sample is disproportionate to the spike level. The recovery of the associated control sample (LCS or LFB) was acceptable.

ACZ ID	WORKNUM	PARAMETER	METHOD	QUAL	DESCRIPTION
L13428-07	WG348991	Calcium, total (3050)	M6010B ICP	ZH	Serial Dilution exceeded the acceptance criteria. Matrix interference [physical or chemical] is suspected.
		Copper, total (3050)	M6010B ICP	M3	The spike recovery value is unusable since the analyte concentration in the sample is disproportionate to the spike level. The recovery of the associated control sample (LCS or LFB) was acceptable.
			M6010B ICP	ZH	Serial Dilution exceeded the acceptance criteria. Matrix interference [physical or chemical] is suspected.
		Magnesium, total (3050)	M6010B ICP	ZH	Serial Dilution exceeded the acceptance criteria. Matrix interference [physical or chemical] is suspected.
	WG349095	Water Extraction	ASA No. 9 10-2.3.2	N1	See Case Narrative.
	WG349205	Sulfate, soluble (Water)	D516-02 - Turbidimetric	HD	Analysis is outside the intended scope of the method, which does not provide hold time information for soil extracts. No hold time is observed for collection to extraction. The referenced method hold time is observed for extraction-to-analysis.
			D516-02 - Turbidimetric	M3	The spike recovery value is unusable since the analyte concentration in the sample is disproportionate to the spike level. The recovery of the associated control sample (LCS or LFB) was acceptable.
L13428-08	WG348991	Calcium, total (3050)	M6010B ICP	ZH	Serial Dilution exceeded the acceptance criteria. Matrix interference [physical or chemical] is suspected.
		Copper, total (3050)	M6010B ICP	M3	The spike recovery value is unusable since the analyte concentration in the sample is disproportionate to the spike level. The recovery of the associated control sample (LCS or LFB) was acceptable.
			M6010B ICP	ZH	Serial Dilution exceeded the acceptance criteria. Matrix interference [physical or chemical] is suspected.
		Magnesium, total (3050)	M6010B ICP	ZH	Serial Dilution exceeded the acceptance criteria. Matrix interference [physical or chemical] is suspected.
	WG349205	Sulfate, soluble (Water)	D516-02 - Turbidimetric	HD	Analysis is outside the intended scope of the method, which does not provide hold time information for soil extracts. No hold time is observed for collection to extraction. The referenced method hold time is observed for extraction-to-analysis.
			D516-02 - Turbidimetric	M3	The spike recovery value is unusable since the analyte concentration in the sample is disproportionate to the spike level. The recovery of the associated control sample (LCS or LFB) was acceptable.
L13428-09	WG348991	Calcium, total (3050)	M6010B ICP	ZH	Serial Dilution exceeded the acceptance criteria. Matrix interference [physical or chemical] is suspected.
		Copper, total (3050)	M6010B ICP	M3	The spike recovery value is unusable since the analyte concentration in the sample is disproportionate to the spike level. The recovery of the associated control sample (LCS or LFB) was acceptable.
			M6010B ICP	ZH	Serial Dilution exceeded the acceptance criteria. Matrix interference [physical or chemical] is suspected.
		Magnesium, total (3050)	M6010B ICP	ZH	Serial Dilution exceeded the acceptance criteria. Matrix interference [physical or chemical] is suspected.
	WG349205	Sulfate, soluble (Water)	D516-02 - Turbidimetric	HD	Analysis is outside the intended scope of the method, which does not provide hold time information for soil extracts. No hold time is observed for collection to extraction. The referenced method hold time is observed for extraction-to-analysis.
			D516-02 - Turbidimetric	M3	The spike recovery value is unusable since the analyte concentration in the sample is disproportionate to the spike level. The recovery of the associated control sample (LCS or LFB) was acceptable.

ACZ ID	WORKNUM	PARAMETER	METHOD	QUAL	DESCRIPTION
L13428-10	WG348991	Calcium, total (3050)	M6010B ICP	ZH	Serial Dilution exceeded the acceptance criteria. Matrix interference [physical or chemical] is suspected.
		Copper, total (3050)	M6010B ICP	M3	The spike recovery value is unusable since the analyte concentration in the sample is disproportionate to the spike level. The recovery of the associated control sample (LCS or LFB) was acceptable.
			M6010B ICP	ZH	Serial Dilution exceeded the acceptance criteria. Matrix interference [physical or chemical] is suspected.
		Magnesium, total (3050)	M6010B ICP	ZH	Serial Dilution exceeded the acceptance criteria. Matrix interference [physical or chemical] is suspected.
	WG349205	Sulfate, soluble (Water)	D516-02 - Turbidimetric	HD	Analysis is outside the intended scope of the method, which does not provide hold time information for soil extracts. No hold time is observed for collection to extraction. The referenced method hold time is observed for extraction-to-analysis.
			D516-02 - Turbidimetric	M3	The spike recovery value is unusable since the analyte concentration in the sample is disproportionate to the spike level. The recovery of the associated control sample (LCS or LFB) was acceptable.
L13428-11	WG348991	Calcium, total (3050)	M6010B ICP	ZH	Serial Dilution exceeded the acceptance criteria. Matrix interference [physical or chemical] is suspected.
		Copper, total (3050)	M6010B ICP	M3	The spike recovery value is unusable since the analyte concentration in the sample is disproportionate to the spike level. The recovery of the associated control sample (LCS or LFB) was acceptable.
			M6010B ICP	ZH	Serial Dilution exceeded the acceptance criteria. Matrix interference [physical or chemical] is suspected.
		Magnesium, total (3050)	M6010B ICP	ZH	Serial Dilution exceeded the acceptance criteria. Matrix interference [physical or chemical] is suspected.
	WG349205	Sulfate, soluble (Water)	D516-02 - Turbidimetric	HD	Analysis is outside the intended scope of the method, which does not provide hold time information for soil extracts. No hold time is observed for collection to extraction. The referenced method hold time is observed for extraction-to-analysis.
			D516-02 - Turbidimetric	M3	The spike recovery value is unusable since the analyte concentration in the sample is disproportionate to the spike level. The recovery of the associated control sample (LCS or LFB) was acceptable.
L13428-12	WG348991	Calcium, total (3050)	M6010B ICP	ZH	Serial Dilution exceeded the acceptance criteria. Matrix interference [physical or chemical] is suspected.
		Copper, total (3050)	M6010B ICP	M3	The spike recovery value is unusable since the analyte concentration in the sample is disproportionate to the spike level. The recovery of the associated control sample (LCS or LFB) was acceptable.
			M6010B ICP	ZH	Serial Dilution exceeded the acceptance criteria. Matrix interference [physical or chemical] is suspected.
		Magnesium, total (3050)	M6010B ICP	ZH	Serial Dilution exceeded the acceptance criteria. Matrix interference [physical or chemical] is suspected.
	WG349205	Sulfate, soluble (Water)	D516-02 - Turbidimetric	DD	Sample required dilution due to matrix color or odor.
			D516-02 - Turbidimetric	HD	Analysis is outside the intended scope of the method, which does not provide hold time information for soil extracts. No hold time is observed for collection to extraction. The referenced method hold time is observed for extraction-to-analysis.
			D516-02 - Turbidimetric	M3	The spike recovery value is unusable since the analyte concentration in the sample is disproportionate to the spike level. The recovery of the associated control sample (LCS or LFB) was acceptable.

ACZ ID	WORKNUM	PARAMETER	METHOD	QUAL	DESCRIPTION
L13428-13	WG348991	Calcium, total (3050)	M6010B ICP	ZH	Serial Dilution exceeded the acceptance criteria. Matrix interference [physical or chemical] is suspected.
		Copper, total (3050)	M6010B ICP	M3	The spike recovery value is unusable since the analyte concentration in the sample is disproportionate to the spike level. The recovery of the associated control sample (LCS or LFB) was acceptable.
			M6010B ICP	ZH	Serial Dilution exceeded the acceptance criteria. Matrix interference [physical or chemical] is suspected.
		Magnesium, total (3050)	M6010B ICP	ZH	Serial Dilution exceeded the acceptance criteria. Matrix interference [physical or chemical] is suspected.
	WG349205	Sulfate, soluble (Water)	D516-02 - Turbidimetric	HD	Analysis is outside the intended scope of the method, which does not provide hold time information for soil extracts. No hold time is observed for collection to extraction. The referenced method hold time is observed for extraction-to-analysis.
			D516-02 - Turbidimetric	M3	The spike recovery value is unusable since the analyte concentration in the sample is disproportionate to the spike level. The recovery of the associated control sample (LCS or LFB) was acceptable.
L13428-14	WG348991	Calcium, total (3050)	M6010B ICP	ZH	Serial Dilution exceeded the acceptance criteria. Matrix interference [physical or chemical] is suspected.
		Copper, total (3050)	M6010B ICP	M3	The spike recovery value is unusable since the analyte concentration in the sample is disproportionate to the spike level. The recovery of the associated control sample (LCS or LFB) was acceptable.
			M6010B ICP	ZH	Serial Dilution exceeded the acceptance criteria. Matrix interference [physical or chemical] is suspected.
		Magnesium, total (3050)	M6010B ICP	ZH	Serial Dilution exceeded the acceptance criteria. Matrix interference [physical or chemical] is suspected.
	WG349205	Sulfate, soluble (Water)	D516-02 - Turbidimetric	HD	Analysis is outside the intended scope of the method, which does not provide hold time information for soil extracts. No hold time is observed for collection to extraction. The referenced method hold time is observed for extraction-to-analysis.
			D516-02 - Turbidimetric	M3	The spike recovery value is unusable since the analyte concentration in the sample is disproportionate to the spike level. The recovery of the associated control sample (LCS or LFB) was acceptable.
L13428-15	WG348991	Calcium, total (3050)	M6010B ICP	ZH	Serial Dilution exceeded the acceptance criteria. Matrix interference [physical or chemical] is suspected.
		Copper, total (3050)	M6010B ICP	M3	The spike recovery value is unusable since the analyte concentration in the sample is disproportionate to the spike level. The recovery of the associated control sample (LCS or LFB) was acceptable.
			M6010B ICP	ZH	Serial Dilution exceeded the acceptance criteria. Matrix interference [physical or chemical] is suspected.
		Magnesium, total (3050)	M6010B ICP	ZH	Serial Dilution exceeded the acceptance criteria. Matrix interference [physical or chemical] is suspected.
	WG349205	Sulfate, soluble (Water)	D516-02 - Turbidimetric	HD	Analysis is outside the intended scope of the method, which does not provide hold time information for soil extracts. No hold time is observed for collection to extraction. The referenced method hold time is observed for extraction-to-analysis.
			D516-02 - Turbidimetric	M3	The spike recovery value is unusable since the analyte concentration in the sample is disproportionate to the spike level. The recovery of the associated control sample (LCS or LFB) was acceptable.

ACZ ID	WORKNUM	PARAMETER	METHOD	QUAL	DESCRIPTION
L13428-16	WG348991	Calcium, total (3050)	M6010B ICP	ZH	Serial Dilution exceeded the acceptance criteria. Matrix interference [physical or chemical] is suspected.
		Copper, total (3050)	M6010B ICP	M3	The spike recovery value is unusable since the analyte concentration in the sample is disproportionate to the spike level. The recovery of the associated control sample (LCS or LFB) was acceptable.
			M6010B ICP	ZH	Serial Dilution exceeded the acceptance criteria. Matrix interference [physical or chemical] is suspected.
		Magnesium, total (3050)	M6010B ICP	ZH	Serial Dilution exceeded the acceptance criteria. Matrix interference [physical or chemical] is suspected.
	WG349205	Sulfate, soluble (Water)	D516-02 - Turbidimetric	HD	Analysis is outside the intended scope of the method, which does not provide hold time information for soil extracts. No hold time is observed for collection to extraction. The referenced method hold time is observed for extraction-to-analysis.
			D516-02 - Turbidimetric	M3	The spike recovery value is unusable since the analyte concentration in the sample is disproportionate to the spike level. The recovery of the associated control sample (LCS or LFB) was acceptable.
L13428-17	WG348991	Calcium, total (3050)	M6010B ICP	ZH	Serial Dilution exceeded the acceptance criteria. Matrix interference [physical or chemical] is suspected.
		Copper, total (3050)	M6010B ICP	M3	The spike recovery value is unusable since the analyte concentration in the sample is disproportionate to the spike level. The recovery of the associated control sample (LCS or LFB) was acceptable.
			M6010B ICP	ZH	Serial Dilution exceeded the acceptance criteria. Matrix interference [physical or chemical] is suspected.
		Magnesium, total (3050)	M6010B ICP	ZH	Serial Dilution exceeded the acceptance criteria. Matrix interference [physical or chemical] is suspected.
	WG349205	Sulfate, soluble (Water)	D516-02 - Turbidimetric	HD	Analysis is outside the intended scope of the method, which does not provide hold time information for soil extracts. No hold time is observed for collection to extraction. The referenced method hold time is observed for extraction-to-analysis.
			D516-02 - Turbidimetric	M3	The spike recovery value is unusable since the analyte concentration in the sample is disproportionate to the spike level. The recovery of the associated control sample (LCS or LFB) was acceptable.
L13428-18	WG348991	Calcium, total (3050)	M6010B ICP	ZH	Serial Dilution exceeded the acceptance criteria. Matrix interference [physical or chemical] is suspected.
		Copper, total (3050)	M6010B ICP	M3	The spike recovery value is unusable since the analyte concentration in the sample is disproportionate to the spike level. The recovery of the associated control sample (LCS or LFB) was acceptable.
			M6010B ICP	ZH	Serial Dilution exceeded the acceptance criteria. Matrix interference [physical or chemical] is suspected.
		Magnesium, total (3050)	M6010B ICP	ZH	Serial Dilution exceeded the acceptance criteria. Matrix interference [physical or chemical] is suspected.
	WG349205	Sulfate, soluble (Water)	D516-02 - Turbidimetric	HD	Analysis is outside the intended scope of the method, which does not provide hold time information for soil extracts. No hold time is observed for collection to extraction. The referenced method hold time is observed for extraction-to-analysis.
			D516-02 - Turbidimetric	M3	The spike recovery value is unusable since the analyte concentration in the sample is disproportionate to the spike level. The recovery of the associated control sample (LCS or LFB) was acceptable.

ACZ ID	WORKNUM	PARAMETER	METHOD	QUAL	DESCRIPTION
L13428-19	WG348991	Calcium, total (3050)	M6010B ICP	ZH	Serial Dilution exceeded the acceptance criteria. Matrix interference [physical or chemical] is suspected.
		Copper, total (3050)	M6010B ICP	M3	The spike recovery value is unusable since the analyte concentration in the sample is disproportionate to the spike level. The recovery of the associated control sample (LCS or LFB) was acceptable.
			M6010B ICP	ZH	Serial Dilution exceeded the acceptance criteria. Matrix interference [physical or chemical] is suspected.
		Magnesium, total (3050)	M6010B ICP	ZH	Serial Dilution exceeded the acceptance criteria. Matrix interference [physical or chemical] is suspected.
	WG349205	Sulfate, soluble (Water)	D516-02 - Turbidimetric	HD	Analysis is outside the intended scope of the method, which does not provide hold time information for soil extracts. No hold time is observed for collection to extraction. The referenced method hold time is observed for extraction-to-analysis.
			D516-02 - Turbidimetric	M3	The spike recovery value is unusable since the analyte concentration in the sample is disproportionate to the spike level. The recovery of the associated control sample (LCS or LFB) was acceptable.
L13428-20	WG348991	Calcium, total (3050)	M6010B ICP	ZH	Serial Dilution exceeded the acceptance criteria. Matrix interference [physical or chemical] is suspected.
		Copper, total (3050)	M6010B ICP	M3	The spike recovery value is unusable since the analyte concentration in the sample is disproportionate to the spike level. The recovery of the associated control sample (LCS or LFB) was acceptable.
			M6010B ICP	ZH	Serial Dilution exceeded the acceptance criteria. Matrix interference [physical or chemical] is suspected.
		Magnesium, total (3050)	M6010B ICP	ZH	Serial Dilution exceeded the acceptance criteria. Matrix interference [physical or chemical] is suspected.
	WG349205	Sulfate, soluble (Water)	D516-02 - Turbidimetric	DD	Sample required dilution due to matrix color or odor.
			D516-02 - Turbidimetric	HD	Analysis is outside the intended scope of the method, which does not provide hold time information for soil extracts. No hold time is observed for collection to extraction. The referenced method hold time is observed for extraction-to-analysis.
			D516-02 - Turbidimetric	M3	The spike recovery value is unusable since the analyte concentration in the sample is disproportionate to the spike level. The recovery of the associated control sample (LCS or LFB) was acceptable.

Soil Analysis

The following parameters are not offered for certification or are not covered by NELAC certificate #ACZ.

Conductivity	SM2510B
Max Particle Size	SM2510B
Solids, Percent	CLPSOW390, PART F, D-98

Wet Chemistry

The following parameters are not offered for certification or are not covered by NELAC certificate #ACZ.

Sulfate, soluble (Water)	D516-02 - Turbidimetric

Sample Receipt

Freeport-McMoRan - Chino Mines Company
ZN000001N6

ACZ Project ID: L13428
Date Received: 07/23/2013 10:06
Received By: mtb
Date Printed: 7/23/2013

Receipt Verification

	YES	NO	NA
1) Is a foreign soil permit included for applicable samples?			X
2) Is the Chain of Custody or other directive shipping papers present?	X		
3) Does this project require special handling procedures such as CLP protocol?			X
4) Are any samples NRC licensable material?			X
5) If samples are received past hold time, proceed with requested short hold time analyses?	X		
6) Is the Chain of Custody complete and accurate?	X		
7) Were any changes made to the Chain of Custody prior to ACZ receiving the samples?	X		

`A change was made in the sample time page 2 section prior to ACZ custody.`

Samples/Containers

	YES	NO	NA
8) Are all containers intact and with no leaks?	X		
9) Are all labels on containers and are they intact and legible?	X		
10) Do the sample labels and Chain of Custody match for Sample ID, Date, and Time?	X		
11) For preserved bottle types, was the pH checked and within limits?			X
12) Is there sufficient sample volume to perform all requested work?	X		
13) Is the custody seal intact on all containers?			X
14) Are samples that require zero headspace acceptable?			X
15) Are all sample containers appropriate for analytical requirements?	X		
16) Is there an Hg-1631 trip blank present?			X
17) Is there a VOA trip blank present?			X
18) Were all samples received within hold time?	X		

Chain of Custody Related Remarks

Client Contact Remarks

Shipping Containers

Cooler Id	Temp (°C)	Rad (µR/Hr)	Custody Seal Intact?
NA18035	24.6	15	Yes

Was ice present in the shipment container(s)?

`No - Wet or gel ice was not present in the shipment container(s).`

Client must contact an ACZ Project Manager if analysis should not proceed for samples received outside of their thermal preservation acceptance criteria.

ACZ Laboratories, Inc. L13428
2773 Downhill Drive Steamboat Springs, CO 80487 (800) 334-5493

CHAIN of CUSTODY

Report to:

Name: Pam Pinson
Company: Chino Mines Company
E-mail: Pamela_Pinson@FMI.com
Address: P.O. Box 10
Bayard, NM 88023
Telephone: 575-912-5213

Copy of Report to:

Name: Matthew Barkley
Company: ARCADIS
E-mail: Matthew.Barkley@arcadis-us.com
Telephone: 303-231-9115 ext 157

Invoice to:

Name: Pam Pinson
Company: Chino Mines Company
E-mail: Pamela_Pinson@FMI.com
Address: P.O. Box 10
Bayard, NM 88023
Telephone: 575-912-5213

If sample(s) received past holding time (HT), or if insufficient HT remains to complete analysis before expiration, shall ACZ proceed with requested short HT analyses? YES ☒ NO ☐
If "NO" then ACZ will contact client for further instruction. If neither "YES" nor "NO" is indicated, ACZ will proceed with the requested analyses, even if HT is expired, and data will be qualified.

Are samples for CO DW Compliance Monitoring? YES ☐
If yes, please include state forms. Results will be reported to PQL. NO ☒

PROJECT INFORMATION

Quote #:
Project/PO #:
Reporting state for compliance testing:
Sampler's Name: Matthew Barkley
Are any samples NRC licensable material? Yes No

ANALYSES REQUESTED *(attach list or use quote number)*

SAMPLE IDENTIFICATION	DATE:TIME	Matrix	# of Containers	soil sieved to < 2mm	Copper (Total)	pH					
STS-RWU-2011-4 0-6	7/15/13 1015	SO	1	X	X	X					
1# West 0-6	7/15/13 1057	SO	1	X	X	X					
STS-RWU-2011-15 0-6	7/15/13 1130	SO	1	X	X	X					
STS-RWU-2011-6 0-6	7/15/13 1157	SO	1	X	X	X					
STS-RWU-2011-1 0-6	7/16/13 0903	SO	1	X	X	X					
STS-RWU-2011-3 0-6	7/16/13 0813	SO	1	X	X	X					
STS-RWU-2011-14 0-6	7/15/13 1305	SO	1	X	X	X					
STS-RWU-2011-2 0-6	7/16/13 1015	SO	1	X	X	X					
STS-RWU-2011-8 0-6	7/16/13 1341	SO	1	X	X	X					
STS-RWU-2011-5 0-6	7/16/13 1259	SO	1	X	X	X					

Matrix: SW (Surface Water) · GW (Ground Water) · WW (Waste Water) · DW (Drinking Water) · SL (Sludge) · SO (Soil) · OL (Oil) · Other (Specify)

REMARKS

Sieve all soil samples to <2 mm prior to analysis. Soil should be reported on a dry weight basis.
Methods:
pH - 9045C, Copper - 6010B analysis

Please refer to ACZ's terms & conditions located on the reverse side of this COC.

RELINQUISHED BY:	DATE:TIME	RECEIVED BY:	DATE:TIME
Pam Pinson	7-18-13-3:00pm	LZB	7.23.13 10:00

1/2

L13428 Chain of Custody

ACZ Laboratories, Inc. L13428

2773 Downhill Drive Steamboat Springs, CO 80487 (800) 334-5493

CHAIN of CUSTODY

Report to:

Name: Pam Pinson
Company: Chino Mines Company
E-mail: Pamela_Pinson@FMI.com

Address: P.O. Box 10
Bayard, NM 88023
Telephone: 575-912-5213

Copy of Report to:

Name: Matthew Barkley
Company: ARCADIS

E-mail: Matthew.Barkley@arcadis-us.com
Telephone: 303-231-9115 ext 157

Invoice to:

Name: Pam Pinson
Company: Chino Mines Company
E-mail: Pamela_Pinson@FMI.com

Address: P.O. Box 10
Bayard, NM 88023
Telephone: 575-912-5213

If sample(s) received past holding time (HT), or if insufficient HT remains to complete analysis before expiration, shall ACZ proceed with requested short HT analyses? YES ☒ NO ☐
If "NO" then ACZ will contact client for further instruction. If neither "YES" nor "NO" is indicated, ACZ will proceed with the requested analyses, even if HT is expired, and data will be qualified.

Are samples for CO DW Compliance Monitoring? YES ☐ NO ☒
If yes, please include state forms. Results will be reported to PQL.

PROJECT INFORMATION

Quote #:
Project/PO #:
Reporting state for compliance testing:
Sampler's Name: Matthew Barkley
Are any samples NRC licensable material? Yes No

ANALYSES REQUESTED *(attach list or use quote number)*

SAMPLE IDENTIFICATION	DATE:TIME	Matrix	# of Containers	soil sieved to < 2mm	Copper (Total)	pH					
STS-RWU-2011-16 0-6	7/16/13 1431	SO	1	x	x	x					
STSI-RWU-2011-7 0-6	7/15/13 1727	SO	1	x	x	x					
STS-RWU-2011-9 0-6	7/16/13 1207	SO	1	x	x	x					
STS-RWU-2011-10 0-6	7/16/13 1801	SO	1	x	x	x					
STS-RWU-2011-11 0-6	7/15/13 1455	SO	1	x	x	x					
STS-RWU-2011-12 0-6	7/15/13 1630	SO	1	x	x	x					
STS-RWU-2011-13 0-6	7/15/13 1420	SO	1	x	x	x					
STS-RWU-2011-17 0-6	7/15/13 1405	SO	1	x	x	x					
STS-RWU-2012-B1 0-6	7/17/13 ~~[illegible]~~ 930	SO	1	x	x	x					
STS-RWU-2012-B2 0-6	7/17/13 1037	SO	1	x	x	x					

Matrix: SW (Surface Water) · GW (Ground Water) · WW (Waste Water) · DW (Drinking Water) · SL (Sludge) · SO (Soil) · OL (Oil) · Other (Specify)

REMARKS

Sieve all soil samples to <2 mm prior to analysis. Soil should be reported on a dry weight basis.
Methods:
pH - 9045C, Copper - 6010B analysis

Please refer to ACZ's terms & conditions located on the reverse side of this COC.

RELINQUISHED BY:	DATE:TIME	RECEIVED BY:	DATE:TIME
Pam Pinson	7-18-13 - 3pM		7.23.13 10:00

2/2

FRMAD050.01.15.09 White - Return with sample. Yellow - Retain for your records.

ACZ Laboratories, Inc.
2773 Downhill Drive   Steamboat Springs, CO 80487   (800) 334-5493

Analytical Report

August 14, 2013

Report to:
Pam Pinson
Freeport-McMoRan - Chino Mines Company
PO Box 10
Bayard, NM 88023

cc: Matthew Barkley

Bill to:
Pam Pinson
Freeport-McMoRan - Chino Mines Company
P.O. Box 13308
Phoenix, AZ 85002-3308

Project ID: ZN000001N6
ACZ Project ID: L13429

Pam Pinson:

Enclosed are the analytical results for sample(s) submitted to ACZ Laboratories, Inc. (ACZ) on July 23, 2013. This project has been assigned to ACZ's project number, L13429. Please reference this number in all future inquiries.

All analyses were performed according to ACZ's Quality Assurance Plan. The enclosed results relate only to the samples received under L13429. Each section of this report has been reviewed and approved by the appropriate Laboratory Supervisor, or a qualified substitute.

Except as noted, the test results for the methods and parameters listed on ACZ's current NELAC certificate letter (#ACZ) meet all requirements of NELAC.

This report shall be used or copied only in its entirety. ACZ is not responsible for the consequences arising from the use of a partial report.

All samples and sub-samples associated with this project will be disposed of after September 13, 2013. If the samples are determined to be hazardous, additional charges apply for disposal (typically $11/sample). If you would like the samples to be held longer than ACZ's stated policy or to be returned, please contact your Project Manager or Customer Service Representative for further details and associated costs. ACZ retains analytical raw data reports for ten years.

If you have any questions or other needs, please contact your Project Manager.

S. Habermehl

Scott Habermehl has reviewed
and approved this report.

Freeport-McMoRan - Chino Mines Company		ACZ Sample ID:	***L13429-01***
Project ID:	ZN000001N6	Date Sampled:	*07/17/13 09:20*
Sample ID:	STS-RWU-2012-B3 0-6	Date Received:	*07/23/13*
		Sample Matrix:	*Soil*

Metals Analysis

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Calcium, total (3050)	M6010B ICP	101	1530		*	mg/Kg	20	100	08/08/13 15:23	jjc
Copper, total (3050)	M6010B ICP	101	161		*	mg/Kg	1	5	08/08/13 15:23	jjc
Magnesium, total (3050)	M6010B ICP	101	2520		*	mg/Kg	20	100	08/08/13 15:23	jjc
Potassium, total (3050)	M6010B ICP	101	1790			mg/Kg	30	200	08/08/13 15:23	jjc
Sodium, total (3050)	M6010B ICP	101	140	B		mg/Kg	30	200	08/08/13 15:23	jjc

Soil Analysis

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Conductivity @25C	SM2510B									
Conductivity		1	0.401		*	mmhos/cm	0.001	0.01	08/08/13 0:00	cdb
Max Particle Size		1	2000		*	um			08/08/13 0:00	cdb
pH, Corrosivity	M9045D/M9040C									
pH		1	4.7			units	0.1	0.1	08/08/13 0:00	cdb
pH measured at		1	20.9			C	0.1	0.1	08/08/13 0:00	cdb
Solids, Percent	CLPSOW390, PART F, D-98	1	83.3		*	%	0.1	0.5	07/25/13 15:00	mss2

Soil Preparation

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972								07/25/13 16:16	njj/mss
Digestion - Hot Plate	M3050B ICP								08/07/13 13:12	cdb
Saturated Paste Extraction	USDA No. 60 (2)								08/07/13 17:15	cdb
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2								08/07/13 9:20	cdb
Water Extraction	ASA No. 9 10-2.3.2								08/08/13 11:00	brd

Wet Chemistry

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Sulfate, soluble (Water)	D516-02 - Turbidimetric	50	433		*	mg/Kg	50	250	08/12/13 15:19	mpb

Inorganic Analytical Results

Freeport-McMoRan - Chino Mines Company		ACZ Sample ID:	***L13429-02***
Project ID:	ZN000001N6	Date Sampled:	*07/16/13 17:14*
Sample ID:	WILDLIFE REF NORTH 0-6	Date Received:	*07/23/13*
		Sample Matrix:	*Soil*

Metals Analysis

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Calcium, total (3050)	M6010B ICP	104	3520		*	mg/Kg	20	100	08/08/13 15:32	jjc
Copper, total (3050)	M6010B ICP	104	213		*	mg/Kg	1	5	08/08/13 15:32	jjc
Magnesium, total (3050)	M6010B ICP	104	5330		*	mg/Kg	20	100	08/08/13 15:32	jjc
Potassium, total (3050)	M6010B ICP	104	3620			mg/Kg	30	200	08/08/13 15:32	jjc
Sodium, total (3050)	M6010B ICP	104	200			mg/Kg	30	200	08/08/13 15:32	jjc

Soil Analysis

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Conductivity @25C	SM2510B									
Conductivity		1	0.681		*	mmhos/cm	0.001	0.01	08/08/13 0:00	cdb
Max Particle Size		1	2000		*	um			08/08/13 0:00	cdb
pH, Corrosivity	M9045D/M9040C									
pH		1	5.9			units	0.1	0.1	08/08/13 0:00	cdb
pH measured at		1	20.9			C	0.1	0.1	08/08/13 0:00	cdb
Solids, Percent	CLPSOW390, PART F, D-98	1	86.5		*	%	0.1	0.5	07/25/13 15:00	mss2

Soil Preparation

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972								07/25/13 16:20	njj/mss
Digestion - Hot Plate	M3050B ICP								08/07/13 15:18	cdb
Saturated Paste Extraction	USDA No. 60 (2)								08/07/13 17:24	cdb
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2								08/07/13 9:22	cdb
Water Extraction	ASA No. 9 10-2.3.2								08/08/13 13:00	brd

Wet Chemistry

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Sulfate, soluble (Water)	D516-02 - Turbidimetric	250	3150		*	mg/Kg	250	1250	08/12/13 15:25	mpb

** Please refer to Qualifier Reports for details.*

Freeport-McMoRan - Chino Mines Company
Project ID: ZN000001N6
Sample ID: WILDLIFE REF SOUTH 0-6

ACZ Sample ID: ***L13429-03***
Date Sampled: *07/16/13 16:40*
Date Received: *07/23/13*
Sample Matrix: *Soil*

Metals Analysis

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Calcium, total (3050)	M6010B ICP	101	1010		*	mg/Kg	20	100	08/08/13 15:38	jjc
Copper, total (3050)	M6010B ICP	101	288		*	mg/Kg	1	5	08/08/13 15:38	jjc
Magnesium, total (3050)	M6010B ICP	101	1750		*	mg/Kg	20	100	08/08/13 15:38	jjc
Potassium, total (3050)	M6010B ICP	101	1970			mg/Kg	30	200	08/08/13 15:38	jjc
Sodium, total (3050)	M6010B ICP	101	120	B		mg/Kg	30	200	08/08/13 15:38	jjc

Soil Analysis

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Conductivity @25C	SM2510B									
Conductivity		1	0.608		*	mmhos/cm	0.001	0.01	08/08/13 0:00	cdb
Max Particle Size		1	2000		*	um			08/08/13 0:00	cdb
pH, Corrosivity	M9045D/M9040C									
pH		1	4.6			units	0.1	0.1	08/08/13 0:00	cdb
pH measured at		1	20.9			C	0.1	0.1	08/08/13 0:00	cdb
Solids, Percent	CLPSOW390, PART F, D-98	1	89.7		*	%	0.1	0.5	07/25/13 15:00	mss2

Soil Preparation

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972								07/25/13 16:23	mjj/mss
Digestion - Hot Plate	M3050B ICP								08/07/13 16:00	cdb
Saturated Paste Extraction	USDA No. 60 (2)								08/07/13 17:42	cdb
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2								08/07/13 9:25	cdb
Water Extraction	ASA No. 9 10-2.3.2								08/08/13 14:00	brd

Wet Chemistry

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Sulfate, soluble (Water)	D516-02 - Turbidimetric	50	1080		*	mg/Kg	50	250	08/12/13 15:19	mpb

** Please refer to Qualifier Reports for details.*

Freeport-McMoRan - Chino Mines Company
Project ID: ZN000001N6
Sample ID: DUP #1

ACZ Sample ID: ***L13429-04***
Date Sampled: *07/16/13 00:00*
Date Received: *07/23/13*
Sample Matrix: *Soil*

Metals Analysis

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Calcium, total (3050)	M6010B ICP	101	680		*	mg/Kg	20	100	08/08/13 15:41	jjc
Copper, total (3050)	M6010B ICP	101	578		*	mg/Kg	1	5	08/08/13 15:41	jjc
Magnesium, total (3050)	M6010B ICP	101	2070		*	mg/Kg	20	100	08/08/13 15:41	jjc
Potassium, total (3050)	M6010B ICP	101	1840			mg/Kg	30	200	08/08/13 15:41	jjc
Sodium, total (3050)	M6010B ICP	101	110	B		mg/Kg	30	200	08/08/13 15:41	jjc

Soil Analysis

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Conductivity @25C	SM2510B									
Conductivity		1	0.618		*	mmhos/cm	0.001	0.01	08/08/13 0:00	cdb
Max Particle Size		1	2000		*	um			08/08/13 0:00	cdb
pH, Corrosivity	M9045D/M9040C									
pH		1	4.3			units	0.1	0.1	08/08/13 0:00	cdb
pH measured at		1	20.9			C	0.1	0.1	08/08/13 0:00	cdb
Solids, Percent	CLPSOW390, PART F, D-98	1	81.4		*	%	0.1	0.5	07/25/13 15:00	mss2

Soil Preparation

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972								07/25/13 16:26	njj/mss
Digestion - Hot Plate	M3050B ICP								08/07/13 9:00	cdb
Saturated Paste Extraction	USDA No. 60 (2)								08/07/13 17:51	cdb
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2								08/07/13 9:27	cdb
Water Extraction	ASA No. 9 10-2.3.2								08/08/13 15:00	brd

Wet Chemistry

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Sulfate, soluble (Water)	D516-02 - Turbidimetric	5	188		*	mg/Kg	5	25	08/12/13 15:19	mpb

Inorganic Analytical Results

Freeport-McMoRan - Chino Mines Company		ACZ Sample ID:	***L13429-05***
Project ID:	ZN000001N6	Date Sampled:	*07/16/13 00:00*
Sample ID:	DUP #2	Date Received:	*07/23/13*
		Sample Matrix:	*Soil*

Metals Analysis

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Calcium, total (3050)	M6010B ICP	103	3930		*	mg/Kg	20	100	08/08/13 15:50	jjc
Copper, total (3050)	M6010B ICP	103	208		*	mg/Kg	1	5	08/08/13 15:50	jjc
Magnesium, total (3050)	M6010B ICP	103	5880		*	mg/Kg	20	100	08/08/13 15:50	jjc
Potassium, total (3050)	M6010B ICP	103	3940			mg/Kg	30	200	08/08/13 15:50	jjc
Sodium, total (3050)	M6010B ICP	103	200			mg/Kg	30	200	08/08/13 15:50	jjc

Soil Analysis

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Conductivity @25C	SM2510B									
Conductivity		1	0.702		*	mmhos/cm	0.001	0.01	08/08/13 0:00	cdb
Max Particle Size		1	2000		*	um			08/08/13 0:00	cdb
pH, Corrosivity	M9045D/M9040C									
pH		1	5.6			units	0.1	0.1	08/08/13 0:00	cdb
pH measured at		1	20.9			C	0.1	0.1	08/08/13 0:00	cdb
Solids, Percent	CLPSOW390, PART F, D-98	1	88.6		*	%	0.1	0.5	07/25/13 15:00	mss2

Soil Preparation

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972								07/25/13 16:30	njj/mss
Digestion - Hot Plate	M3050B ICP								08/07/13 9:42	cdb
Saturated Paste Extraction	USDA No. 60 (2)								08/07/13 18:00	cdb
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2								08/07/13 9:30	cdb
Water Extraction	ASA No. 9 10-2.3.2								08/08/13 16:00	brd

Wet Chemistry

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Sulfate, soluble (Water)	D516-02 - Turbidimetric	250	2690		*	mg/Kg	250	1250	08/12/13 15:25	mpb

Inorganic Reference

Report Header Explanations

Batch	A distinct set of samples analyzed at a specific time
Found	Value of the QC Type of interest
Limit	Upper limit for RPD, in %.
Lower	Lower Recovery Limit, in % (except for LCSS, mg/Kg)
MDL	Method Detection Limit. Same as Minimum Reporting Limit. Allows for instrument and annual fluctuations.
PCN/SCN	A number assigned to reagents/standards to trace to the manufacturer's certificate of analysis
PQL	Practical Quantitation Limit, typically 5 times the MDL.
QC	True Value of the Control Sample or the amount added to the Spike
Rec	Recovered amount of the true value or spike added, in % (except for LCSS, mg/Kg)
RPD	Relative Percent Difference, calculation used for Duplicate QC Types
Upper	Upper Recovery Limit, in % (except for LCSS, mg/Kg)
Sample	Value of the Sample of interest

QC Sample Types

AS	Analytical Spike (Post Digestion)	*LCSWD*	Laboratory Control Sample - Water Duplicate
ASD	Analytical Spike (Post Digestion) Duplicate	*LFB*	Laboratory Fortified Blank
CCB	Continuing Calibration Blank	*LFM*	Laboratory Fortified Matrix
CCV	Continuing Calibration Verification standard	*LFMD*	Laboratory Fortified Matrix Duplicate
DUP	Sample Duplicate	*LRB*	Laboratory Reagent Blank
ICB	Initial Calibration Blank	*MS*	Matrix Spike
ICV	Initial Calibration Verification standard	*MSD*	Matrix Spike Duplicate
ICSAB	Inter-element Correction Standard - A plus B solutions	*PBS*	Prep Blank - Soil
LCSS	Laboratory Control Sample - Soil	*PBW*	Prep Blank - Water
LCSSD	Laboratory Control Sample - Soil Duplicate	*PQV*	Practical Quantitation Verification standard
LCSW	Laboratory Control Sample - Water	*SDL*	Serial Dilution

QC Sample Type Explanations

Blanks	Verifies that there is no or minimal contamination in the prep method or calibration procedure.
Control Samples	Verifies the accuracy of the method, including the prep procedure.
Duplicates	Verifies the precision of the instrument and/or method.
Spikes/Fortified Matrix	Determines sample matrix interferences, if any.
Standard	Verifies the validity of the calibration.

ACZ Qualifiers (Qual)

B	Analyte concentration detected at a value between MDL and PQL. The associated value is an estimated quantity.
H	Analysis exceeded method hold time. pH is a field test with an immediate hold time.
L	Target analyte response was below the laboratory defined negative threshold.
U	The material was analyzed for, but was not detected above the level of the associated value. The associated value is either the sample quantitation limit or the sample detection limit.

Method References

(1) EPA 600/4-83-020. Methods for Chemical Analysis of Water and Wastes, March 1983.
(2) EPA 600/R-93-100. Methods for the Determination of Inorganic Substances in Environmental Samples, August 1993.
(3) EPA 600/R-94-111. Methods for the Determination of Metals in Environmental Samples - Supplement I, May 1994.
(4) EPA SW-846. Test Methods for Evaluating Solid Waste.
(5) Standard Methods for the Examination of Water and Wastewater.

Comments

(1) QC results calculated from raw data. Results may vary slightly if the rounded values are used in the calculations.
(2) Soil, Sludge, and Plant matrices for Inorganic analyses are reported on a dry weight basis.
(3) Animal matrices for Inorganic analyses are reported on an "as received" basis.
(4) An asterisk in the "XQ" column indicates there is an extended qualifier and/or certification qualifier associated with the result.
(5) If the MDL equals the PQL or the MDL column is omitted, the PQL is the reporting limit.

For a complete list of ACZ's Extended Qualifiers, please click: http://www.acz.com/public/extquallist.pdf

Calcium, total (3050) M6010B ICP

ACZ ID	Type	Analyzed	PCN/SCN	QC	Sample	Found	Units	Rec	Lower	Upper	RPD	Limit	Qual
WG349134													
WG349134ICV	ICV	08/08/13 14:58	II130716-1	100		98.06	mg/L	98.1	90	110			
WG349134ICB	ICB	08/08/13 15:01				U	mg/L		-0.6	0.6			
WG349117PBS	PBS	08/08/13 15:14				U	mg/Kg		-60	60			
WG349117LCSS	LCSS	08/08/13 15:17	PCN42465	7890		7928	mg/Kg		6500	9290			
WG349117LCSSD	LCSSD	08/08/13 15:20	PCN42465	7890		8221	mg/Kg		6500	9290	3.6	20	
L13429-01MS	MS	08/08/13 15:26	II130716-5	6868.2828	1530	7820	mg/Kg	91.6	75	125			
L13429-01MSD	MSD	08/08/13 15:29	II130716-5	6868.2828	1530	7811	mg/Kg	91.4	75	125	0.12	20	

Conductivity SM2510B

ACZ ID	Type	Analyzed	PCN/SCN	QC	Sample	Found	Units	Rec	Lower	Upper	RPD	Limit	Qual
WG349132													
L13429-02DUP	DUP	08/08/13 16:24			.681	.678	nmhos/cn				0.4	20	

Copper, total (3050) M6010B ICP

ACZ ID	Type	Analyzed	PCN/SCN	QC	Sample	Found	Units	Rec	Lower	Upper	RPD	Limit	Qual
WG349134													
WG349134ICV	ICV	08/08/13 14:58	II130716-1	2		1.914	mg/L	95.7	90	110			
WG349134ICB	ICB	08/08/13 15:01				U	mg/L		-0.03	0.03			
WG349117PBS	PBS	08/08/13 15:14				U	mg/Kg		-3	3			
WG349117LCSS	LCSS	08/08/13 15:17	PCN42465	162		159.7	mg/Kg		135	190			
WG349117LCSSD	LCSSD	08/08/13 15:20	PCN42465	162		161.3	mg/Kg		135	190	1	20	
L13429-01MS	MS	08/08/13 15:26	II130716-5	50.5	161	193.6	mg/Kg	64.6	75	125			M3
L13429-01MSD	MSD	08/08/13 15:29	II130716-5	50.5	161	192.9	mg/Kg	63.2	75	125	0.36	20	M3

Magnesium, total (3050) M6010B ICP

ACZ ID	Type	Analyzed	PCN/SCN	QC	Sample	Found	Units	Rec	Lower	Upper	RPD	Limit	Qual
WG349134													
WG349134ICV	ICV	08/08/13 14:58	II130716-1	100		95.79	mg/L	95.8	90	110			
WG349134ICB	ICB	08/08/13 15:01				U	mg/L		-0.6	0.6			
WG349117PBS	PBS	08/08/13 15:14				U	mg/Kg		-60	60			
WG349117LCSS	LCSS	08/08/13 15:17	PCN42465	3520		3554	mg/Kg		2640	4410			
WG349117LCSSD	LCSSD	08/08/13 15:20	PCN42465	3520		3658	mg/Kg		2640	4410	2.9	20	
L13429-01MS	MS	08/08/13 15:26	II130716-5	5049.74952	2520	6854	mg/Kg	85.8	75	125			
L13429-01MSD	MSD	08/08/13 15:29	II130716-5	5049.74952	2520	6862	mg/Kg	86	75	125	0.12	20	

Ph M9045D/M9040C

ACZ ID	Type	Analyzed	PCN/SCN	QC	Sample	Found	Units	Rec	Lower	Upper	RPD	Limit	Qual
WG349085													
WG349085ICV	ICV	08/08/13 10:07	PCN40669	4		3.95	units	98.8	97	103			
L13675-01DUP	DUP	08/08/13 11:07			10.9	10.92	units				0.2	20	

Freeport-McMoRan - Chino Mines Company

ACZ Project ID: ***L13429***

Potassium, total (3050) M6010B ICP

ACZ ID	Type	Analyzed	PCN/SCN	QC	Sample	Found	Units	Rec	Lower	Upper	RPD	Limit	Qual
WG349134													
WG349134ICV	ICV	08/08/13 14:58	II130716-1	20		19.59	mg/L	98	90	110			
WG349134ICB	ICB	08/08/13 15:01				U	mg/L		-0.9	0.9			
WG349117PBS	PBS	08/08/13 15:14				U	mg/Kg		-90	90			
WG349117LCSS	LCSS	08/08/13 15:17	PCN42465	2600		2848	mg/Kg		1720	3470			
WG349117LCSSD	LCSSD	08/08/13 15:20	PCN42465	2600		2901	mg/Kg		1720	3470	1.8	20	
L13429-01MS	MS	08/08/13 15:26	II130716-5	10096.07312	1790	10989	mg/Kg	91.1	75	125			
L13429-01MSD	MSD	08/08/13 15:29	II130716-5	10096.07312	1790	10969	mg/Kg	90.9	75	125	0.18	20	

Sodium, total (3050) M6010B ICP

ACZ ID	Type	Analyzed	PCN/SCN	QC	Sample	Found	Units	Rec	Lower	Upper	RPD	Limit	Qual
WG349134													
WG349134ICV	ICV	08/08/13 14:58	II130716-1	100		98.01	mg/L	98	90	110			
WG349134ICB	ICB	08/08/13 15:01				U	mg/L		-0.9	0.9			
WG349117PBS	PBS	08/08/13 15:14				U	mg/Kg		-90	90			
WG349117LCSS	LCSS	08/08/13 15:17	PCN42465	517		531	mg/Kg		381	653			
WG349117LCSSD	LCSSD	08/08/13 15:20	PCN42465	517		530	mg/Kg		381	653	0.2	20	
L13429-01MS	MS	08/08/13 15:26	II130716-5	10104.9995	140	9341	mg/Kg	91.1	75	125			
L13429-01MSD	MSD	08/08/13 15:29	II130716-5	10104.9995	140	9332	mg/Kg	91	75	125	0.1	20	

Solids, Percent CLPSOW390, PART F, D-98

ACZ ID	Type	Analyzed	PCN/SCN	QC	Sample	Found	Units	Rec	Lower	Upper	RPD	Limit	Qual
WG348267													
L13412-01DUP	DUP	07/25/13 15:00			95.4	95.6	%				0.2	20	
WG348267PBS	PBS	07/25/13 15:00				U	%		99.9	100.1			

Sulfate, soluble (Water) D516-02 - Turbidimetric

ACZ ID	Type	Analyzed	PCN/SCN	QC	Sample	Found	Units	Rec	Lower	Upper	RPD	Limit	Qual
WG349293													
WG349293ICB	ICB	08/12/13 14:55				U	mg/L		-3	3			
WG349293ICV	ICV	08/12/13 14:55	WI130808-1	20		19.9	mg/L	99.5	90	110			
WG349293LFB	LFB	08/12/13 15:19	WI130416-3	9.99		10.2	mg/L	102.1	90	110			
WG349096PBS	PBS	08/12/13 15:19				U	mg/L		-15	15			
L13429-01DUP	DUP	08/12/13 15:19			433	399	mg/L				8.2	20	RA
L13429-05AS	AS	08/12/13 15:25	SO4TURB5X	500	2690	3000	mg/L	62	90	110			M3

ACZ ID	WORKNUM	PARAMETER	METHOD	QUAL	DESCRIPTION
L13429-01	WG349134	Calcium, total (3050)	M6010B ICP	ZH	Serial Dilution exceeded the acceptance criteria. Matrix interference [physical or chemical] is suspected.
		Copper, total (3050)	M6010B ICP	M3	The spike recovery value is unusable since the analyte concentration in the sample is disproportionate to the spike level. The recovery of the associated control sample (LCS or LFB) was acceptable.
			M6010B ICP	ZH	Serial Dilution exceeded the acceptance criteria. Matrix interference [physical or chemical] is suspected.
		Magnesium, total (3050)	M6010B ICP	ZH	Serial Dilution exceeded the acceptance criteria. Matrix interference [physical or chemical] is suspected.
	WG349293	Sulfate, soluble (Water)	D516-02 - Turbidimetric	HD	Analysis is outside the intended scope of the method, which does not provide hold time information for soil extracts. No hold time is observed for collection to extraction. The referenced method hold time is observed for extraction-to-analysis.
			D516-02 - Turbidimetric	M3	The spike recovery value is unusable since the analyte concentration in the sample is disproportionate to the spike level. The recovery of the associated control sample (LCS or LFB) was acceptable.
			D516-02 - Turbidimetric	RA	Relative Percent Difference (RPD) was not used for data validation because the sample concentration is too low for accurate evaluation (< 10x MDL).
L13429-02	WG349134	Calcium, total (3050)	M6010B ICP	ZH	Serial Dilution exceeded the acceptance criteria. Matrix interference [physical or chemical] is suspected.
		Copper, total (3050)	M6010B ICP	M3	The spike recovery value is unusable since the analyte concentration in the sample is disproportionate to the spike level. The recovery of the associated control sample (LCS or LFB) was acceptable.
			M6010B ICP	ZH	Serial Dilution exceeded the acceptance criteria. Matrix interference [physical or chemical] is suspected.
		Magnesium, total (3050)	M6010B ICP	ZH	Serial Dilution exceeded the acceptance criteria. Matrix interference [physical or chemical] is suspected.
	WG349293	Sulfate, soluble (Water)	D516-02 - Turbidimetric	HD	Analysis is outside the intended scope of the method, which does not provide hold time information for soil extracts. No hold time is observed for collection to extraction. The referenced method hold time is observed for extraction-to-analysis.
			D516-02 - Turbidimetric	M3	The spike recovery value is unusable since the analyte concentration in the sample is disproportionate to the spike level. The recovery of the associated control sample (LCS or LFB) was acceptable.
			D516-02 - Turbidimetric	RA	Relative Percent Difference (RPD) was not used for data validation because the sample concentration is too low for accurate evaluation (< 10x MDL).

Inorganic Extended Qualifier Report

Freeport-McMoRan - Chino Mines Company

ACZ Project ID: ***L13429***

ACZ ID	WORKNUM	PARAMETER	METHOD	QUAL	DESCRIPTION
L13429-03	WG349134	Calcium, total (3050)	M6010B ICP	ZH	Serial Dilution exceeded the acceptance criteria. Matrix interference [physical or chemical] is suspected.
		Copper, total (3050)	M6010B ICP	M3	The spike recovery value is unusable since the analyte concentration in the sample is disproportionate to the spike level. The recovery of the associated control sample (LCS or LFB) was acceptable.
			M6010B ICP	ZH	Serial Dilution exceeded the acceptance criteria. Matrix interference [physical or chemical] is suspected.
		Magnesium, total (3050)	M6010B ICP	ZH	Serial Dilution exceeded the acceptance criteria. Matrix interference [physical or chemical] is suspected.
	WG349293	Sulfate, soluble (Water)	D516-02 - Turbidimetric	HD	Analysis is outside the intended scope of the method, which does not provide hold time information for soil extracts. No hold time is observed for collection to extraction. The referenced method hold time is observed for extraction-to-analysis.
			D516-02 - Turbidimetric	M3	The spike recovery value is unusable since the analyte concentration in the sample is disproportionate to the spike level. The recovery of the associated control sample (LCS or LFB) was acceptable.
			D516-02 - Turbidimetric	RA	Relative Percent Difference (RPD) was not used for data validation because the sample concentration is too low for accurate evaluation (< 10x MDL).
L13429-04	WG349134	Calcium, total (3050)	M6010B ICP	ZH	Serial Dilution exceeded the acceptance criteria. Matrix interference [physical or chemical] is suspected.
		Copper, total (3050)	M6010B ICP	M3	The spike recovery value is unusable since the analyte concentration in the sample is disproportionate to the spike level. The recovery of the associated control sample (LCS or LFB) was acceptable.
			M6010B ICP	ZH	Serial Dilution exceeded the acceptance criteria. Matrix interference [physical or chemical] is suspected.
		Magnesium, total (3050)	M6010B ICP	ZH	Serial Dilution exceeded the acceptance criteria. Matrix interference [physical or chemical] is suspected.
	WG349293	Sulfate, soluble (Water)	D516-02 - Turbidimetric	HD	Analysis is outside the intended scope of the method, which does not provide hold time information for soil extracts. No hold time is observed for collection to extraction. The referenced method hold time is observed for extraction-to-analysis.
			D516-02 - Turbidimetric	M3	The spike recovery value is unusable since the analyte concentration in the sample is disproportionate to the spike level. The recovery of the associated control sample (LCS or LFB) was acceptable.
			D516-02 - Turbidimetric	RA	Relative Percent Difference (RPD) was not used for data validation because the sample concentration is too low for accurate evaluation (< 10x MDL).

ACZ ID	WORKNUM	PARAMETER	METHOD	QUAL	DESCRIPTION
L13429-05	WG349134	Calcium, total (3050)	M6010B ICP	ZH	Serial Dilution exceeded the acceptance criteria. Matrix interference [physical or chemical] is suspected.
		Copper, total (3050)	M6010B ICP	M3	The spike recovery value is unusable since the analyte concentration in the sample is disproportionate to the spike level. The recovery of the associated control sample (LCS or LFB) was acceptable.
			M6010B ICP	ZH	Serial Dilution exceeded the acceptance criteria. Matrix interference [physical or chemical] is suspected.
		Magnesium, total (3050)	M6010B ICP	ZH	Serial Dilution exceeded the acceptance criteria. Matrix interference [physical or chemical] is suspected.
	WG349293	Sulfate, soluble (Water)	D516-02 - Turbidimetric	HD	Analysis is outside the intended scope of the method, which does not provide hold time information for soil extracts. No hold time is observed for collection to extraction. The referenced method hold time is observed for extraction-to-analysis.
			D516-02 - Turbidimetric	M3	The spike recovery value is unusable since the analyte concentration in the sample is disproportionate to the spike level. The recovery of the associated control sample (LCS or LFB) was acceptable.
			D516-02 - Turbidimetric	RA	Relative Percent Difference (RPD) was not used for data validation because the sample concentration is too low for accurate evaluation (< 10x MDL).

Soil Analysis

The following parameters are not offered for certification or are not covered by NELAC certificate #ACZ.

Conductivity	SM2510B
Max Particle Size	SM2510B
Solids, Percent	CLPSOW390, PART F, D-98

Wet Chemistry

The following parameters are not offered for certification or are not covered by NELAC certificate #ACZ.

Sulfate, soluble (Water)	D516-02 - Turbidimetric

ACZ Laboratories, Inc.
2773 Downhill Drive Steamboat Springs, CO 80487 (800) 334-5493

Sample Receipt

Freeport-McMoRan - Chino Mines Company
ZN000001N6

ACZ Project ID:	L13429
Date Received:	07/23/2013 10:06
Received By:	mtb
Date Printed:	7/23/2013

Receipt Verification

	YES	NO	NA
1) Is a foreign soil permit included for applicable samples?			X
2) Is the Chain of Custody or other directive shipping papers present?	X		▨
3) Does this project require special handling procedures such as CLP protocol?			X
4) Are any samples NRC licensable material?			X
5) If samples are received past hold time, proceed with requested short hold time analyses?	X		
6) Is the Chain of Custody complete and accurate?	X		▨
7) Were any changes made to the Chain of Custody prior to ACZ receiving the samples?	X		▨

```
A change was made in the sample lines 4-8 section prior to ACZ
custody.
```

Samples/Containers

	YES	NO	NA
8) Are all containers intact and with no leaks?	X		▨
9) Are all labels on containers and are they intact and legible?	X		▨
10) Do the sample labels and Chain of Custody match for Sample ID, Date, and Time?	X		▨
11) For preserved bottle types, was the pH checked and within limits?			X
12) Is there sufficient sample volume to perform all requested work?	X		▨
13) Is the custody seal intact on all containers?			X
14) Are samples that require zero headspace acceptable?			X
15) Are all sample containers appropriate for analytical requirements?	X		▨
16) Is there an Hg-1631 trip blank present?			X
17) Is there a VOA trip blank present?			X
18) Were all samples received within hold time?	X		▨

Chain of Custody Related Remarks

Client Contact Remarks

Shipping Containers

```
Cooler Id      Temp (°C)      Rad (µR/Hr)      Custody Seal Intact?
---------      ---------      -----------      --------------------
NA18035        24.6           15               Yes
```

Was ice present in the shipment container(s)?

```
No - Wet or gel ice was not present in the shipment container(s).
```

Client must contact an ACZ Project Manager if analysis should not proceed for samples received outside of their thermal preservation acceptance criteria.

ACZ Laboratories, Inc. L13429

2773 Downhill Drive Steamboat Springs, CO 80487 (800) 334-5493

CHAIN of CUSTODY

Report to:

Name: Pam Pinson
Company: Chino Mines Company
E-mail: Pamela_Pinson@FMI.com

Address: P.O. Box 10
Bayard, NM 88023
Telephone: 575-912-5213

Copy of Report to:

Name: Matthew Barkley
Company: ARCADIS

E-mail: Matthew.Barkley@arcadis-us.com
Telephone: 303-231-9115 ext 157

Invoice to:

Name: Pam Pinson
Company: Chino Mines Company
E-mail: Pamela_Pinson@FMI.com

Address: P.O. Box 10
Bayard, NM 88023
Telephone: 575-912-5213

If sample(s) received past holding time (HT), or if insufficient HT remains to complete analysis before expiration, shall ACZ proceed with requested short HT analyses? YES ☒ NO ☐
If "NO" then ACZ will contact client for further instruction. If neither "YES" nor "NO" is indicated, ACZ will proceed with the requested analyses, even if HT is expired, and data will be qualified.

Are samples for CO DW Compliance Monitoring? YES ☐
If yes, please include state forms. Results will be reported to PQL. NO ☒

PROJECT INFORMATION

ANALYSES REQUESTED *(attach list or use quote number)*

Quote #:
Project/PO #:
Reporting state for compliance testing:
Sampler's Name: Matthew Barkley
Are any samples NRC licensable material? Yes No

SAMPLE IDENTIFICATION	DATE:TIME	Matrix	# of Containers	soil sieved to < 2mm	Copper (Total)	pH	Salinity				
STS-RWU-2012-B3 0-6	7/17/13 0920	SO	1	x	x	x					
Wildlife Ref North 0-6	7/16/13 1714	SO	1	x	x	x					
Wildlife Ref South 0-6	7/16/13 1640	SO	1	x	x	x					
~~FID 37 0-6~~		~~SO~~	~~1~~	~~x~~			~~x~~				
~~FID 15 0-6~~		~~SO~~	~~1~~	~~x~~			~~x~~				
~~FID 18 0-6~~		~~SO~~	~~1~~	~~x~~			~~x~~				
~~FID 16 0-6~~		~~SO~~	~~1~~	~~x~~			~~x~~				
~~FID 101 0-6~~		~~SO~~	~~1~~	~~x~~			~~x~~				
Dup #1		SO	1	X	X	X					
Dup #2		SO	1	X	X	X					

Matrix SW (Surface Water) · GW (Ground Water) · WW (Waste Water) · DW (Drinking Water) · SL (Sludge) · SO (Soil) · OL (Oil) · Other (Specify)

REMARKS

Sieve all soil samples to <2 mm prior to analysis. Soil should be reported on a dry weight basis.
Methods:
pH - 9045C, Copper - 6010B analysis

Please refer to ACZ's terms & conditions located on the reverse side of this COC.

RELINQUISHED BY:	DATE:TIME	RECEIVED BY:	DATE:TIME
Pam Pinson	7-18-13 3pM	LZB	7-23-13 10:00

RMAD050.01.15.09 White - Return with sample. Yellow - Retain for your records.

L13429 Chain of Custody

ANALYTICAL SUMMARY REPORT

February 10, 2015

Chino Mine Company
PO Box 10
Bayard, NM 88023

Work Order: H15010309
Project Name: Not Indicated

Energy Laboratories Inc Helena MT received the following 33 samples for Chino Mine Company on 1/22/2015 for analysis.

Lab ID	Client Sample ID	Collect Date	Receive Date	Matrix	Test
H15010309-001	STS-PT-1-10M	01/15/15 8:00	01/22/15	Soil	Metals, Water Extractable Copper Activity CaCl2 Hot Water Soil Extraction Soil Preparation
H15010309-002	STS-PT-2013-2-10M	01/15/15 8:00	01/22/15	Soil	Metals, Water Extractable Copper Activity CaCl2 Hot Water Soil Extraction
H15010309-003	STS-PT-2013-3-10M	01/15/15 8:00	01/22/15	Soil	Same As Above
H15010309-004	STS-PT-2013-4-10M	01/15/15 8:00	01/22/15	Soil	Same As Above
H15010309-005	STS-PT-2013-5-10M	01/15/15 8:00	01/22/15	Soil	Same As Above
H15010309-006	STS-PT-2013-6-10M	01/15/15 8:00	01/22/15	Soil	Same As Above
H15010309-007	STS-PT-2013-7-10M	01/15/15 8:00	01/22/15	Soil	Same As Above
H15010309-008	STS-PT-2013-8-10M	01/15/15 8:00	01/22/15	Soil	Same As Above
H15010309-009	STS-PT-2013-9-10M	01/15/15 8:00	01/22/15	Soil	Same As Above
H15010309-010	STS-PT-2013-10-10M	01/15/15 8:00	01/22/15	Soil	Same As Above
H15010309-011	STS-PT-2013-11-10M	01/15/15 8:00	01/22/15	Soil	Same As Above
H15010309-012	STS-PT-2013-12-10M	01/15/15 8:00	01/22/15	Soil	Same As Above
H15010309-013	STS-PT-2013-13-10M	01/15/15 8:00	01/22/15	Soil	Same As Above
H15010309-014	STS-PT-2013-14-10M	01/15/15 8:00	01/22/15	Soil	Same As Above
H15010309-015	STS-PT-2013-15-1/4"M	01/15/15 8:00	01/22/15	Soil	Same As Above
H15010309-016	STS-PT-2013-16-1/4"M	01/15/15 8:00	01/22/15	Soil	Same As Above
H15010309-017	STS-PT-2013-17-10M	01/15/15 8:00	01/22/15	Soil	Same As Above
H15010309-018	STS-PT-2013-19-10M	01/15/15 8:00	01/22/15	Soil	Same As Above
H15010309-019	STS-2013-20-10M	01/15/15 8:00	01/22/15	Soil	Same As Above
H15010309-020	STS-PT-2013-21-10M	01/15/15 8:00	01/22/15	Soil	Same As Above
H15010309-021	STS-PT-2013-22-10M	01/15/15 8:00	01/22/15	Soil	Same As Above
H15010309-022	STS-PT-2013-23-10M	01/15/15 8:00	01/22/15	Soil	Same As Above
H15010309-023	STS-PT-2013-24-10M	01/15/15 8:00	01/22/15	Soil	Same As Above
H15010309-024	STS-PT-2013-25-10M	01/15/15 8:00	01/22/15	Soil	Same As Above
H15010309-025	STS-2013-26-10M	01/15/15 8:00	01/22/15	Soil	Same As Above

ANALYTICAL SUMMARY REPORT

H15010309-026	STS-PT-2013-27-10M	01/15/15 8:00	01/22/15	Soil	Same As Above
H15010309-027	STS-PT-2013-28-10M	01/15/15 8:00	01/22/15	Soil	Same As Above
H15010309-028	STS-PT-2013-29-10M	01/15/15 8:00	01/22/15	Soil	Same As Above
H15010309-029	STS-PT-2013-30-10M	01/15/15 8:00	01/22/15	Soil	Same As Above
H15010309-030	STS-PT-2013-31-10M	01/15/15 8:00	01/22/15	Soil	Same As Above
H15010309-031	STS-PT-2013-32-10M	01/15/15 8:00	01/22/15	Soil	Same As Above
H15010309-032	STS-2013-35-10M	01/15/15 8:00	01/22/15	Soil	Same As Above
H15010309-033	STS-2013-36-10M	01/15/15 8:00	01/22/15	Soil	Same As Above

The analyses presented in this report were performed by Energy Laboratories, Inc., 3161 E. Lyndale Ave., Helena, MT 59604, unless otherwise noted. Any exceptions or problems with the analyses are noted in the Laboratory Analytical Report, the QA/QC Summary Report, or the Case Narrative.

The results as reported relate only to the item(s) submitted for testing.

If you have any questions regarding these test results, please call.

Report Approved By:

CLIENT:	Chino Mine Company
Project:	Not Indicated
Work Order:	H15010309

Report Date: 02/10/15

CASE NARRATIVE

Prep Comments for Sample H15010309-001A, Test SOIL PRP: air dried-sieved to 10 mesh-after samples split

LABORATORY ANALYTICAL REPORT

Prepared by Helena, MT Branch

Client:	Chino Mine Company	**Report Date:**	02/10/15
Project:	Not Indicated	**Date Received:**	01/22/15
Workorder:	H15010309		

		Analysis		Cu-CACL2	Conductivity , CaCl2	Millivolts	pCu, Measured	ph, CaCl2
		Units		mg/kg	mmhos/cm	mV	s_u_	s_u_
Sample ID	**Client Sample ID**	**Up**	**Low**	**Results**	**Results**	**Results**	**Results**	**Results**
H15010309-001	STS-PT-1-10M	0	0	33.5	2.3	44	3.56	4.5
H15010309-002	STS-PT-2013-2-10M	0	0	0.2	2.2	-58	7.38	6.8
H15010309-003	STS-PT-2013-3-10M	0	0	0.4	2.4	-10	5.60	5.1
H15010309-004	STS-PT-2013-4-10M	0	0	0.4	2.4	-22	6.06	5.0
H15010309-005	STS-PT-2013-5-10M	0	0	0.2	2.6	-31	6.40	5.7
H15010309-006	STS-PT-2013-6-10M	0	0	8.8	3.1	24	4.31	3.5
H15010309-007	STS-PT-2013-7-10M	0	0	36.1	3.9	35	3.91	3.0
H15010309-008	STS-PT-2013-8-10M	0	0	1.4	2.5	4	5.08	4.7
H15010309-009	STS-PT-2013-9-10M	0	0	145	2.3	61	2.93	4.1
H15010309-010	STS-PT-2013-10-10M	0	0	31.9	2.5	42	3.66	4.5
H15010309-011	STS-PT-2013-11-10M	0	0	12.1	2.6	30	4.11	3.7
H15010309-012	STS-PT-2013-12-10M	0	0	0.1	3.1	-57	7.36	6.2
H15010309-013	STS-PT-2013-13-10M	0	0	0.9	2.4	-2	5.32	4.6
H15010309-014	STS-PT-2013-14-10M	0	0	37.4	3.6	40	3.75	3.6
H15010309-015	STS-PT-2013-15-1/4"M	0	0	2.0	2.5	8	4.93	4.8
H15010309-016	STS-PT-2013-16-1/4"M	0	0	6.9	2.7	22	4.40	4.8
H15010309-017	STS-PT-2013-17-10M	0	0	0.2	2.7	-72	7.91	6.9
H15010309-018	STS-PT-2013-19-10M	0	0	45.3	2.4	46	3.50	4.3
H15010309-019	STS-2013-20-10M	0	0	0.2	2.5	-91	8.62	7.2
H15010309-020	STS-PT-2013-21-10M	0	0	3.3	2.4	13	4.73	3.8
H15010309-021	STS-PT-2013-22-10M	0	0	16.1	2.3	32	4.03	4.0
H15010309-022	STS-PT-2013-23-10M	0	0	9.9	2.4	27	4.23	3.9
H15010309-023	STS-PT-2013-24-10M	0	0	< 0.1	2.6	-99	8.93	6.9
H15010309-024	STS-PT-2013-25-10M	0	0	< 0.1	2.4	-98	8.87	6.9
H15010309-025	STS-2013-26-10M	0	0	< 0.1	2.5	-110	9.32	7.3
H15010309-026	STS-PT-2013-27-10M	0	0	3.1	2.4	12	4.76	4.4
H15010309-027	STS-PT-2013-28-10M	0	0	< 0.1	2.5	-104	9.11	7.1
H15010309-028	STS-PT-2013-29-10M	0	0	7.5	2.3	23	4.36	4.4
H15010309-029	STS-PT-2013-30-10M	0	0	10.7	2.7	25	4.29	3.4
H15010309-030	STS-PT-2013-31-10M	0	0	0.7	2.5	-11	5.63	4.7
H15010309-031	STS-PT-2013-32-10M	0	0	16.2	2.4	32	4.02	4.6
H15010309-032	STS-2013-35-10M	0	0	133	2.5	56	3.14	4.0
H15010309-033	STS-2013-36-10M	0	0	52.3	2.9	42	3.64	4.8

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: Chino Mine Company
Project: Not Indicated

Report Date: 02/10/15
Work Order: H15010309

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: **arcadis SOP**									Batch: 27927
Lab ID: **LCS-27927**	Laboratory Control Sample				Run: SOIL CUPRIC ION SELECTIV				02/05/15 10:44
Conductivity, CaCl2	4.13	mmhos/cm	0.10	100	70	130			
pCu, Measured	10.3	s.u.	0.010	103	70	130			
ph, CaCl2	7.55	s.u.	0.10	101	70	130			
Lab ID: **H15010309-010Adup**	Sample Duplicate				Run: SOIL CUPRIC ION SELECTIV				02/05/15 10:56
Conductivity, CaCl2	2.50	mmhos/cm	0.10						
Millivolts	42.0	mV							
pCu, Measured	3.65	s.u.	0.010						
ph, CaCl2	4.55	s.u.	0.10						
Lab ID: **H15010309-020Adup**	Sample Duplicate				Run: SOIL CUPRIC ION SELECTIV				02/05/15 11:13
Conductivity, CaCl2	2.37	mmhos/cm	0.10						
Millivolts	13.2	mV							
pCu, Measured	4.73	s.u.	0.010						
ph, CaCl2	3.71	s.u.	0.10						
Method: **arcadis SOP**									Batch: 27928
Lab ID: **LCS-27928**	Laboratory Control Sample				Run: SOIL CUPRIC ION SELECTIV				02/05/15 11:19
Conductivity, CaCl2	4.10	mmhos/cm	0.10	100	70	130			
pCu, Measured	9.78	s.u.	0.010	97	70	130			
ph, CaCl2	7.43	s.u.	0.10	99	70	130			
Lab ID: **H15010309-026Adup**	Sample Duplicate				Run: SOIL CUPRIC ION SELECTIV				02/05/15 11:28
Conductivity, CaCl2	2.42	mmhos/cm	0.10						
Millivolts	13.9	mV							
pCu, Measured	4.70	s.u.	0.010						
ph, CaCl2	4.20	s.u.	0.10						
Lab ID: **H15010309-033ADUP**	Sample Duplicate				Run: SOIL CUPRIC ION SELECTIV				02/05/15 11:37
Conductivity, CaCl2	3.01	mmhos/cm	0.10						
Millivolts	42.5	mV							
pCu, Measured	3.63	s.u.	0.010						
ph, CaCl2	4.93	s.u.	0.10						

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: Chino Mine Company **Report Date:** 02/10/15
Project: Not Indicated **Work Order:** H15010309

Analyte		Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method:	**E200.7**									Analytical Run: ICP2-HE_150206C
Lab ID:	**ICV**	Initial Calibration Verification Standard								02/06/15 09:14
Copper		0.806	mg/L	0.010	101	90	110			
Lab ID:	**ICSA**	Interference Check Sample A								02/06/15 09:29
Copper		0.00169	mg/L	0.010		0	0			
Lab ID:	**ICSAB**	Interference Check Sample AB								02/06/15 09:33
Copper		0.510	mg/L	0.010	102	80	120			

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: Chino Mine Company
Report Date: 02/10/15
Project: Not Indicated
Work Order: H15010309

Analyte		Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method:	**SW6010B**									Batch: 27927
Lab ID:	**MB-27927**	Method Blank				Run: ICP2-HE_150206C				02/06/15 12:31
Copper		ND	mg/kg	0.006						
Lab ID:	**LCS-27927**	Laboratory Control Sample				Run: ICP2-HE_150206C				02/06/15 12:38
Copper		0.0496	mg/kg	0.10	84	70	130			
Lab ID:	**H15010309-001AMS2**	Sample Matrix Spike				Run: ICP2-HE_150206C				02/06/15 12:50
Copper		36.1	mg/kg	0.10		75	125			A
Lab ID:	**H15010309-001AMSD2**	Sample Matrix Spike Duplicate				Run: ICP2-HE_150206C				02/06/15 12:54
Copper		35.8	mg/kg	0.10		75	125	0.8	20	A
Lab ID:	**H15010309-010Adup**	Sample Duplicate				Run: ICP2-HE_150206C				02/06/15 14:06
Copper		31.3	mg/kg	0.10						
Lab ID:	**H15010309-020Adup**	Sample Duplicate				Run: ICP2-HE_150206C				02/06/15 14:56
Copper		3.48	mg/kg	0.10						
Method:	**SW6010B**									Batch: 27928
Lab ID:	**MB-27928**	Method Blank				Run: ICP2-HE_150206C				02/06/15 15:00
Copper		ND	mg/kg	0.006						
Lab ID:	**LCS-27928**	Laboratory Control Sample				Run: ICP2-HE_150206C				02/06/15 15:15
Copper		0.0461	mg/kg	0.10	78	70	130			
Lab ID:	**H15010309-021AMS2**	Sample Matrix Spike				Run: ICP2-HE_150206C				02/06/15 15:27
Copper		18.7	mg/kg	0.10		75	125			A
Lab ID:	**H15010309-021AMSD2**	Sample Matrix Spike Duplicate				Run: ICP2-HE_150206C				02/06/15 15:30
Copper		18.5	mg/kg	0.10		75	125	1.0	20	A
Lab ID:	**H15010309-026Adup**	Sample Duplicate				Run: ICP2-HE_150206C				02/06/15 16:01
Copper		3.63	mg/kg	0.10						
Lab ID:	**H15010309-033Adup**	Sample Duplicate				Run: ICP2-HE_150206C				02/06/15 16:32
Copper		55.0	mg/kg	0.10						

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

A - The analyte level was greater than four times the spike level. In accordance with the method % recovery is not calculated.

Workorder Receipt Checklist

Chino Mine Company

H15010309

Login completed by: Tracy L. Lorash
Reviewed by: BL2000\rwilliams
Reviewed Date: 1/27/2015

Date Received: 1/22/2015
Received by: AHN
Carrier name: FedEx Express

Shipping container/cooler in good condition?	Yes ☑	No ☐	Not Present ☐
Custody seals intact on all shipping container(s)/cooler(s)?	Yes ☐	No ☐	Not Present ☑
Custody seals intact on all sample bottles?	Yes ☐	No ☐	Not Present ☑
Chain of custody present?	Yes ☑	No ☐	
Chain of custody signed when relinquished and received?	Yes ☑	No ☐	
Chain of custody agrees with sample labels?	Yes ☑	No ☐	
Samples in proper container/bottle?	Yes ☑	No ☐	
Sample containers intact?	Yes ☑	No ☐	
Sufficient sample volume for indicated test?	Yes ☑	No ☐	
All samples received within holding time? (Exclude analyses that are considered field parameters such as pH, DO, Res Cl, Sulfite, Ferrous Iron, etc.)	Yes ☑	No ☐	
Temp Blank received in all shipping container(s)/cooler(s)?	Yes ☐	No ☑	Not Applicable ☐
Container/Temp Blank temperature:	N/A°C No Ice		
Water - VOA vials have zero headspace?	Yes ☐	No ☐	No VOA vials submitted ☑
Water - pH acceptable upon receipt?	Yes ☐	No ☐	Not Applicable ☑

Standard Reporting Procedures:

Lab measurement of analytes considered field parameters that require analysis within 15 minutes of sampling such as pH, Dissolved Oxygen and Residual Chlorine, are qualified as being analyzed outside of recommended holding time.

Solid/soil samples are reported on a wet weight basis (as received) unless specifically indicated. If moisture corrected, data units are typically noted as –dry. For agricultural and mining soil parameters/characteristics, all samples are dried and ground prior to sample analysis.

Contact and Corrective Action Comments:

No collection time on COC or sample jars. Estimated collection time in the laboratory. Tl 1/26/15

H15010309

SAMPLE TRANSMITTAL LOG

Wildlife International
EVANS ANALYTICAL GROUP

PROJECT NO.: 757p-101

	Soil Number	Lot Number	Sample Size[1]	Date Sampled
Box 2	1	STS-PT-1-10M	1 Quart	1/15/15
	2	STS-PT-2013-2-10M	1 Quart	1/15/15
	3	STS-PT-2013-3-10M	1 Quart	1/15/15
	4	STS-PT-2013-4-10M	1 Quart	1/15/15
	5	STS-PT-2013-5-10M	1 Quart	1/15/15
	6	STS-PT-2013-6-10M	1 Quart	1/15/15
	7	STS-PT-2013-7-10M	1 Quart	1/15/15
	8	STS-PT-2013-8-10M	1 Quart	1/15/15
	9	STS-PT-2013-9-10M	1 Quart	1/15/15
	10	STS-PT-2013-10-10M	1 Quart	1/15/15
	11	STS-PT-2013-11-10M	1 Quart	1/15/15
	12	STS-PT-2013-12-10M	1 Quart	1/15/15
Box 3	13	STS-PT-2013-13-10M	1 Quart	1/15/15
	14	STS-PT-2013-14-10M	1 Quart	1/15/15
	15	STS-PT-2013-15-1/4"M	1 Quart	1/15/15
	16	STS-PT-2013-16-1/4"M	1 Quart	1/15/15
	17	STS-PT-2013-17-10M	1 Quart	1/15/15
	19	STS-PT-2013-19-10M	1 Quart	1/15/15
	20	STS-2013-20-10M	1 Quart	1/15/15
	21	STS-PT-2013-21-10M	1 Quart	1/15/15
	22	STS-PT-2013-22-10M	1 Quart	1/15/15
	23	STS-PT-2013-23-10M	1 Quart	1/15/15
	24	STS-PT-2013-24-10M	1 Quart	1/15/15
	25	STS-PT-2013-25-10M	1 Quart	1/15/15
Box 1	26	STS-2013-26-10M	1 Quart	1/15/15
	27	STS-PT-2013-27-10M	1 Quart	1/15/15
	28	STS-PT-2013-28-10M	1 Quart	1/15/15
	29	STS-PT-2013-29-10M	1 Quart	1/15/15
	30	STS-PT-2013-30-10M	1 Quart	1/15/15
	31	STS-PT-2013-31-10M	1 Quart	1/15/15
	32	STS-PT-2013-32-10M	1 Quart	1/15/15
	35	STS-2013-35-10M	1 Quart	1/15/15
	36	STS-2013-36-10M	1 Quart	1/15/15

[1] Samples placed in clean quart size plastic ~~bag~~ container
ⓙ JP 1.15.15

Sampled By(Date & Initials): EWP 1-15-15 JCT 1-15-15

Received By (Date & Initials): 1/27/15 09:36
FedEx Express

Box 1
[illegible]

On Ice: Y [✓ N]
Temp Blank: Y [✓ N]

Page 1 of 1

ANALYTICAL SUMMARY REPORT

August 28, 2015

Chino Mine Company
PO Box 10
Bayard, NM 88023

Work Order: H15080326
Project Name: WI Water Analysis

Energy Laboratories Inc Helena MT received the following 2 samples for Chino Mine Company on 8/18/2015 for analysis.

Lab ID	Client Sample ID	Collect Date	Receive Date	Matrix	Test
H15080326-001	1st Flush	08/17/15 8:00	08/18/15	Aqueous	Metals by ICP/ICPMS, Dissolved Alkalinity Conductivity Hardness as CaCO3 pH Preparation, Dissolved Filtration
H15080326-002	Cleared Lines	08/17/15 8:00	08/18/15	Aqueous	Same As Above

The analyses presented in this report were performed by Energy Laboratories, Inc., 3161 E. Lyndale Ave., Helena, MT 59604, unless otherwise noted. Any exceptions or problems with the analyses are noted in the Laboratory Analytical Report, the QA/QC Summary Report, or the Case Narrative.

The results as reported relate only to the item(s) submitted for testing.

If you have any questions regarding these test results, please call.

Report Approved By:

LABORATORY ANALYTICAL REPORT

Prepared by Helena, MT Branch

Client:	Chino Mine Company	**Report Date:**	08/28/15
Project:	WI Water Analysis	**Collection Date:**	08/17/15 08:00
Lab ID:	H15080326-001	**DateReceived:**	08/18/15
Client Sample ID:	1st Flush	**Matrix:**	Aqueous

Analyses	Result	Units	Qualifiers	RL	MCL/ QCL	Method	Analysis Date / By
PHYSICAL PROPERTIES							
pH	8.0	s.u.	H	0.1		A4500-H B	08/19/15 13:14 / SRW
Conductivity @ 25 C	385	umhos/cm		1		A2510 B	08/19/15 13:14 / SRW
INORGANICS							
Alkalinity, Total as CaCO3	200	mg/L		4		A2320 B	08/19/15 19:32 / SRW
Hardness as CaCO3	140	mg/L		1		A2340 B	08/27/15 14:11 / sld
METALS, DISSOLVED							
Cadmium	ND	mg/L		0.00003		E200.8	08/26/15 20:26 / dck
Calcium	35	mg/L		1		E200.8	08/26/15 20:26 / dck
Copper	0.028	mg/L		0.001		E200.8	08/26/15 20:26 / dck
Lead	0.0010	mg/L		0.0003		E200.8	08/26/15 20:26 / dck
Magnesium	13	mg/L		1		E200.8	08/26/15 20:26 / dck
Nickel	0.012	mg/L		0.005		E200.8	08/26/15 20:26 / dck
Zinc	0.04	mg/L		0.01		E200.8	08/26/15 20:26 / dck

Report Definitions:

RL - Analyte reporting limit.
QCL - Quality control limit.
H - Analysis performed past recommended holding time.
MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.

LABORATORY ANALYTICAL REPORT

Prepared by Helena, MT Branch

Client:	Chino Mine Company	**Report Date:**	08/28/15
Project:	WI Water Analysis	**Collection Date:**	08/17/15 08:00
Lab ID:	H15080326-002	**DateReceived:**	08/18/15
Client Sample ID:	Cleared Lines	**Matrix:**	Aqueous

Analyses	Result	Units	Qualifiers	RL	MCL/ QCL	Method	Analysis Date / By
PHYSICAL PROPERTIES							
pH	8.2	s.u.	H	0.1		A4500-H B	08/19/15 13:17 / SRW
Conductivity @ 25 C	394	umhos/cm		1		A2510 B	08/19/15 13:17 / SRW
INORGANICS							
Alkalinity, Total as CaCO3	200	mg/L		4		A2320 B	08/19/15 19:38 / SRW
Hardness as CaCO3	141	mg/L		1		A2340 B	08/27/15 14:11 / sld
METALS, DISSOLVED							
Cadmium	ND	mg/L		0.00003		E200.8	08/26/15 20:30 / dck
Calcium	35	mg/L		1		E200.8	08/26/15 20:30 / dck
Copper	0.001	mg/L		0.001		E200.8	08/26/15 20:30 / dck
Lead	ND	mg/L		0.0003		E200.8	08/26/15 20:30 / dck
Magnesium	13	mg/L		1		E200.8	08/26/15 20:30 / dck
Nickel	ND	mg/L		0.005		E200.8	08/26/15 20:30 / dck
Zinc	ND	mg/L		0.01		E200.8	08/26/15 20:30 / dck

Report Definitions:

RL - Analyte reporting limit.
QCL - Quality control limit.
H - Analysis performed past recommended holding time.
MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: Chino Mine Company
Project: WI Water Analysis

Report Date: 08/28/15
Work Order: H15080326

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: A2320 B										Batch: R108634
Lab ID: MB		Method Blank				Run: PHSC_101-H_150819A				08/19/15 18:02
Alkalinity, Total as CaCO3		2	mg/L	0.7						
Lab ID: LCS		Laboratory Control Sample				Run: PHSC_101-H_150819A				08/19/15 18:08
Alkalinity, Total as CaCO3		610	mg/L	4.0	101	90	110			
Lab ID: H15080332-001ADUP		Sample Duplicate				Run: PHSC_101-H_150819A				08/19/15 19:23
Alkalinity, Total as CaCO3		450	mg/L	4.0				1.0	10	

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: Chino Mine Company
Project: WI Water Analysis
Report Date: 08/28/15
Work Order: H15080326

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: **A2510 B**							Analytical Run: PHSC_101-H_150819A			
Lab ID: **CCV - SC 1413**		Continuing Calibration Verification Standard								08/19/15 10:35
Conductivity @ 25 C		1400	umhos/cm	1.0	99	90	110			
Method: **A2510 B**										Batch: R108634
Lab ID: **SC 150**		Initial Calibration Verification Standard				Run: PHSC_101-H_150819A				08/19/15 08:24
Conductivity @ 25 C		149	umhos/cm	1.0	99	90	110			
Lab ID: **SC 5000**		Initial Calibration Verification Standard				Run: PHSC_101-H_150819A				08/19/15 08:26
Conductivity @ 25 C		4990	umhos/cm	1.0	100	90	110			
Lab ID: **SC 20000**		Initial Calibration Verification Standard				Run: PHSC_101-H_150819A				08/19/15 08:29
Conductivity @ 25 C		19600	umhos/cm	1.0	98	90	110			
Lab ID: **SC 2ND 1000**		Laboratory Control Sample				Run: PHSC_101-H_150819A				08/19/15 08:31
Conductivity @ 25 C		1000	umhos/cm	1.0	100	90	110			
Lab ID: **H15080331-001ADUP**		Sample Duplicate				Run: PHSC_101-H_150819A				08/19/15 13:22
Conductivity @ 25 C		38800	umhos/cm	1.0				0.2	10	

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: Chino Mine Company
Project: WI Water Analysis

Report Date: 08/28/15
Work Order: H15080326

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: A4500-H B							Analytical Run: PHSC_101-H_150819A			
Lab ID: pH 7		Initial Calibration Verification Standard								08/19/15 08:21
pH		7.0	s.u.	0.1	100	98	102			
Lab ID: CCV - pH 7		Continuing Calibration Verification Standard								08/19/15 10:32
pH		7.0	s.u.	0.1	100	98	102			
Lab ID: CCV - pH 7		Continuing Calibration Verification Standard								08/19/15 13:30
pH		7.0	s.u.	0.1	100	98	102			
Method: A4500-H B							Batch: R108634			
Lab ID: H15080331-001ADUP		Sample Duplicate				Run: PHSC_101-H_150819A				08/19/15 13:22
pH		7.7	s.u.	0.1				0.0	3	

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: Chino Mine Company **Report Date:** 08/28/15

Project: WI Water Analysis **Work Order:** H15080326

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: **E200.8**							Analytical Run: ICPMS204-B_150826B			
Lab ID: **ICV STD**	7	Initial Calibration Verification Standard								08/26/15 14:10
Cadmium		0.0313	mg/L	0.0010	104	90	110			
Calcium		3.08	mg/L	0.50	103	90	110			
Copper		0.0626	mg/L	0.010	104	90	110			
Lead		0.0594	mg/L	0.010	99	90	110			
Magnesium		3.11	mg/L	0.50	104	90	110			
Nickel		0.0613	mg/L	0.010	102	90	110			
Zinc		0.0626	mg/L	0.010	104	90	110			
Lab ID: **ICSA**	7	Interference Check Sample A								08/26/15 14:13
Cadmium		0.000341	mg/L	0.0010						
Calcium		119	mg/L	0.50	99	70	130			
Copper		0.000777	mg/L	0.010						
Lead		0.000254	mg/L	0.010						
Magnesium		40.6	mg/L	0.50	102	70	130			
Nickel		0.000646	mg/L	0.010						
Zinc		0.00102	mg/L	0.010						
Lab ID: **ICSAB**	7	Interference Check Sample AB								08/26/15 14:16
Cadmium		0.0102	mg/L	0.0010	102	70	130			
Calcium		120	mg/L	0.50	100	70	130			
Copper		0.0215	mg/L	0.010	107	70	130			
Lead		0.000259	mg/L	0.010		0	0			
Magnesium		40.0	mg/L	0.50	100	70	130			
Nickel		0.0211	mg/L	0.010	106	70	130			
Zinc		0.0110	mg/L	0.010	110	70	130			
Method: **E200.8**										Batch: R108876
Lab ID: **ICB**	7	Method Blank				Run: ICPMS204-B_150826B				08/26/15 14:43
Cadmium		ND	mg/L	2E-05						
Calcium		ND	mg/L	0.010						
Copper		ND	mg/L	6E-05						
Lead		ND	mg/L	3E-05						
Magnesium		ND	mg/L	0.0003						
Nickel		0.0001	mg/L	3E-05						
Zinc		0.0008	mg/L	0.0001						
Lab ID: **LFB**	7	Laboratory Fortified Blank				Run: ICPMS204-B_150826B				08/26/15 14:46
Cadmium		0.0519	mg/L	0.0010	104	85	115			
Calcium		1.07	mg/L	0.50	107	85	115			
Copper		0.0529	mg/L	0.010	106	85	115			
Lead		0.0508	mg/L	0.010	102	85	115			
Magnesium		1.04	mg/L	0.50	104	85	115			
Nickel		0.0528	mg/L	0.010	105	85	115			
Zinc		0.0534	mg/L	0.010	105	85	115			

Qualifiers:

RL - Analyte reporting limit. ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: Chino Mine Company **Report Date:** 08/28/15
Project: WI Water Analysis **Work Order:** H15080326

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: E200.8										Batch: R108876
Lab ID: H15080261-031FMS	7	Sample Matrix Spike				Run: ICPMS204-B_150826B				08/26/15 19:45
Cadmium		0.0479	mg/L	0.0010	96	70	130			
Calcium		135	mg/L	1.0		70	130			A
Copper		0.0495	mg/L	0.0050	98	70	130			
Lead		0.0491	mg/L	0.0010	98	70	130			
Magnesium		78.4	mg/L	1.0		70	130			A
Nickel		0.0503	mg/L	0.0050	98	70	130			
Zinc		0.0486	mg/L	0.010	94	70	130			
Lab ID: H15080261-031FMSD	7	Sample Matrix Spike Duplicate				Run: ICPMS204-B_150826B				08/26/15 19:48
Cadmium		0.0488	mg/L	0.0010	98	70	130	2.0	20	
Calcium		137	mg/L	1.0		70	130	1.6	20	A
Copper		0.0506	mg/L	0.0050	100	70	130	2.0	20	
Lead		0.0505	mg/L	0.0010	101	70	130	2.9	20	
Magnesium		79.5	mg/L	1.0		70	130	1.5	20	A
Nickel		0.0514	mg/L	0.0050	100	70	130	2.1	20	
Zinc		0.0506	mg/L	0.010	98	70	130	4.0	20	

Qualifiers:

RL - Analyte reporting limit.

A - The analyte level was greater than four times the spike level. In accordance with the method % recovery is not calculated.

ND - Not detected at the reporting limit.

Work Order Receipt Checklist

Chino Mine Company

H15080326

Login completed by: Skyler T. Pester
Reviewed by: BL2000\sdull
Reviewed Date: 8/27/2015

Date Received: 8/18/2015
Received by: stp
Carrier name: FedEx Express

Shipping container/cooler in good condition?	Yes ☑	No ☐	Not Present ☐
Custody seals intact on all shipping container(s)/cooler(s)?	Yes ☐	No ☐	Not Present ☑
Custody seals intact on all sample bottles?	Yes ☐	No ☐	Not Present ☑
Chain of custody present?	Yes ☐	No ☑	
Chain of custody signed when relinquished and received?	Yes ☐	No ☑	
Chain of custody agrees with sample labels?	Yes ☐	No ☑	
Samples in proper container/bottle?	Yes ☑	No ☐	
Sample containers intact?	Yes ☑	No ☐	
Sufficient sample volume for indicated test?	Yes ☐	No ☑	
All samples received within holding time? (Exclude analyses that are considered field parameters such as pH, DO, Res Cl, Sulfite, Ferrous Iron, etc.)	Yes ☑	No ☐	
Temp Blank received in all shipping container(s)/cooler(s)?	Yes ☐	No ☑	Not Applicable ☐
Container/Temp Blank temperature:	10.5°C No Ice		
Water - VOA vials have zero headspace?	Yes ☐	No ☐	No VOA vials submitted ☑
Water - pH acceptable upon receipt?	Yes ☐	No ☑	Not Applicable ☐

Standard Reporting Procedures:

Lab measurement of analytes considered field parameters that require analysis within 15 minutes of sampling such as pH, Dissolved Oxygen and Residual Chlorine, are qualified as being analyzed outside of recommended holding time.

Solid/soil samples are reported on a wet weight basis (as received) unless specifically indicated. If moisture corrected, data units are typically noted as –dry. For agricultural and mining soil parameters/characteristics, all samples are dried and ground prior to sample analysis.

Contact and Corrective Action Comments:

Client sample container leaked into ziplock bag during shipping, transfered to proper sealed containers upon arrival. Very low sample volume, prioritize metals, and ph/ec. then ALK, hardness, and DOC. Insufficient sample to analyze DOC. Analysis taken from emails from J. Meyer and M. Barkley. No collection times listed on sample containers - collection times estimated in laboratory.
Samples for Dissolved Metals/Hardness were subsampled, filtered, and preserved to pH <2 with 2 mL of Nitric acid per 250 mL in the laboratory. According to 40CFR136, samples for Dissolved Metals should be filtered and preserved within 15 minutes of collection. 8/19/2015 STP.

Energy Laboratories Inc
3161 East Lyndale Avenue
Helena, MT 59601
(406) 442-0711

CHAIN-OF-CUSTODY RECORD

Page 1 of 1

WorkOrder: H15080326

Client:
Chino Mine Company
PO Box 10
Bayard, NM 88023

TEL:
FAX:
ProjectNo: WI Water Analys
PO:

19-Aug-15

					Requested Tests					
Sample ID	**ClientSampID**	**Matrix**	**Collection Date**	**Bottle**	**200_7_8-W-D**	**ALK-W**	**OND-PROBE-**	**DNESS-CALC**	**PH-W**	**WC REVIEW**
H15080326-001	1st Flush	Aqueous	8/17/2015 8:00:00 AM		A	B	B	A	B	A
H15080326-002	Cleared Lines	Aqueous	8/17/2015 8:00:00 AM		A	B	B	A	B	

Fedex express overnight
10.5°C
No Ice

Comments: Samples Submitted from WI, under directive of Matthew B. to be analyzed for suspected contamination. See Email in place of COC. 8/19/2015 STP. Very low sample volume, prioritize metals, and ph/ec. then ALK, hardness, and DOC.

	Date/Time		Date/Time
Relinquished by:		**Received by:**	
Relinquished by:		**Received by:**	
Relinquished by:		**Received by:**	8-18-15 9:36 AM

NOTE: Samples are discarded 60 days after results are reported unless other arrangements are made. Hazardous samples will be returned to client or disposed of at client expense.

Bottle Type: L-Liter V-Voa S-Soil Jar O-Orbo T-Tedlar B-Brass P-Plastic OT-Other

TECHNICAL MEMORANDUM

Golder Associates Inc.
5200 Pasadena NE, Suite C
Albuquerque, NM USA 87113
Telephone: 505-821-3043
Fax Access: 505-821-5273

TO: **Mr. John Gearhart, Chino Mines Co.** **DATE:** September 11, 2006
FROM: **Lewis Munk, Ph.D., CPSS** **OUR REF.:** 013-1594
RE: **UPPER SOUTH STOCKPILE- NORTH LOBE COVER SUITABILITY**

1.0 INTRODUCTION

The Upper South Stockpile at Chino Mines Company (Chino) has been identified as a potential borrow source for cover materials to be used in the reclamation of the North Mine Area. Chino is currently placing materials mined from the South Pit Area on the Upper South Stockpile. Golder Associates Inc. (Golder) was retained by Chino to sample and analyze these materials with the intent of evaluating the suitability of the materials as soil substitutes.

This memorandum documents the results of analyses conducted on samples from the North Lobe portion of the Upper South Stockpile. This information was gathered in response to a request from the New Mexico Environment Department (NMED) and Mining and Minerals Division (MMD).

2.0 METHODS

On August 10, 2006, Golder described and collected samples from eight test pits excavated on the North Lobe (Fig. 1). The pits were excavated to a depth of about 12 feet. The volume of oversize material (fragments >7.5 cm in diameter) was estimated from the walls of the pits (Soil Survey Division Staff, 1993). The samples were collected at different depth intervals based on changes in color, dominant lithology, and/or rock fragment content. The materials were described and sampled using standard methods (Soil Survey Division Staff, 1993). Field descriptions included depth intervals, soil texture, rock fragments and Munsell color. The rock fragments were estimated from the pit exposures on a volume basis. General descriptions of the dominant lithology were also made.

The samples collected for chemical and physical characterization were placed directly in gallon-size plastic bags (5 to 10 kg). The samples were sent to Energy Laboratories in Billings, Montana for chemical and physical analysis. The bulk soil samples collected for fine-earth analysis were air-dried and passed through a 2 mm sieve at the laboratory. The less than 2 mm soil fraction was analyzed for the particle size distribution (Gee and Bauder, 1986); paste pH and electrical conductivity (Salinity Laboratory Staff, 1954); acid base account (Sobeck et al., 1978); and AB-DTPA extractable arsenic, cadmium, copper, lead, manganese, mercury, molybdenum, and nickel. Water soluble selenium and boron were evaluated to 2:1 extracts.

3.0 RESULTS

The stockpile is represented by a heterogeneous mixture of rhyolite and leach cap that occur in zones related to the dumping sequence. The leach cap is composed predominantly of Santa Rita Stock and Colorado Formation with minor amounts of intrusive dikes and sills. The rhyolite tended to be represented by near surface materials and contained some native soils and plant matter. These materials were generated from the overburden stripping operations in South Pit Area. Clasts with evidence of sulfide mineralization occurred on the stockpile surface, but were rare.

The chemical and physical properties of the samples indicate few inherent limitations for use as cover materials. In general, the materials contained moderate to high volumes of rock fragments (40 to 80% by volume). The rock fragments were angular and mostly less than 10-inches in diameter (Table 1). The leach cap-dominated zones tended to have somewhat higher volumes of rock fragment, although the fragments were generally smaller in maximum size than the zones dominated by the rhyolite. The fine-earth fraction was mostly medium- and moderately coarse-textured with clay contents ranging from 10 to 20%. The silt content was somewhat higher in the leach cap dominated materials compared to the rhyolite.

Chemically, the materials ranged from slightly acid (pH 6.1) to neutral (pH 7.4), and were universally non-saline (Table 2). Water extractable selenium and boron occurred at low concentrations.

The acid forming potential of the samples was evaluated through static sulfur speciation tests (Sobeck et al., 1978). Total sulfur in the samples ranged from 0.02 to 0.48% (Table 3). Nonetheless, the samples generally had positive acid base accounts (ABA) when evaluated on the basis of HNO_3 extractable sulfur; although 2 samples were slightly negative (Table 3). Nearly all the samples had measurable acid neutralization potentials and none had ABA's less than the MMD soil suitability guidelines. Thus, the potential for strong reductions in soil pH and excessive salinity with weathering is expected to be low.

The concentrations of the AB-DTPA extractable constituents are listed in Table 4. With the exception of copper in samples from one location, all the samples are considered acceptable with respect to the MMD soil suitability guidelines (MMD, 1996). The two samples from location CHUSNO6-8 had AB-DTPA extractable copper levels slightly above the MMD guidelines and are not considered a concern with respect to plant toxicity.

4.0 SUMMARY

Overall the materials from the North Lobe area are considered suitable for use as soil substitutes, on the basis of these data. The chemical characteristics are suitable with respect to pH, salinity, and specific ion plant toxicity. The ABA data suggest the materials are unlikely to generate excess acidity.

Physically, the majority of the material evaluated will perform adequately from a cover perspective. The combination of medium to moderately coarse textures and moderate to high rock fragments should provide adequate support for plants and water storage and good erosion protection. Some of the rhyolite zones in the stockpile will require special handling considerations to segregate the extremely large fragments (e.g., boulders). However, these oversize materials may have application for riprap.

5.0 REFERENCES

Agron 9. 1982. Methods of Soil Analysis. Soil Sci. Soc. Am., Madison, WI.

Gee, G.W., and J.W. Bauder. 1986. Particle-size analysis. In: Methods of Soil Analysis. Part 1-Physical and Mineralogical Methods, 2nd Edition. A. Klute (ed). Agron. 9. Soil Sci. Soc. Am., Madison, WI.

Mining and Minerals Division. 1996. Draft closeout plan guidelines for existing mines. Mining Act Reclamation Bureau, Santa Fe, NM. April 30.

Salinity Laboratory Staff. 1954. Diagnosis and improvement of saline and alkali soils. Agricultural Handbook No. 60. USDA-Agricultural Research Service. US Government Printing Office, Washington, D.C.

Sobek, A.A., W.A. Schuller, J.R. Freeman, and R.M. Smith. 1978. Field and laboratory methods applicable to overburdens and minesoils. EPA-600/2-78-054.

Soil Survey Staff. 1993. Soil survey manual. Handbook No. 18, 2nd ed. USDA-Soil Conservation Service. US Government Printing Office, Washington, D.C.

Tables 1 through 4
Figure 1
Attachment 1 - Laboratory Reports

TABLES

TABLE 1
SUMMARY FIELD DESCRIPTIONS FOR UPPER SOUTH STOCKPILE EXCAVATIONS

Field ID	Depth (ft.)	Munsell Color			Rock Fragments (% by Volume)					Lithology
		Hue	Value	Chroma	Gravel	Cobbles	Stones	Boulders	Total	
CHUSN06-1	0-2	2.5YR	4	8	40	5	-	-	45	LC/Tkn
CHUSN06-1	2-4	7.5YR	4	3	45	10	-	-	55	LC/Tkn
CHUSN06-1	4-11.5	7.5YR	4	3	45	15	5	1	66	LC/Tkn
CHUSN06-2	0-2	5YR	4	4	45	5	1	-	51	LC
CHUSN06-2	2-5	7.5YR	4	3	35	15	-	-	50	LC/Tkn
CHUSN06-2	5-12	5YR	4	4	50	15	1	-	66	LC
CHUSN06-3	0-1.5	*	*	*	45	5	-	-	50	Tkn
CHUSN06-3	1.5-12	10YR	4	3	40	15	5	trace	60	Tkn
CHUSN06-4	0-5	5YR	4	6	50	20	2	-	72	LC
CHUSN06-4	5-12	5YR	4	6	50	20	2	-	72	LC
CHUSN06-5	0-3.5	2.5YR	4	6	55	15	1	-	71	LC
CHUSN06-5	3.5-12	7.5YR	4	6	45	15	trace	-	60	Tkn/LC
CHUSN06-6	0-4.5	2.5YR	3	6	60	20	trace	-	80	LC
CHUSN06-6	4.5-12	7.5YR	4	8	55	20	5	-	80	LC
CHUSN06-7	0.5-10	7.5YR	4	3	30	10	5	-	45	Tkn
CHUSN06-8	0-5	-	-	-	30	10	-	-	40	LC
CHUSN06-8	5-12	7.5YR	4	3	35	10	2	-	47	Tkn

Notes:

Rock Fragments according to Soil Survey Division Staff (1993) Gravel = 2mm - 3"; Cobbles = 3" - 10"; Stones = 10" -25"; Boulders >25"

* Mixed Colors - 2.5YR 4/6 and 10YR 5/8

Lithology: LC = leach cap; Tkn = Kneeling Nun Rhyolite

TABLE 2
CHEMICAL AND PHYSICAL PROPERTIES OF THE UPPER SOUTH STOCKPILE SAMPLES

Field ID	Depth (feet)	Saturated Paste pH	Paste Extract EC (dS/m)	Saturation Percentage (% water)	Water Extractable Metals (mg/kg)		Coarse Fragments (%)	Particle Size Distribution (%)			USDA Texture
					Boron	Selenium		Sand	Silt	Clay	
North Lobe											
CHUSN06-1	0-2	6.6	1.35	27.1	0.07	<0.01	45	45	43	12	L
CHUSN06-1	2-4	7.1	1.30	35.4	<0.05	<0.01	55	55	27	18	SL
CHUSN06-1	4-11.5	7.4	1.18	38.8	0.05	<0.01	66	54	26	20	SCL
CHUSN06-2	0-2	6.9	1.61	37.5	<0.05	<0.01	56	49	31	20	L
CHUSN06-2	2-5	6.4	1.65	35.3	<0.05	<0.01	50	57	25	18	SL
CHUSN06-2	5-12	6.9	0.25	30.6	<0.05	<0.01	66	57	25	18	SL
CHUSN06-3	0-1.5	6.7	0.53	26.1	<0.05	<0.01	50	49	39	12	L
CHUSN06-3	1.5-12	6.2	1.06	29.5	<0.05	<0.01	60	65	21	14	SL
CHUSN06-4	0-5	6.1	0.99	23.9	<0.05	<0.01	72	47	42	11	L
CHUSN06-4	5-12	6.7	0.35	25.3	<0.05	<0.01	72	51	39	10	L
CHUSN06-5	0-3.5	6.3	0.79	25.7	0.06	<0.01	71	60	30	10	SL
CHUSN06-5	3.5-12	6.9	0.57	29.4	<0.05	<0.01	60	62	22	16	SL
CHUSN06-6	0-4.5	6.5	0.30	26.5	0.08	<0.01	80	57	29	14	SL
CHUSN06-6	4.5-12	6.7	0.32	25.0	<0.05	<0.01	80	59	29	12	SL
CHUSN06-7	0.5-10	6.9	1.30	31.1	<0.05	<0.01	45	59	26	15	SL
CHUSN06-8	0-5	6.3	1.70	29.7	<0.05	<0.01	40	55	29	16	SL
CHUSN06-8	5-12	6.9	0.88	35.4	<0.05	<0.01	47	59	23	18	SL

Notes:

EC = electrical conductivity

dS/m = deciSiemens per meter

mg/kg = milligrams per kilogram

USDA textural class according to Soil Survey Division Staff (1993). C = clay, S = sand or sandy, L = loam or loamy, Si = silt or silty

TABLE 3
SULFUR FORMS AND ACID-BASE ACCOUNTS OF UPPER SOUTH STOCKPILE SAMPLES

Field ID	Depth (feet)	ANP	AGP	ABA	Total Sulfur (%)	Extractable Sulfur Forms (%)				Saturated Paste pH
						Hot H_2O	HCl	HNO_3	Residual	
North Lobe										
CHUSN06-1	0-2	0.0	0.3	-0.3	0.41	0.02	< 0.01	0.01	0.37	6.6
CHUSN06-1	2-4	4.6	<0.3	4.6	0.02	< 0.01	< 0.01	< 0.01	< 0.01	7.1
CHUSN06-1	4-11.5	6.4	0.3	6.1	0.03	< 0.01	< 0.01	0.01	< 0.01	7.4
CHUSN06-2	0-2	7.0	0.9	6.1	0.15	0.03	< 0.01	0.03	0.09	6.9
CHUSN06-2	2-5	5.2	0.3	4.9	0.03	< 0.01	< 0.01	0.01	< 0.01	6.4
CHUSN06-2	5-12	3.5	<0.3	3.5	0.04	< 0.01	< 0.01	< 0.01	0.02	6.9
CHUSN06-3	0-1.5	2.9	0.9	2.0	0.14	0.02	< 0.01	0.03	0.09	6.7
CHUSN06-3	1.5-12	4.6	<0.3	4.6	0.03	0.01	< 0.01	< 0.01	< 0.01	6.2
CHUSN06-4	0-5	2.9	<0.3	2.9	0.37	0.07	< 0.01	< 0.01	0.31	6.1
CHUSN06-4	5-12	4.1	<03	4.1	0.46	0.05	< 0.01	< 0.01	0.41	6.7
CHUSN06-5	0-3.5	1.2	<0.3	1.2	0.33	0.06	< 0.01	< 0.01	0.26	6.3
CHUSN06-5	3.5-12	6.4	0.3	6.1	0.07	0.02	< 0.01	0.01	0.04	6.9
CHUSN06-6	0-4.5	1.2	<0.3	1.2	0.48	0.07	< 0.01	< 0.01	0.4	6.5
CHUSN06-6	4.5-12	4.6	5.0	-0.4	0.41	0.08	< 0.01	0.16	0.17	6.7
CHUSN06-7	0.5-10	4.6	0.6	4.0	0.04	0.02	< 0.01	0.02	< 0.01	6.9
CHUSN06-8	0-5	4.1	3.1	1.0	0.18	0.02	< 0.01	0.1	0.05	6.3
CHUSN06-8	5-12	7.0	0.9	6.1	0.06	0.01	< 0.01	0.03	0.02	6.9

Notes:

ANP = acid-neutralization potential, in tons $CaCO_3$ per 1,000 tons rock

AGP = acid-generation potential, in tons $CaCO_3$ per 1,000 tons rock (Based on HNO_3 extractable S)

ABA = acid-base accounting = ANP – AGP, in tons $CaCO_3$ per 1,000 tons rock

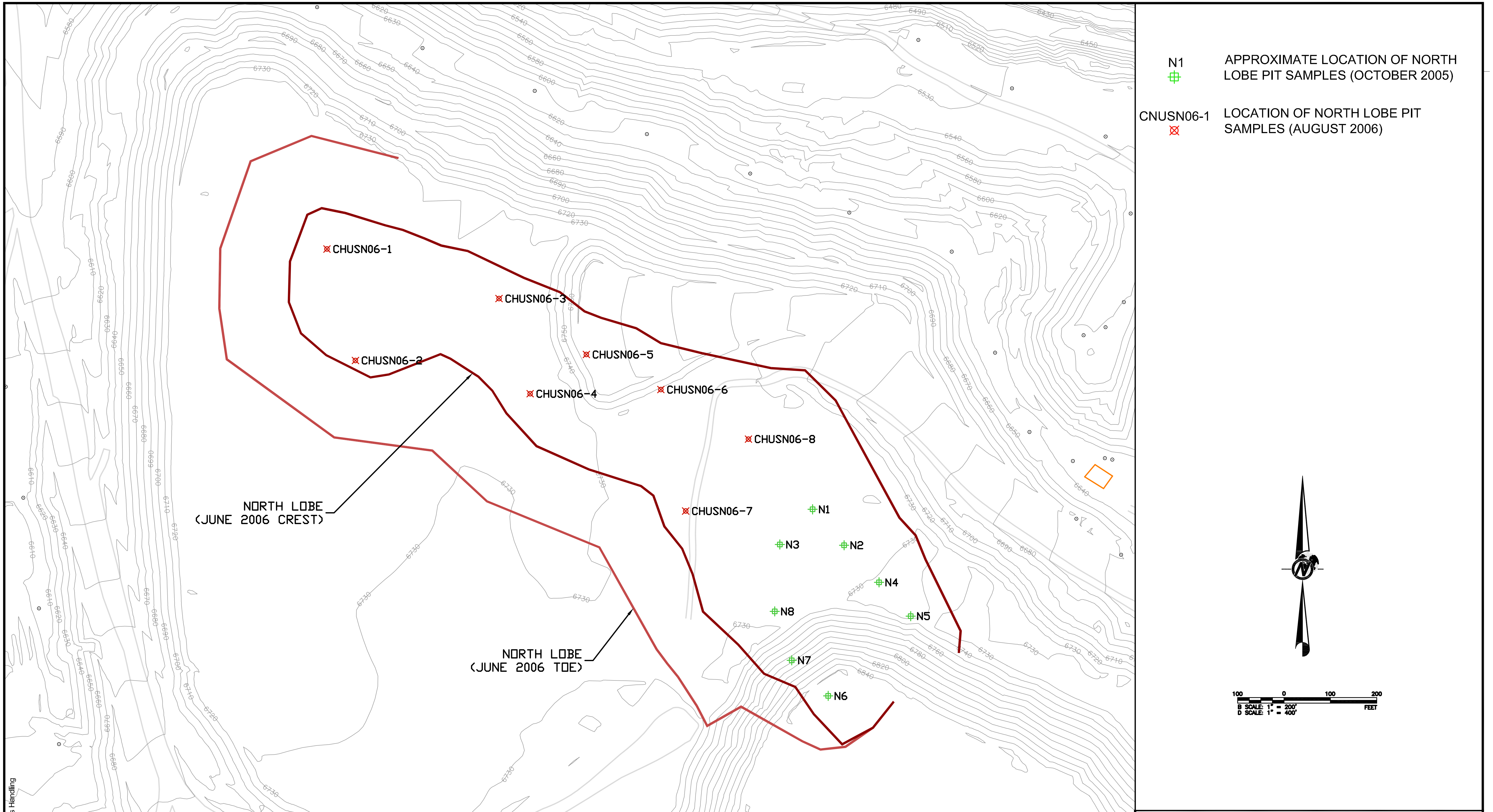
TABLE 4
AB-DTPA EXTRACTIONS FROM THE UPPER SOUTH STOCKPILE

Field ID	Depth (feet)	AB-DTPA Extractable (mg/kg)							
		Arsenic	Cadmium	Copper	Lead	Manganese	Mercury	Molybdenum	Nickel
North Lobe									
CHUSN06-1	0-2	<1.0	<0.01	2	0.1	1.54	<0.05	0.03	0.07
CHUSN06-1	2-4	<1.0	<0.01	2	1.26	3.02	<0.05	0.07	0.09
CHUSN06-1	4-11.5	<1.0	<0.01	2	0.71	1.99	<0.05	0.03	0.08
CHUSN06-2	0-2	<1.0	<0.01	9	0.34	1.74	<0.05	0.05	0.09
CHUSN06-2	2-5	<1.0	0.01	3	0.57	2.56	<0.05	0.04	0.09
CHUSN06-2	5-12	<1.0	<0.01	2	0.32	1.62	<0.05	0.05	0.05
CHUSN06-3	0-1.5	<1.0	<0.01	<1.0	0.33	0.68	<0.05	0.03	0.06
CHUSN06-3	1.5-12	<1.0	<0.01	1	0.18	1.55	<0.05	0.02	0.07
CHUSN06-4	0-5	<1.0	<0.01	2	0.08	0.46	<0.05	0.03	0.05
CHUSN06-4	5-12	<1.0	<0.01	<1.0	0.06	0.21	<0.05	0.06	0.04
CHUSN06-5	0-3.5	<1.0	<0.01	<1.0	0.1	0.57	<0.05	0.04	0.07
CHUSN06-5	3.5-12	<1.0	<0.01	9	0.19	0.88	<0.05	0.03	0.05
CHUSN06-6	0-4.5	<1.0	<0.01	<1.0	0.14	0.64	<0.05	0.03	0.05
CHUSN06-6	4.5-12	<1.0	<0.01	<1.0	2.88	0.46	<0.05	0.1	0.12
CHUSN06-7	0.5-10	<1.0	<0.01	5	0.47	2.22	<0.05	0.02	0.07
CHUSN06-8	0-5	<1.0	<0.01	49	0.23	2.32	<0.05	0.05	0.09
CHUSN06-8	5-12	<1.0	<0.01	16	0.25	0.85	<0.05	0.02	0.06

Note:

mg/kg = milligrams per kilogram

FIGURE



PROJECT

CHINO MINES COMPANY
GRANT COUNTY, NEW MEXICO

TITLE

UPPER SOUTH STOCKPILE - NORTH LOBE SAMPLE LOCATIONS

Golder Associates
Albuquerque, New Mexico

PROJECT No.		013-1594	FILE No.	USS_NL_SL
DESIGN	VM	09/07/06	SCALE AS SHOWN	REV. A
CADD	VM	09/07/06		
CHECK	LM	09/07/06		
REVIEW				

FIGURE 1

ATTACHMENT 1

LABORATORY REPORTS

LABORATORY ANALYTICAL REPORT

Client: Golder Associates Inc
Project: Chino-USSP North 013-1594
Lab ID: B06081524-001
Client Sample ID: CHUSN06-4, 0-5 ft

Report Date: 08/29/06
Collection Date: 08/10/06
DateReceived: 08/17/06
Matrix: Soil

Analyses	Result	Units	Qualifiers	RL	MCL/ QCL	Method	Analysis Date / By
PHYSICAL CHARACTERISTICS							
Coarse Fragments	54	wt%		2		ASA15-5	08/23/06 16:51 / srm
Sand	47	%		1		ASA15-5	08/23/06 16:51 / srm
Silt	42	%		1		ASA15-5	08/23/06 16:51 / srm
Clay	11	%		1		ASA15-5	08/23/06 16:51 / srm
Texture	L					ASA15-5	08/23/06 16:51 / srm
- C = Clay, S = Sand(y), Si = Silt(y), L = Loam(y)							
SATURATED PASTE							
pH, sat. paste	6.10	s.u.		0.10		ASAM10-3.2	08/23/06 16:51 / srm
Conductivity, sat. paste	0.99	mmhos/cm		0.01		ASA10-3	08/24/06 16:40 / srm
Saturation	23.9	%		0.1		USDA27a	08/24/06 16:40 / srm
ACID-BASE ACCOUNTING							
Neutralization Potential	2.9	t/kt		1.0		Sobek Modifie	08/27/06 00:00 / srm
Acid Potential	9.6	t/kt		1.0		Sobek Modifie	08/27/06 00:00 / srm
Acid/Base Potential	-7	t/kt				Sobek Modifie	08/27/06 00:00 / srm
Sulfur, Total	0.37	%		0.01		Sobek Modifie	08/27/06 00:00 / srm
Sulfur, Hot Water Extractable	0.07	%		0.01		Sobek Modifie	08/27/06 00:00 / srm
Sulfur, HCl Extractable	ND	%		0.01		Sobek Modifie	08/27/06 00:00 / srm
Sulfur, HNO3 Extractable	ND	%		0.01		Sobek Modifie	08/27/06 00:00 / srm
Sulfur, Residual	0.31	%		0.01		Sobek Modifie	08/27/06 00:00 / srm
- The acid base potential was calculated from non-sulfate sulfur.							
METALS, WATER EXTRACTABLE							
Selenium	ND	mg/kg		0.01		SW6020	08/23/06 13:17 / car
Boron	ND	mg/kg		0.05		SW6010B	08/23/06 01:29 / rlh
METALS, ABDTPA EXTRACTABLE							
Arsenic	ND	mg/kg		1		SW6020	08/23/06 19:43 / car
Cadmium	ND	mg/kg		0.01		SW6020	08/23/06 19:43 / car
Copper	2	mg/kg		1		SW6010B	08/22/06 18:28 / rlh
Lead	0.08	mg/kg	D	0.03		SW6020	08/23/06 19:43 / car
Manganese	0.46	mg/kg		0.01		SW6010B	08/22/06 18:28 / rlh
Mercury	ND	mg/kg		0.05		SW6020	08/23/06 19:43 / car
Molybdenum	0.03	mg/kg		0.01		SW6020	08/23/06 19:43 / car
Nickel	0.05	mg/kg	D	0.03		SW6020	08/23/06 19:43 / car

Report Definitions:
RL - Analyte reporting limit.
QCL - Quality control limit.
D - RL increased due to sample matrix interference.
MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.

LABORATORY ANALYTICAL REPORT

Client:	Golder Associates Inc	**Report Date:**	08/29/06
Project:	Chino-USSP North 013-1594	**Collection Date:**	08/10/06
Lab ID:	B06081524-002	**DateReceived:**	08/17/06
Client Sample ID:	CHUSN06-3, 1.5-12 ft	**Matrix:**	Soil

Analyses	Result	Units	Qualifiers	RL	MCL/ QCL	Method	Analysis Date / By
PHYSICAL CHARACTERISTICS							
Coarse Fragments	29	wt%		2		ASA15-5	08/23/06 16:51 / srm
Sand	65	%		1		ASA15-5	08/23/06 16:51 / srm
Silt	21	%		1		ASA15-5	08/23/06 16:51 / srm
Clay	14	%		1		ASA15-5	08/23/06 16:51 / srm
Texture	SL					ASA15-5	08/23/06 16:51 / srm
- C = Clay, S = Sand(y), Si = Silt(y), L = Loam(y)							
SATURATED PASTE							
pH, sat. paste	6.20	s.u.		0.10		ASAM10-3.2	08/23/06 16:51 / srm
Conductivity, sat. paste	1.06	mmhos/cm		0.01		ASA10-3	08/24/06 16:40 / srm
Saturation	29.5	%		0.1		USDA27a	08/24/06 16:40 / srm
ACID-BASE ACCOUNTING							
Neutralization Potential	4.6	t/kt		1.0		Sobek Modifie	08/27/06 00:00 / srm
Acid Potential	0	t/kt		1.0		Sobek Modifie	08/27/06 00:00 / srm
Acid/Base Potential	4	t/kt				Sobek Modifie	08/27/06 00:00 / srm
Sulfur, Total	0.03	%		0.01		Sobek Modifie	08/27/06 00:00 / srm
Sulfur, Hot Water Extractable	0.01	%		0.01		Sobek Modifie	08/27/06 00:00 / srm
Sulfur, HCl Extractable	ND	%		0.01		Sobek Modifie	08/27/06 00:00 / srm
Sulfur, HNO3 Extractable	ND	%		0.01		Sobek Modifie	08/27/06 00:00 / srm
Sulfur, Residual	ND	%		0.01		Sobek Modifie	08/27/06 00:00 / srm
- The acid base potential was calculated from non-sulfate sulfur.							
METALS, WATER EXTRACTABLE							
Selenium	ND	mg/kg		0.01		SW6020	08/23/06 13:31 / car
Boron	ND	mg/kg		0.05		SW6010B	08/23/06 01:38 / rlh
METALS, ABDTPA EXTRACTABLE							
Arsenic	ND	mg/kg		1		SW6020	08/23/06 19:57 / car
Cadmium	ND	mg/kg		0.01		SW6020	08/23/06 19:57 / car
Copper	1	mg/kg		1		SW6010B	08/22/06 18:35 / rlh
Lead	0.18	mg/kg	D	0.03		SW6020	08/23/06 19:57 / car
Manganese	1.55	mg/kg		0.01		SW6010B	08/22/06 18:35 / rlh
Mercury	ND	mg/kg		0.05		SW6020	08/23/06 19:57 / car
Molybdenum	0.02	mg/kg		0.01		SW6020	08/23/06 19:57 / car
Nickel	0.07	mg/kg	D	0.03		SW6020	08/23/06 19:57 / car

Report Definitions:

RL - Analyte reporting limit.

QCL - Quality control limit.

D - RL increased due to sample matrix interference.

MCL - Maximum contaminant level.

ND - Not detected at the reporting limit.

LABORATORY ANALYTICAL REPORT

Client:	Golder Associates Inc	**Report Date:**	08/29/06
Project:	Chino-USSP North 013-1594	**Collection Date:**	08/10/06
Lab ID:	B06081524-003	**DateReceived:**	08/17/06
Client Sample ID:	CHUSN06-4, 5-12 ft	**Matrix:**	Soil

Analyses	Result	Units	Qualifiers	RL	MCL/ QCL	Method	Analysis Date / By
PHYSICAL CHARACTERISTICS							
Coarse Fragments	64	wt%		2		ASA15-5	08/23/06 16:51 / srm
Sand	51	%		1		ASA15-5	08/23/06 16:51 / srm
Silt	39	%		1		ASA15-5	08/23/06 16:51 / srm
Clay	10	%		1		ASA15-5	08/23/06 16:51 / srm
Texture	L					ASA15-5	08/23/06 16:51 / srm
- C = Clay, S = Sand(y), Si = Silt(y), L = Loam(y)							
SATURATED PASTE							
pH, sat. paste	6.70	s.u.		0.10		ASAM10-3.2	08/23/06 16:51 / srm
Conductivity, sat. paste	0.35	mmhos/cm		0.01		ASA10-3	08/24/06 16:40 / srm
Saturation	25.3	%		0.1		USDA27a	08/24/06 16:40 / srm
ACID-BASE ACCOUNTING							
Neutralization Potential	4.1	t/kt		1.0		Sobek Modifie	08/27/06 00:00 / srm
Acid Potential	13	t/kt		1.0		Sobek Modifie	08/27/06 00:00 / srm
Acid/Base Potential	-9	t/kt				Sobek Modifie	08/27/06 00:00 / srm
Sulfur, Total	0.46	%		0.01		Sobek Modifie	08/27/06 00:00 / srm
Sulfur, Hot Water Extractable	0.05	%		0.01		Sobek Modifie	08/27/06 00:00 / srm
Sulfur, HCl Extractable	ND	%		0.01		Sobek Modifie	08/27/06 00:00 / srm
Sulfur, HNO3 Extractable	ND	%		0.01		Sobek Modifie	08/27/06 00:00 / srm
Sulfur, Residual	0.41	%		0.01		Sobek Modifie	08/27/06 00:00 / srm
- The acid base potential was calculated from non-sulfate sulfur.							
METALS, WATER EXTRACTABLE							
Selenium	ND	mg/kg		0.01		SW6020	08/23/06 13:59 / car
Boron	ND	mg/kg		0.05		SW6010B	08/23/06 01:46 / rlh
METALS, ABDTPA EXTRACTABLE							
Arsenic	ND	mg/kg		1		SW6020	08/23/06 20:54 / car
Cadmium	ND	mg/kg		0.01		SW6020	08/23/06 20:54 / car
Copper	ND	mg/kg		1		SW6010B	08/22/06 18:50 / rlh
Lead	0.06	mg/kg	D	0.03		SW6020	08/23/06 20:54 / car
Manganese	0.21	mg/kg		0.01		SW6010B	08/22/06 18:50 / rlh
Mercury	ND	mg/kg		0.05		SW6020	08/23/06 20:54 / car
Molybdenum	0.06	mg/kg		0.01		SW6020	08/23/06 20:54 / car
Nickel	0.04	mg/kg	D	0.03		SW6020	08/23/06 20:54 / car

Report Definitions:

RL - Analyte reporting limit.

QCL - Quality control limit.

D - RL increased due to sample matrix interference.

MCL - Maximum contaminant level.

ND - Not detected at the reporting limit.

LABORATORY ANALYTICAL REPORT

Client:	Golder Associates Inc	**Report Date:**	08/29/06
Project:	Chino-USSP North 013-1594	**Collection Date:**	08/10/06
Lab ID:	B06081524-004	**DateReceived:**	08/17/06
Client Sample ID:	CHUSN06-3, 0-1.5 ft	**Matrix:**	Soil

Analyses	Result	Units	Qualifiers	RL	MCL/ QCL	Method	Analysis Date / By
PHYSICAL CHARACTERISTICS							
Coarse Fragments	48	wt%		2		ASA15-5	08/23/06 16:51 / srm
Sand	49	%		1		ASA15-5	08/23/06 16:51 / srm
Silt	39	%		1		ASA15-5	08/23/06 16:51 / srm
Clay	12	%		1		ASA15-5	08/23/06 16:51 / srm
Texture	L					ASA15-5	08/23/06 16:51 / srm
- C = Clay, S = Sand(y), Si = Silt(y), L = Loam(y)							
SATURATED PASTE							
pH, sat. paste	6.70	s.u.		0.10		ASAM10-3.2	08/23/06 16:51 / srm
Conductivity, sat. paste	0.53	mmhos/cm		0.01		ASA10-3	08/24/06 16:40 / srm
Saturation	26.1	%		0.1		USDA27a	08/24/06 16:40 / srm
ACID-BASE ACCOUNTING							
Neutralization Potential	2.9	t/kt		1.0		Sobek Modifie	08/27/06 00:00 / srm
Acid Potential	3.8	t/kt		1.0		Sobek Modifie	08/27/06 00:00 / srm
Acid/Base Potential	0	t/kt				Sobek Modifie	08/27/06 00:00 / srm
Sulfur, Total	0.14	%		0.01		Sobek Modifie	08/27/06 00:00 / srm
Sulfur, Hot Water Extractable	0.02	%		0.01		Sobek Modifie	08/27/06 00:00 / srm
Sulfur, HCl Extractable	ND	%		0.01		Sobek Modifie	08/27/06 00:00 / srm
Sulfur, HNO3 Extractable	0.03	%		0.01		Sobek Modifie	08/27/06 00:00 / srm
Sulfur, Residual	0.09	%		0.01		Sobek Modifie	08/27/06 00:00 / srm
- The acid base potential was calculated from non-sulfate sulfur.							
METALS, WATER EXTRACTABLE							
Selenium	ND	mg/kg		0.01		SW6020	08/23/06 14:42 / car
Boron	ND	mg/kg		0.05		SW6010B	08/23/06 01:51 / rlh
METALS, ABDTPA EXTRACTABLE							
Arsenic	ND	mg/kg		1		SW6020	08/23/06 21:08 / car
Cadmium	ND	mg/kg		0.01		SW6020	08/23/06 21:08 / car
Copper	ND	mg/kg		1		SW6010B	08/22/06 18:53 / rlh
Lead	0.33	mg/kg		0.01		SW6020	08/23/06 21:08 / car
Manganese	0.68	mg/kg		0.01		SW6010B	08/22/06 18:53 / rlh
Mercury	ND	mg/kg		0.05		SW6020	08/23/06 21:08 / car
Molybdenum	0.03	mg/kg		0.01		SW6020	08/23/06 21:08 / car
Nickel	0.06	mg/kg	D	0.03		SW6020	08/23/06 21:08 / car

Report Definitions:	RL - Analyte reporting limit.	MCL - Maximum contaminant level.
	QCL - Quality control limit.	ND - Not detected at the reporting limit.
	D - RL increased due to sample matrix interference.	

LABORATORY ANALYTICAL REPORT

Client:	Golder Associates Inc	**Report Date:**	08/29/06
Project:	Chino-USSP North 013-1594	**Collection Date:**	08/10/06
Lab ID:	B06081524-005	**DateReceived:**	08/17/06
Client Sample ID:	CHUSN06-2, 5-12 ft	**Matrix:**	Soil

Analyses	Result	Units	Qualifiers	RL	MCL/ QCL	Method	Analysis Date / By
PHYSICAL CHARACTERISTICS							
Coarse Fragments	54	wt%		2		ASA15-5	08/23/06 16:51 / srm
Sand	57	%		1		ASA15-5	08/23/06 16:51 / srm
Silt	25	%		1		ASA15-5	08/23/06 16:51 / srm
Clay	18	%		1		ASA15-5	08/23/06 16:51 / srm
Texture	SL					ASA15-5	08/23/06 16:51 / srm
- C = Clay, S = Sand(y), Si = Silt(y), L = Loam(y)							
SATURATED PASTE							
pH, sat. paste	6.90	s.u.		0.10		ASAM10-3.2	08/23/06 16:51 / srm
Conductivity, sat. paste	0.25	mmhos/cm		0.01		ASA10-3	08/24/06 16:40 / srm
Saturation	30.6	%		0.1		USDA27a	08/24/06 16:40 / srm
ACID-BASE ACCOUNTING							
Neutralization Potential	3.5	t/kt		1.0		Sobek Modifie	08/27/06 00:00 / srm
Acid Potential	0	t/kt		1.0		Sobek Modifie	08/27/06 00:00 / srm
Acid/Base Potential	2	t/kt				Sobek Modifie	08/27/06 00:00 / srm
Sulfur, Total	0.04	%		0.01		Sobek Modifie	08/27/06 00:00 / srm
Sulfur, Hot Water Extractable	ND	%		0.01		Sobek Modifie	08/27/06 00:00 / srm
Sulfur, HCl Extractable	ND	%		0.01		Sobek Modifie	08/27/06 00:00 / srm
Sulfur, HNO3 Extractable	ND	%		0.01		Sobek Modifie	08/27/06 00:00 / srm
Sulfur, Residual	0.02	%		0.01		Sobek Modifie	08/27/06 00:00 / srm
- The acid base potential was calculated from non-sulfate sulfur.							
METALS, WATER EXTRACTABLE							
Selenium	ND	mg/kg		0.01		SW6020	08/23/06 14:49 / car
Boron	ND	mg/kg		0.05		SW6010B	08/23/06 01:55 / rlh
METALS, ABDTPA EXTRACTABLE							
Arsenic	ND	mg/kg		1		SW6020	08/23/06 21:16 / car
Cadmium	ND	mg/kg		0.01		SW6020	08/23/06 21:16 / car
Copper	2	mg/kg		1		SW6020	08/23/06 21:16 / car
Lead	0.32	mg/kg		0.01		SW6020	08/23/06 21:16 / car
Manganese	1.62	mg/kg		0.01		SW6010B	08/22/06 18:57 / rlh
Mercury	ND	mg/kg		0.05		SW6020	08/23/06 21:16 / car
Molybdenum	0.05	mg/kg		0.01		SW6020	08/23/06 21:16 / car
Nickel	0.05	mg/kg	D	0.03		SW6020	08/23/06 21:16 / car

Report Definitions:

RL - Analyte reporting limit.
QCL - Quality control limit.
D - RL increased due to sample matrix interference.
MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.

LABORATORY ANALYTICAL REPORT

Client: Golder Associates Inc
Project: Chino-USSP North 013-1594
Lab ID: B06081524-006
Client Sample ID: CHUSN06-2, 2-5 ft

Report Date: 08/29/06
Collection Date: 08/10/06
DateReceived: 08/17/06
Matrix: Soil

Analyses	Result	Units	Qualifiers	RL	MCL/ QCL	Method	Analysis Date / By
PHYSICAL CHARACTERISTICS							
Coarse Fragments	21	wt%		2		ASA15-5	08/23/06 16:51 / srm
Sand	57	%		1		ASA15-5	08/23/06 16:51 / srm
Silt	25	%		1		ASA15-5	08/23/06 16:51 / srm
Clay	18	%		1		ASA15-5	08/23/06 16:51 / srm
Texture	SL					ASA15-5	08/23/06 16:51 / srm
- C = Clay, S = Sand(y), Si = Silt(y), L = Loam(y)							
SATURATED PASTE							
pH, sat. paste	6.40	s.u.		0.10		ASAM10-3.2	08/23/06 16:51 / srm
Conductivity, sat. paste	1.65	mmhos/cm		0.01		ASA10-3	08/24/06 16:40 / srm
Saturation	35.3	%		0.1		USDA27a	08/24/06 16:40 / srm
ACID-BASE ACCOUNTING							
Neutralization Potential	5.2	t/kt		1.0		Sobek Modifie	08/27/06 00:00 / srm
Acid Potential	0	t/kt		1.0		Sobek Modifie	08/27/06 00:00 / srm
Acid/Base Potential	4	t/kt				Sobek Modifie	08/27/06 00:00 / srm
Sulfur, Total	0.03	%		0.01		Sobek Modifie	08/27/06 00:00 / srm
Sulfur, Hot Water Extractable	ND	%		0.01		Sobek Modifie	08/27/06 00:00 / srm
Sulfur, HCl Extractable	ND	%		0.01		Sobek Modifie	08/27/06 00:00 / srm
Sulfur, HNO3 Extractable	0.01	%		0.01		Sobek Modifie	08/27/06 00:00 / srm
Sulfur, Residual	ND	%		0.01		Sobek Modifie	08/27/06 00:00 / srm
- The acid base potential was calculated from non-sulfate sulfur.							
METALS, WATER EXTRACTABLE							
Selenium	ND	mg/kg		0.01		SW6020	08/23/06 14:56 / car
Boron	ND	mg/kg		0.05		SW6010B	08/23/06 01:59 / rlh
METALS, ABDTPA EXTRACTABLE							
Arsenic	ND	mg/kg		1		SW6020	08/23/06 21:23 / car
Cadmium	0.01	mg/kg		0.01		SW6020	08/23/06 21:23 / car
Copper	3	mg/kg		1		SW6010B	08/22/06 19:00 / rlh
Lead	0.57	mg/kg		0.01		SW6020	08/23/06 21:23 / car
Manganese	2.56	mg/kg		0.01		SW6010B	08/22/06 19:00 / rlh
Mercury	ND	mg/kg		0.05		SW6020	08/23/06 21:23 / car
Molybdenum	0.04	mg/kg		0.01		SW6020	08/23/06 21:23 / car
Nickel	0.09	mg/kg	D	0.03		SW6020	08/23/06 21:23 / car

Report Definitions:
RL - Analyte reporting limit.
QCL - Quality control limit.
D - RL increased due to sample matrix interference.
MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.

LABORATORY ANALYTICAL REPORT

Client:	Golder Associates Inc	**Report Date:**	08/29/06
Project:	Chino-USSP North 013-1594	**Collection Date:**	08/10/06
Lab ID:	B06081524-007	**DateReceived:**	08/17/06
Client Sample ID:	CHUSN06-1, 0-2 ft	**Matrix:**	Soil

Analyses	Result	Units	Qualifiers	RL	MCL/ QCL	Method	Analysis Date / By
PHYSICAL CHARACTERISTICS							
Coarse Fragments	37	wt%		2		ASA15-5	08/23/06 16:51 / srm
Sand	45	%		1		ASA15-5	08/23/06 16:51 / srm
Silt	43	%		1		ASA15-5	08/23/06 16:51 / srm
Clay	12	%		1		ASA15-5	08/23/06 16:51 / srm
Texture	L					ASA15-5	08/23/06 16:51 / srm
- C = Clay, S = Sand(y), Si = Silt(y), L = Loam(y)							
SATURATED PASTE							
pH, sat. paste	6.60	s.u.		0.10		ASAM10-3.2	08/23/06 16:51 / srm
Conductivity, sat. paste	1.35	mmhos/cm		0.01		ASA10-3	08/24/06 16:40 / srm
Saturation	27.1	%		0.1		USDA27a	08/24/06 16:40 / srm
ACID-BASE ACCOUNTING							
Neutralization Potential	0	t/kt		1.0		Sobek Modifie	08/27/06 00:00 / srm
Acid Potential	12	t/kt		1.0		Sobek Modifie	08/27/06 00:00 / srm
Acid/Base Potential	-12	t/kt				Sobek Modifie	08/27/06 00:00 / srm
Sulfur, Total	0.41	%		0.01		Sobek Modifie	08/27/06 00:00 / srm
Sulfur, Hot Water Extractable	0.02	%		0.01		Sobek Modifie	08/27/06 00:00 / srm
Sulfur, HCl Extractable	ND	%		0.01		Sobek Modifie	08/27/06 00:00 / srm
Sulfur, HNO3 Extractable	0.01	%		0.01		Sobek Modifie	08/27/06 00:00 / srm
Sulfur, Residual	0.37	%		0.01		Sobek Modifie	08/27/06 00:00 / srm
- The acid base potential was calculated from non-sulfate sulfur.							
METALS, WATER EXTRACTABLE							
Selenium	ND	mg/kg		0.01		SW6020	08/23/06 15:03 / car
Boron	0.07	mg/kg		0.05		SW6010B	08/23/06 02:04 / rlh
METALS, ABDTPA EXTRACTABLE							
Arsenic	ND	mg/kg		1		SW6020	08/23/06 21:30 / car
Cadmium	ND	mg/kg		0.01		SW6020	08/23/06 21:30 / car
Copper	2	mg/kg		1		SW6010B	08/22/06 19:04 / rlh
Lead	0.10	mg/kg	D	0.03		SW6020	08/23/06 21:30 / car
Manganese	1.54	mg/kg		0.01		SW6010B	08/22/06 19:04 / rlh
Mercury	ND	mg/kg		0.05		SW6020	08/23/06 21:30 / car
Molybdenum	0.03	mg/kg		0.01		SW6020	08/23/06 21:30 / car
Nickel	0.07	mg/kg	D	0.03		SW6020	08/23/06 21:30 / car

Report Definitions:

RL - Analyte reporting limit.

QCL - Quality control limit.

D - RL increased due to sample matrix interference.

MCL - Maximum contaminant level.

ND - Not detected at the reporting limit.

LABORATORY ANALYTICAL REPORT

Client:	Golder Associates Inc	**Report Date:**	08/29/06
Project:	Chino-USSP North 013-1594	**Collection Date:**	08/10/06
Lab ID:	B06081524-008	**DateReceived:**	08/17/06
Client Sample ID:	CHUSN06-2, 0-2 ft	**Matrix:**	Soil

Analyses	Result	Units	Qualifiers	RL	MCL/ QCL	Method	Analysis Date / By
PHYSICAL CHARACTERISTICS							
Coarse Fragments	60	wt%		2		ASA15-5	08/23/06 16:51 / srm
Sand	49	%		1		ASA15-5	08/23/06 16:51 / srm
Silt	31	%		1		ASA15-5	08/23/06 16:51 / srm
Clay	20	%		1		ASA15-5	08/23/06 16:51 / srm
Texture	L					ASA15-5	08/23/06 16:51 / srm
- C = Clay, S = Sand(y), Si = Silt(y), L = Loam(y)							
SATURATED PASTE							
pH, sat. paste	6.90	s.u.		0.10		ASAM10-3.2	08/23/06 16:51 / srm
Conductivity, sat. paste	1.61	mmhos/cm		0.01		ASA10-3	08/24/06 16:40 / srm
Saturation	37.5	%		0.1		USDA27a	08/24/06 16:40 / srm
ACID-BASE ACCOUNTING							
Neutralization Potential	7.0	t/kt		1.0		Sobek Modifie	08/27/06 00:00 / srm
Acid Potential	3.7	t/kt		1.0		Sobek Modifie	08/27/06 00:00 / srm
Acid/Base Potential	3	t/kt				Sobek Modifie	08/27/06 00:00 / srm
Sulfur, Total	0.15	%		0.01		Sobek Modifie	08/27/06 00:00 / srm
Sulfur, Hot Water Extractable	0.03	%		0.01		Sobek Modifie	08/27/06 00:00 / srm
Sulfur, HCl Extractable	ND	%		0.01		Sobek Modifie	08/27/06 00:00 / srm
Sulfur, HNO3 Extractable	0.03	%		0.01		Sobek Modifie	08/27/06 00:00 / srm
Sulfur, Residual	0.09	%		0.01		Sobek Modifie	08/27/06 00:00 / srm
- The acid base potential was calculated from non-sulfate sulfur.							
METALS, WATER EXTRACTABLE							
Selenium	ND	mg/kg		0.01		SW6020	08/23/06 15:11 / car
Boron	ND	mg/kg		0.05		SW6010B	08/23/06 02:08 / rlh
METALS, ABDTPA EXTRACTABLE							
Arsenic	ND	mg/kg		1		SW6020	08/23/06 21:37 / car
Cadmium	ND	mg/kg		0.01		SW6020	08/23/06 21:37 / car
Copper	9	mg/kg		1		SW6010B	08/22/06 19:08 / rlh
Lead	0.34	mg/kg		0.01		SW6020	08/23/06 21:37 / car
Manganese	1.74	mg/kg		0.01		SW6010B	08/22/06 19:08 / rlh
Mercury	ND	mg/kg		0.05		SW6020	08/23/06 21:37 / car
Molybdenum	0.05	mg/kg		0.01		SW6020	08/23/06 21:37 / car
Nickel	0.09	mg/kg	D	0.03		SW6020	08/23/06 21:37 / car

Report Definitions:

RL - Analyte reporting limit.

QCL - Quality control limit.

D - RL increased due to sample matrix interference.

MCL - Maximum contaminant level.

ND - Not detected at the reporting limit.

LABORATORY ANALYTICAL REPORT

Client:	Golder Associates Inc	**Report Date:**	08/29/06
Project:	Chino-USSP North 013-1594	**Collection Date:**	08/10/06
Lab ID:	B06081524-009	**DateReceived:**	08/17/06
Client Sample ID:	CHUSN06-1, 2-4 ft	**Matrix:**	Soil

Analyses	Result	Units	Qualifiers	RL	MCL/ QCL	Method	Analysis Date / By
PHYSICAL CHARACTERISTICS							
Coarse Fragments	46	wt%		2		ASA15-5	08/23/06 16:51 / srm
Sand	55	%		1		ASA15-5	08/23/06 16:51 / srm
Silt	27	%		1		ASA15-5	08/23/06 16:51 / srm
Clay	18	%		1		ASA15-5	08/23/06 16:51 / srm
Texture	SL					ASA15-5	08/23/06 16:51 / srm
- C = Clay, S = Sand(y), Si = Silt(y), L = Loam(y)							
SATURATED PASTE							
pH, sat. paste	7.10	s.u.		0.10		ASAM10-3.2	08/23/06 16:51 / srm
Conductivity, sat. paste	1.30	mmhos/cm		0.01		ASA10-3	08/24/06 16:40 / srm
Saturation	35.4	%		0.1		USDA27a	08/24/06 16:40 / srm
ACID-BASE ACCOUNTING							
Neutralization Potential	4.6	t/kt		1.0		Sobek Modifie	08/27/06 00:00 / srm
Acid Potential	0	t/kt		1.0		Sobek Modifie	08/27/06 00:00 / srm
Acid/Base Potential	4	t/kt				Sobek Modifie	08/27/06 00:00 / srm
Sulfur, Total	0.02	%		0.01		Sobek Modifie	08/27/06 00:00 / srm
Sulfur, Hot Water Extractable	ND	%		0.01		Sobek Modifie	08/27/06 00:00 / srm
Sulfur, HCl Extractable	ND	%		0.01		Sobek Modifie	08/27/06 00:00 / srm
Sulfur, HNO3 Extractable	ND	%		0.01		Sobek Modifie	08/27/06 00:00 / srm
Sulfur, Residual	ND	%		0.01		Sobek Modifie	08/27/06 00:00 / srm
- The acid base potential was calculated from non-sulfate sulfur.							
METALS, WATER EXTRACTABLE							
Selenium	ND	mg/kg		0.01		SW6020	08/23/06 15:18 / car
Boron	ND	mg/kg		0.05		SW6010B	08/23/06 02:20 / rlh
METALS, ABDTPA EXTRACTABLE							
Arsenic	ND	mg/kg		1		SW6020	08/23/06 21:44 / car
Cadmium	ND	mg/kg		0.01		SW6020	08/23/06 21:44 / car
Copper	2	mg/kg		1		SW6010B	08/22/06 19:11 / rlh
Lead	1.26	mg/kg		0.01		SW6020	08/23/06 21:44 / car
Manganese	3.02	mg/kg		0.01		SW6010B	08/22/06 19:11 / rlh
Mercury	ND	mg/kg		0.05		SW6020	08/23/06 21:44 / car
Molybdenum	0.07	mg/kg		0.01		SW6020	08/23/06 21:44 / car
Nickel	0.09	mg/kg	D	0.03		SW6020	08/23/06 21:44 / car

Report Definitions:	RL - Analyte reporting limit.	MCL - Maximum contaminant level.
	QCL - Quality control limit.	ND - Not detected at the reporting limit.
	D - RL increased due to sample matrix interference.	

LABORATORY ANALYTICAL REPORT

Client:	Golder Associates Inc	**Report Date:**	08/29/06
Project:	Chino-USSP North 013-1594	**Collection Date:**	08/10/06
Lab ID:	B06081524-010	**DateReceived:**	08/17/06
Client Sample ID:	CHUSN06-1, 4-11.5 ft	**Matrix:**	Soil

Analyses	Result	Units	Qualifiers	RL	MCL/ QCL	Method	Analysis Date / By
PHYSICAL CHARACTERISTICS							
Coarse Fragments	39	wt%		2		ASA15-5	08/23/06 16:51 / srm
Sand	54	%		1		ASA15-5	08/23/06 16:51 / srm
Silt	26	%		1		ASA15-5	08/23/06 16:51 / srm
Clay	20	%		1		ASA15-5	08/23/06 16:51 / srm
Texture	SCL					ASA15-5	08/23/06 16:51 / srm
- C = Clay, S = Sand(y), Si = Silt(y), L = Loam(y)							
SATURATED PASTE							
pH, sat. paste	7.40	s.u.		0.10		ASAM10-3.2	08/23/06 16:51 / srm
Conductivity, sat. paste	1.18	mmhos/cm		0.01		ASA10-3	08/24/06 16:40 / srm
Saturation	38.8	%		0.1		USDA27a	08/24/06 16:40 / srm
ACID-BASE ACCOUNTING							
Neutralization Potential	6.4	t/kt		1.0		Sobek Modifie	08/27/06 00:00 / srm
Acid Potential	0	t/kt		1.0		Sobek Modifie	08/27/06 00:00 / srm
Acid/Base Potential	6	t/kt				Sobek Modifie	08/27/06 00:00 / srm
Sulfur, Total	0.03	%		0.01		Sobek Modifie	08/27/06 00:00 / srm
Sulfur, Hot Water Extractable	ND	%		0.01		Sobek Modifie	08/27/06 00:00 / srm
Sulfur, HCl Extractable	ND	%		0.01		Sobek Modifie	08/27/06 00:00 / srm
Sulfur, HNO3 Extractable	0.01	%		0.01		Sobek Modifie	08/27/06 00:00 / srm
Sulfur, Residual	ND	%		0.01		Sobek Modifie	08/27/06 00:00 / srm
- The acid base potential was calculated from non-sulfate sulfur.							
METALS, WATER EXTRACTABLE							
Selenium	ND	mg/kg		0.01		SW6020	08/23/06 15:25 / car
Boron	0.05	mg/kg		0.05		SW6010B	08/23/06 02:25 / rlh
METALS, ABDTPA EXTRACTABLE							
Arsenic	ND	mg/kg		1		SW6020	08/23/06 21:51 / car
Cadmium	ND	mg/kg		0.01		SW6020	08/23/06 21:51 / car
Copper	2	mg/kg		1		SW6010B	08/22/06 19:15 / rlh
Lead	0.71	mg/kg		0.01		SW6020	08/23/06 21:51 / car
Manganese	1.99	mg/kg		0.01		SW6010B	08/22/06 19:15 / rlh
Mercury	ND	mg/kg		0.05		SW6020	08/23/06 21:51 / car
Molybdenum	0.03	mg/kg		0.01		SW6020	08/23/06 21:51 / car
Nickel	0.08	mg/kg	D	0.03		SW6020	08/23/06 21:51 / car

Report Definitions:

RL - Analyte reporting limit.
QCL - Quality control limit.
D - RL increased due to sample matrix interference.
MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.

LABORATORY ANALYTICAL REPORT

Client: Golder Associates Inc
Project: Chino-USSP North 013-1594
Lab ID: B06081524-011
Client Sample ID: CHUSN06-7, 0.5-10 ft

Report Date: 08/29/06
Collection Date: 08/10/06
DateReceived: 08/17/06
Matrix: Soil

Analyses	Result	Units	Qualifiers	RL	MCL/ QCL	Method	Analysis Date / By
PHYSICAL CHARACTERISTICS							
Coarse Fragments	39	wt%		2		ASA15-5	08/23/06 16:51 / srm
Sand	59	%		1		ASA15-5	08/23/06 16:51 / srm
Silt	26	%		1		ASA15-5	08/23/06 16:51 / srm
Clay	15	%		1		ASA15-5	08/23/06 16:51 / srm
Texture	SL					ASA15-5	08/23/06 16:51 / srm
- C = Clay, S = Sand(y), Si = Silt(y), L = Loam(y)							
SATURATED PASTE							
pH, sat. paste	6.90	s.u.		0.10		ASAM10-3.2	08/23/06 16:51 / srm
Conductivity, sat. paste	1.30	mmhos/cm		0.01		ASA10-3	08/24/06 16:40 / srm
Saturation	31.1	%		0.1		USDA27a	08/24/06 16:40 / srm
ACID-BASE ACCOUNTING							
Neutralization Potential	4.6	t/kt		1.0		Sobek Modifie	08/27/06 00:00 / srm
Acid Potential	0	t/kt		1.0		Sobek Modifie	08/27/06 00:00 / srm
Acid/Base Potential	4	t/kt				Sobek Modifie	08/27/06 00:00 / srm
Sulfur, Total	0.04	%		0.01		Sobek Modifie	08/27/06 00:00 / srm
Sulfur, Hot Water Extractable	0.02	%		0.01		Sobek Modifie	08/27/06 00:00 / srm
Sulfur, HCl Extractable	ND	%		0.01		Sobek Modifie	08/27/06 00:00 / srm
Sulfur, HNO3 Extractable	0.02	%		0.01		Sobek Modifie	08/27/06 00:00 / srm
Sulfur, Residual	ND	%		0.01		Sobek Modifie	08/27/06 00:00 / srm
- The acid base potential was calculated from non-sulfate sulfur.							
METALS, WATER EXTRACTABLE							
Selenium	ND	mg/kg		0.01		SW6020	08/23/06 15:32 / car
Boron	ND	mg/kg		0.05		SW6010B	08/23/06 02:29 / rlh
METALS, ABDTPA EXTRACTABLE							
Arsenic	ND	mg/kg		1		SW6020	08/23/06 22:27 / car
Cadmium	ND	mg/kg		0.01		SW6020	08/23/06 22:27 / car
Copper	5	mg/kg		1		SW6010B	08/22/06 19:18 / rlh
Lead	0.47	mg/kg		0.01		SW6020	08/23/06 22:27 / car
Manganese	2.22	mg/kg		0.01		SW6010B	08/22/06 19:18 / rlh
Mercury	ND	mg/kg		0.05		SW6020	08/23/06 22:27 / car
Molybdenum	0.02	mg/kg		0.01		SW6020	08/23/06 22:27 / car
Nickel	0.07	mg/kg	D	0.03		SW6020	08/23/06 22:27 / car

Report Definitions:
RL - Analyte reporting limit.
QCL - Quality control limit.
D - RL increased due to sample matrix interference.
MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.

LABORATORY ANALYTICAL REPORT

Client:	Golder Associates Inc	**Report Date:**	08/29/06
Project:	Chino-USSP North 013-1594	**Collection Date:**	08/10/06
Lab ID:	B06081524-012	**DateReceived:**	08/17/06
Client Sample ID:	CHUSN06-8, 0-5 ft	**Matrix:**	Soil

Analyses	Result	Units	Qualifiers	RL	MCL/ QCL	Method	Analysis Date / By
PHYSICAL CHARACTERISTICS							
Coarse Fragments	49	wt%		2		ASA15-5	08/23/06 16:51 / srm
Sand	55	%		1		ASA15-5	08/23/06 16:51 / srm
Silt	29	%		1		ASA15-5	08/23/06 16:51 / srm
Clay	16	%		1		ASA15-5	08/23/06 16:51 / srm
Texture	SL					ASA15-5	08/23/06 16:51 / srm
- C = Clay, S = Sand(y), Si = Silt(y), L = Loam(y)							
SATURATED PASTE							
pH, sat. paste	6.30	s.u.		0.10		ASAM10-3.2	08/23/06 16:51 / srm
Conductivity, sat. paste	1.70	mmhos/cm		0.01		ASA10-3	08/24/06 16:40 / srm
Saturation	29.7	%		0.1		USDA27a	08/24/06 16:40 / srm
ACID-BASE ACCOUNTING							
Neutralization Potential	4.1	t/kt		1.0		Sobek Modifie	08/27/06 00:00 / srm
Acid Potential	4.8	t/kt		1.0		Sobek Modifie	08/27/06 00:00 / srm
Acid/Base Potential	0	t/kt				Sobek Modifie	08/27/06 00:00 / srm
Sulfur, Total	0.18	%		0.01		Sobek Modifie	08/27/06 00:00 / srm
Sulfur, Hot Water Extractable	0.02	%		0.01		Sobek Modifie	08/27/06 00:00 / srm
Sulfur, HCl Extractable	ND	%		0.01		Sobek Modifie	08/27/06 00:00 / srm
Sulfur, HNO3 Extractable	0.10	%		0.01		Sobek Modifie	08/27/06 00:00 / srm
Sulfur, Residual	0.05	%		0.01		Sobek Modifie	08/27/06 00:00 / srm
- The acid base potential was calculated from non-sulfate sulfur.							
METALS, WATER EXTRACTABLE							
Selenium	ND	mg/kg		0.01		SW6020	08/23/06 16:15 / car
Boron	ND	mg/kg		0.05		SW6010B	08/23/06 02:38 / rlh
METALS, ABDTPA EXTRACTABLE							
Arsenic	ND	mg/kg		1		SW6020	08/23/06 22:42 / car
Cadmium	ND	mg/kg		0.01		SW6020	08/23/06 22:42 / car
Copper	49	mg/kg		1		SW6010B	08/22/06 19:33 / rlh
Lead	0.23	mg/kg	D	0.03		SW6020	08/23/06 22:42 / car
Manganese	2.32	mg/kg		0.01		SW6010B	08/22/06 19:33 / rlh
Mercury	ND	mg/kg		0.05		SW6020	08/23/06 22:42 / car
Molybdenum	0.05	mg/kg		0.01		SW6020	08/23/06 22:42 / car
Nickel	0.09	mg/kg	D	0.03		SW6020	08/23/06 22:42 / car

Report Definitions:

RL - Analyte reporting limit.

QCL - Quality control limit.

D - RL increased due to sample matrix interference.

MCL - Maximum contaminant level.

ND - Not detected at the reporting limit.

LABORATORY ANALYTICAL REPORT

Client:	Golder Associates Inc	**Report Date:**	08/29/06
Project:	Chino-USSP North 013-1594	**Collection Date:**	08/10/06
Lab ID:	B06081524-013	**DateReceived:**	08/17/06
Client Sample ID:	CHUSN06-8, 5-12 ft	**Matrix:**	Soil

Analyses	Result	Units	Qualifiers	RL	MCL/ QCL	Method	Analysis Date / By
PHYSICAL CHARACTERISTICS							
Coarse Fragments	23	wt%		2		ASA15-5	08/23/06 16:51 / srm
Sand	59	%		1		ASA15-5	08/23/06 16:51 / srm
Silt	23	%		1		ASA15-5	08/23/06 16:51 / srm
Clay	18	%		1		ASA15-5	08/23/06 16:51 / srm
Texture	SL					ASA15-5	08/23/06 16:51 / srm
- C = Clay, S = Sand(y), Si = Silt(y), L = Loam(y)							
SATURATED PASTE							
pH, sat. paste	6.90	s.u.		0.10		ASAM10-3.2	08/23/06 16:51 / srm
Conductivity, sat. paste	0.88	mmhos/cm		0.01		ASA10-3	08/24/06 16:40 / srm
Saturation	35.4	%		0.1		USDA27a	08/24/06 16:40 / srm
ACID-BASE ACCOUNTING							
Neutralization Potential	7.0	t/kt		1.0		Sobek Modifie	08/27/06 00:00 / srm
Acid Potential	1.6	t/kt		1.0		Sobek Modifie	08/27/06 00:00 / srm
Acid/Base Potential	5	t/kt				Sobek Modifie	08/27/06 00:00 / srm
Sulfur, Total	0.06	%		0.01		Sobek Modifie	08/27/06 00:00 / srm
Sulfur, Hot Water Extractable	0.01	%		0.01		Sobek Modifie	08/27/06 00:00 / srm
Sulfur, HCl Extractable	ND	%		0.01		Sobek Modifie	08/27/06 00:00 / srm
Sulfur, HNO3 Extractable	0.03	%		0.01		Sobek Modifie	08/27/06 00:00 / srm
Sulfur, Residual	0.02	%		0.01		Sobek Modifie	08/27/06 00:00 / srm
- The acid base potential was calculated from non-sulfate sulfur.							
METALS, WATER EXTRACTABLE							
Selenium	ND	mg/kg		0.01		SW6020	08/23/06 16:43 / car
Boron	ND	mg/kg		0.05		SW6010B	08/23/06 02:46 / rlh
METALS, ABDTPA EXTRACTABLE							
Arsenic	ND	mg/kg		1		SW6020	08/23/06 23:11 / car
Cadmium	ND	mg/kg		0.01		SW6020	08/23/06 23:11 / car
Copper	16	mg/kg		1		SW6010B	08/22/06 19:40 / rlh
Lead	0.25	mg/kg	D	0.03		SW6020	08/23/06 23:11 / car
Manganese	0.85	mg/kg		0.01		SW6010B	08/22/06 19:40 / rlh
Mercury	ND	mg/kg		0.05		SW6020	08/23/06 23:11 / car
Molybdenum	0.02	mg/kg		0.01		SW6020	08/23/06 23:11 / car
Nickel	0.06	mg/kg	D	0.03		SW6020	08/23/06 23:11 / car

Report Definitions:

RL - Analyte reporting limit.
QCL - Quality control limit.
D - RL increased due to sample matrix interference.

MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.

LABORATORY ANALYTICAL REPORT

Client:	Golder Associates Inc	**Report Date:**	08/29/06
Project:	Chino-USSP North 013-1594	**Collection Date:**	08/10/06
Lab ID:	B06081524-014	**DateReceived:**	08/17/06
Client Sample ID:	CHUSN06-6, 0-4.5 ft	**Matrix:**	Soil

Analyses	Result	Units	Qualifiers	RL	MCL/ QCL	Method	Analysis Date / By
PHYSICAL CHARACTERISTICS							
Coarse Fragments	76	wt%		2		ASA15-5	08/23/06 16:51 / srm
Sand	57	%		1		ASA15-5	08/23/06 16:51 / srm
Silt	29	%		1		ASA15-5	08/23/06 16:51 / srm
Clay	14	%		1		ASA15-5	08/23/06 16:51 / srm
Texture	SL					ASA15-5	08/23/06 16:51 / srm
- C = Clay, S = Sand(y), Si = Silt(y), L = Loam(y)							
SATURATED PASTE							
pH, sat. paste	6.50	s.u.		0.10		ASAM10-3.2	08/23/06 16:51 / srm
Conductivity, sat. paste	0.30	mmhos/cm		0.01		ASA10-3	08/24/06 16:40 / srm
Saturation	26.5	%		0.1		USDA27a	08/24/06 16:40 / srm
ACID-BASE ACCOUNTING							
Neutralization Potential	1.2	t/kt		1.0		Sobek Modifie	08/27/06 00:00 / srm
Acid Potential	13	t/kt		1.0		Sobek Modifie	08/27/06 00:00 / srm
Acid/Base Potential	-11	t/kt				Sobek Modifie	08/27/06 00:00 / srm
Sulfur, Total	0.48	%		0.01		Sobek Modifie	08/27/06 00:00 / srm
Sulfur, Hot Water Extractable	0.07	%		0.01		Sobek Modifie	08/27/06 00:00 / srm
Sulfur, HCl Extractable	ND	%		0.01		Sobek Modifie	08/27/06 00:00 / srm
Sulfur, HNO3 Extractable	ND	%		0.01		Sobek Modifie	08/27/06 00:00 / srm
Sulfur, Residual	0.40	%		0.01		Sobek Modifie	08/27/06 00:00 / srm
- The acid base potential was calculated from non-sulfate sulfur.							
METALS, WATER EXTRACTABLE							
Selenium	ND	mg/kg		0.01		SW6020	08/23/06 16:51 / car
Boron	0.08	mg/kg		0.05		SW6010B	08/23/06 02:50 / rlh
METALS, ABDTPA EXTRACTABLE							
Arsenic	ND	mg/kg		1		SW6020	08/23/06 23:18 / car
Cadmium	ND	mg/kg		0.01		SW6020	08/23/06 23:18 / car
Copper	ND	mg/kg		1		SW6010B	08/22/06 19:43 / rlh
Lead	0.14	mg/kg	D	0.03		SW6020	08/23/06 23:18 / car
Manganese	0.64	mg/kg		0.01		SW6010B	08/22/06 19:43 / rlh
Mercury	ND	mg/kg		0.05		SW6020	08/23/06 23:18 / car
Molybdenum	0.03	mg/kg		0.01		SW6020	08/23/06 23:18 / car
Nickel	0.05	mg/kg	D	0.03		SW6020	08/23/06 23:18 / car

Report Definitions:

RL - Analyte reporting limit.

QCL - Quality control limit.

D - RL increased due to sample matrix interference.

MCL - Maximum contaminant level.

ND - Not detected at the reporting limit.

LABORATORY ANALYTICAL REPORT

Client:	Golder Associates Inc	**Report Date:**	08/29/06
Project:	Chino-USSP North 013-1594	**Collection Date:**	08/10/06
Lab ID:	B06081524-015	**DateReceived:**	08/17/06
Client Sample ID:	CHUSN06-6, 4.5-12 ft	**Matrix:**	Soil

Analyses	Result	Units	Qualifiers	RL	MCL/ QCL	Method	Analysis Date / By
PHYSICAL CHARACTERISTICS							
Coarse Fragments	59	wt%		2		ASA15-5	08/23/06 16:51 / srm
Sand	59	%		1		ASA15-5	08/23/06 16:51 / srm
Silt	29	%		1		ASA15-5	08/23/06 16:51 / srm
Clay	12	%		1		ASA15-5	08/23/06 16:51 / srm
Texture	SL					ASA15-5	08/23/06 16:51 / srm
- C = Clay, S = Sand(y), Si = Silt(y), L = Loam(y)							
SATURATED PASTE							
pH, sat. paste	6.70	s.u.		0.10		ASAM10-3.2	08/23/06 16:51 / srm
Conductivity, sat. paste	0.32	mmhos/cm		0.01		ASA10-3	08/24/06 16:40 / srm
Saturation	25.0	%		0.1		USDA27a	08/24/06 16:40 / srm
ACID-BASE ACCOUNTING							
Neutralization Potential	4.6	t/kt		1.0		Sobek Modifie	08/27/06 00:00 / srm
Acid Potential	10	t/kt		1.0		Sobek Modifie	08/27/06 00:00 / srm
Acid/Base Potential	-6	t/kt				Sobek Modifie	08/27/06 00:00 / srm
Sulfur, Total	0.41	%		0.01		Sobek Modifie	08/27/06 00:00 / srm
Sulfur, Hot Water Extractable	0.08	%		0.01		Sobek Modifie	08/27/06 00:00 / srm
Sulfur, HCl Extractable	ND	%		0.01		Sobek Modifie	08/27/06 00:00 / srm
Sulfur, HNO3 Extractable	0.16	%		0.01		Sobek Modifie	08/27/06 00:00 / srm
Sulfur, Residual	0.17	%		0.01		Sobek Modifie	08/27/06 00:00 / srm
- The acid base potential was calculated from non-sulfate sulfur.							
METALS, WATER EXTRACTABLE							
Selenium	ND	mg/kg		0.01		SW6020	08/23/06 16:58 / car
Boron	ND	mg/kg		0.05		SW6010B	08/23/06 02:55 / rlh
METALS, ABDTPA EXTRACTABLE							
Arsenic	ND	mg/kg		1		SW6020	08/23/06 23:25 / car
Cadmium	ND	mg/kg		0.01		SW6020	08/23/06 23:25 / car
Copper	ND	mg/kg		1		SW6010B	08/22/06 19:47 / rlh
Lead	2.88	mg/kg		0.01		SW6020	08/23/06 23:25 / car
Manganese	0.46	mg/kg		0.01		SW6010B	08/22/06 19:47 / rlh
Mercury	ND	mg/kg		0.05		SW6020	08/23/06 23:25 / car
Molybdenum	0.10	mg/kg		0.01		SW6020	08/23/06 23:25 / car
Nickel	0.12	mg/kg	D	0.03		SW6020	08/23/06 23:25 / car

Report Definitions:

RL - Analyte reporting limit.

QCL - Quality control limit.

D - RL increased due to sample matrix interference.

MCL - Maximum contaminant level.

ND - Not detected at the reporting limit.

LABORATORY ANALYTICAL REPORT

Client:	Golder Associates Inc	**Report Date:**	08/29/06
Project:	Chino-USSP North 013-1594	**Collection Date:**	08/10/06
Lab ID:	B06081524-016	**DateReceived:**	08/17/06
Client Sample ID:	CHUSN06-5, 3.5-12 ft	**Matrix:**	Soil

Analyses	Result	Units	Qualifiers	RL	MCL/ QCL	Method	Analysis Date / By
PHYSICAL CHARACTERISTICS							
Coarse Fragments	52	wt%		2		ASA15-5	08/23/06 16:51 / srm
Sand	62	%		1		ASA15-5	08/23/06 16:51 / srm
Silt	22	%		1		ASA15-5	08/23/06 16:51 / srm
Clay	16	%		1		ASA15-5	08/23/06 16:51 / srm
Texture	SL					ASA15-5	08/23/06 16:51 / srm
- C = Clay, S = Sand(y), Si = Silt(y), L = Loam(y)							
SATURATED PASTE							
pH, sat. paste	6.90	s.u.		0.10		ASAM10-3.2	08/23/06 16:51 / srm
Conductivity, sat. paste	0.57	mmhos/cm		0.01		ASA10-3	08/24/06 16:40 / srm
Saturation	29.4	%		0.1		USDA27a	08/24/06 16:40 / srm
ACID-BASE ACCOUNTING							
Neutralization Potential	6.4	t/kt		1.0		Sobek Modifie	08/27/06 00:00 / srm
Acid Potential	1.8	t/kt		1.0		Sobek Modifie	08/27/06 00:00 / srm
Acid/Base Potential	5	t/kt				Sobek Modifie	08/27/06 00:00 / srm
Sulfur, Total	0.07	%		0.01		Sobek Modifie	08/27/06 00:00 / srm
Sulfur, Hot Water Extractable	0.02	%		0.01		Sobek Modifie	08/27/06 00:00 / srm
Sulfur, HCl Extractable	ND	%		0.01		Sobek Modifie	08/27/06 00:00 / srm
Sulfur, HNO3 Extractable	0.01	%		0.01		Sobek Modifie	08/27/06 00:00 / srm
Sulfur, Residual	0.04	%		0.01		Sobek Modifie	08/27/06 00:00 / srm
- The acid base potential was calculated from non-sulfate sulfur.							
METALS, WATER EXTRACTABLE							
Selenium	ND	mg/kg		0.01		SW6020	08/23/06 17:05 / car
Boron	ND	mg/kg		0.05		SW6010B	08/23/06 02:59 / rlh
METALS, ABDTPA EXTRACTABLE							
Arsenic	ND	mg/kg		1		SW6020	08/24/06 00:01 / car
Cadmium	ND	mg/kg		0.01		SW6020	08/24/06 00:01 / car
Copper	9	mg/kg		1		SW6010B	08/22/06 19:50 / rlh
Lead	0.19	mg/kg	D	0.03		SW6020	08/24/06 00:01 / car
Manganese	0.88	mg/kg		0.01		SW6010B	08/22/06 19:50 / rlh
Mercury	ND	mg/kg		0.05		SW6020	08/24/06 00:01 / car
Molybdenum	0.03	mg/kg		0.01		SW6020	08/24/06 00:01 / car
Nickel	0.05	mg/kg	D	0.03		SW6020	08/24/06 00:01 / car

Report Definitions:
RL - Analyte reporting limit.
QCL - Quality control limit.
D - RL increased due to sample matrix interference.
MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.

LABORATORY ANALYTICAL REPORT

Client:	Golder Associates Inc	**Report Date:**	08/29/06
Project:	Chino-USSP North 013-1594	**Collection Date:**	08/10/06
Lab ID:	B06081524-017	**DateReceived:**	08/17/06
Client Sample ID:	CHUSN06-5, 0-3.5 ft	**Matrix:**	Soil

Analyses	Result	Units	Qualifiers	RL	MCL/ QCL	Method	Analysis Date / By
PHYSICAL CHARACTERISTICS							
Coarse Fragments	70	wt%		2		ASA15-5	08/23/06 16:51 / srm
Sand	60	%		1		ASA15-5	08/23/06 16:51 / srm
Silt	30	%		1		ASA15-5	08/23/06 16:51 / srm
Clay	10	%		1		ASA15-5	08/23/06 16:51 / srm
Texture	SL					ASA15-5	08/23/06 16:51 / srm
- C = Clay, S = Sand(y), Si = Silt(y), L = Loam(y)							
SATURATED PASTE							
pH, sat. paste	6.30	s.u.		0.10		ASAM10-3.2	08/23/06 16:51 / srm
Conductivity, sat. paste	0.79	mmhos/cm		0.01		ASA10-3	08/24/06 16:40 / srm
Saturation	25.7	%		0.1		USDA27a	08/24/06 16:40 / srm
ACID-BASE ACCOUNTING							
Neutralization Potential	1.2	t/kt		1.0		Sobek Modifie	08/27/06 00:00 / srm
Acid Potential	8.4	t/kt		1.0		Sobek Modifie	08/27/06 00:00 / srm
Acid/Base Potential	-7	t/kt				Sobek Modifie	08/27/06 00:00 / srm
Sulfur, Total	0.33	%		0.01		Sobek Modifie	08/27/06 00:00 / srm
Sulfur, Hot Water Extractable	0.06	%		0.01		Sobek Modifie	08/27/06 00:00 / srm
Sulfur, HCl Extractable	ND	%		0.01		Sobek Modifie	08/27/06 00:00 / srm
Sulfur, HNO3 Extractable	ND	%		0.01		Sobek Modifie	08/27/06 00:00 / srm
Sulfur, Residual	0.26	%		0.01		Sobek Modifie	08/27/06 00:00 / srm
- The acid base potential was calculated from non-sulfate sulfur.							
METALS, WATER EXTRACTABLE							
Selenium	ND	mg/kg		0.01		SW6020	08/23/06 17:12 / car
Boron	0.06	mg/kg		0.05		SW6010B	08/23/06 03:11 / rlh
METALS, ABDTPA EXTRACTABLE							
Arsenic	ND	mg/kg		1		SW6020	08/24/06 00:08 / car
Cadmium	ND	mg/kg		0.01		SW6020	08/24/06 00:08 / car
Copper	ND	mg/kg		1		SW6010B	08/22/06 19:54 / rlh
Lead	0.10	mg/kg	D	0.03		SW6020	08/24/06 00:08 / car
Manganese	0.57	mg/kg		0.01		SW6010B	08/22/06 19:54 / rlh
Mercury	ND	mg/kg		0.05		SW6020	08/24/06 00:08 / car
Molybdenum	0.04	mg/kg		0.01		SW6020	08/24/06 00:08 / car
Nickel	0.07	mg/kg	D	0.03		SW6020	08/24/06 00:08 / car

Report Definitions:

RL - Analyte reporting limit.

QCL - Quality control limit.

D - RL increased due to sample matrix interference.

MCL - Maximum contaminant level.

ND - Not detected at the reporting limit.

TECHNICAL MEMORANDUM

TO: Ned Hall - Chino Mines Company July 7, 2000

FR: Michael Klisch, Rens Verburg - Golder Associates

RE: RUSTLER CANYON WASTE ROCK CHARACTERIZATION 993-1658.002

INTRODUCTION

This technical memorandum describes the results of static and kinetic testing conducted on five samples of Tertiary volcanic rocks that may be placed in proposed waste rock stockpiles in Rustler Canyon. The testing was performed to evaluate the long-term environmental stability of these rock types, in particular their long-term leaching characteristics.

One sample from the Sugarlump Tuff and four samples of the Kneeling Nun Tuff were tested. The following testing was performed on each individual sample: acid-base accounting, paste pH, mineralogical analysis by X-ray diffraction (XRD), and major and trace element analysis by X-ray fluorescence (XRF). Long-term humidity cell testing was conducted on the Sugarlump Tuff sample and two composite Kneeling Nun Tuff samples. Sample selection and testing procedures were similar to those used in earlier waste rock characterization efforts at Chino, and are described in more detail in Golder (1998). Attachment C also contains a description of the test procedures.

SAMPLE DESCRIPTION AND SELECTION

The Sugarlump Tuff and Kneeling Nun Tuff postdate the ore mineralization at Chino. Detailed descriptions of these units are included in a geologic report of the Santa Rita Quadrangle (Jones et al., 1967) and the units have recently been mapped in detail by Chino Geological Services technical staff. The Sugarlump Tuff is a poorly consolidated gravel, sand, and pumiceous tuff. The thickness of the Sugarlump Tuff varies from about 0 to 500 feet due to deposition over an irregular, eroded land surface, and it typically forms slopes. The Kneeling Nun Tuff is a massive welded to weakly consolidated rhyolite tuff. The Kneeling Nun Tuff overlies the Sugarlump Tuff. The Kneeling Nun Tuff is about 200 to 600 feet thick south of the Chino Mine, which is easily identified because of its cliff-forming habits. Recent mapping by Chino identified four members of the Kneeling Nun Tuff based on its composition (crystal vs. lithic fragments) and degree of welding.

Samples were selected for testing by Chino Geological Services staff. One sample was selected from the Sugarlump Tuff (sample 10622) and four samples were selected from the Kneeling Nun Tuff (samples 10623 through 10626), with one sample collected from

TABLE 5

Standard Parameters - Kneeling Nun Tuff Composite A

Week	pH	Conductivity	Acidity	Alkalinity	Sulfate	Iron	Calcium	Cumulative Acidity	Cumulative Alkalinity	Cumulative Sulfate	Cumulative Iron	Cumulative Calcium
	pH units	umhos/cm	mg/L as $CaCO_3$	mg/L as $CaCO_3$	mg/L	mg/L	mg/L	g as $CaCO_3$	g as $CaCO_3$	g	mg	g
0	6.96	54	<5	10	10	0.2	2.08	0.00	0.0	0.030	0.600	0.006
1	7.02	36	<5	8	<10	<0.05	1.44	0.00	0.1	0.030	0.600	0.011
2	7.17	20	<5	5	<10	0.06	1.12	0.00	0.1	0.030	0.783	0.015
3	7.06	16	<5	8	<10	0.05	0.8	0.00	0.1	0.030	0.943	0.017
4	7.25	16	<5	8	<10	0.08	0.64	0.00	0.1	0.030	1.210	0.019
5	7.14	11	<5	6	<10	<0.05	1.12	0.00	0.1	0.030	1.210	0.023
6	7.34	14	<5	7	<10	<0.05	1.12	0.00	0.2	0.030	1.210	0.026
7	7.33	11	<5	8	<10	<0.05	0.96	0.00	0.2	0.030	1.210	0.029
8	6.8	10	<5	6	<10	<0.05	0.48	0.00	0.2	0.030	1.210	0.031
9	6.93	11	<5	6	<10	<0.05	0.48	0.00	0.2	0.030	1.210	0.032
10	7.47	10	<5	7	<10	<0.05	0.8	0.00	0.2	0.030	1.210	0.034
11	6.77	16	<5	8	<10	<0.05	1.28	0.00	0.3	0.030	1.210	0.039
12	6.71	11	<5	6	<10	<0.05	0.64	0.00	0.3	0.030	1.210	0.041
13	6.69	9	<5	6	<10	<0.05	0.8	0.00	0.3	0.030	1.210	0.044
14	6.59	9	<5	<5	<10	<0.05	0.96	0.00	0.3	0.030	1.210	0.047
15	6.61	9	<5	6	<10	<0.05	0.8	0.00	0.3	0.030	1.210	0.049
16	6.92	8	<5	6	<10	<0.05	0.8	0.00	0.4	0.030	1.210	0.052
17	6.93	9	<5	<5	<10	<0.05	0.8	0.00	0.4	0.030	1.210	0.054
18	6.95	8	<5	6	<10	<0.05	0.8	0.00	0.4	0.030	1.210	0.057
19	6.58	7	<5	<5	<10	<0.05	0.48	0.00	0.4	0.030	1.210	0.058
20	6.86	7	<5	6	<10	<0.05	0.64	0.00	0.4	0.030	1.210	0.060

TABLE 6

Standard Parameters - Kneeling Nun Tuff Composite B

Week	pH	Conductivity	Acidity	Alkalinity	Sulfate	Iron	Calcium	Cumulative Acidity	Cumulative Alkalinity	Cumulative Sulfate	Cumulative Iron	Cumulative Calcium
	pH units	umhos/cm	mg/L as $CaCO_3$	mg/L as $CaCO_3$	mg/L	mg/L	mg/L	g as $CaCO_3$	g as $CaCO_3$	g	mg	g
0	6.71	49	<5	8	<10	<0.05	2.08	0.0	0.025	0.000	0.0	0.006
1	7.19	32	<5	8	<10	<0.05	1.76	0.0	0.053	0.000	0.0	0.013
2	7.19	19	<5	7	<10	<0.05	1.12	0.0	0.076	0.000	0.0	0.016
3	7.04	19	<5	8	<10	<0.05	0.8	0.0	0.104	0.000	0.0	0.019
4	7.18	14	<5	8	<10	<0.05	0.64	0.0	0.131	0.000	0.0	0.021
5	7.17	12	<5	6	<10	<0.05	0.96	0.0	0.151	0.000	0.0	0.025
6	7.19	10	<5	6	<10	<0.05	1.28	0.0	0.172	0.000	0.0	0.029
7	7.28	10	<5	8	<10	<0.05	0.48	0.0	0.198	0.000	0.0	0.030
8	7.12	10	<5	6	<10	<0.05	0.64	0.0	0.218	0.000	0.0	0.033
9	6.96	9	<5	7	<10	<0.05	0.32	0.0	0.242	0.000	0.0	0.034
10	7.24	8	<5	6	<10	<0.05	0.8	0.0	0.261	0.000	0.0	0.036
11	7.07	10	<5	6	<10	<0.05	0.96	0.0	0.282	0.000	0.0	0.040
12	6.8	8	<5	<5	<10	<0.05	0.64	0.0	0.282	0.000	0.0	0.042
13	6.36	7	<5	<5	<10	<0.05	0.64	0.0	0.282	0.000	0.0	0.044
14	6.58	7	<5	<5	<10	<0.05	0.96	0.0	0.282	0.000	0.0	0.047
15	6.77	7	<5	6	<10	<0.05	0.8	0.0	0.302	0.000	0.0	0.050
16	6.59	7	<5	<5	<10	<0.05	0.64	0.0	0.302	0.000	0.0	0.052
17	6.92	6	<5	6	<10	<0.05	0.96	0.0	0.323	0.000	0.0	0.055
18	6.74	6	<5	<5	<10	<0.05	0.8	0.0	0.323	0.000	0.0	0.058
19	6.77	5	<5	<5	<10	<0.05	0.48	0.0	0.323	0.000	0.0	0.059
20	6.59	6	<5	<5	<10	<0.05	0.48	0.0	0.323	0.000	0.0	0.061

TABLE 8

Comprehensive Metals Results - Kneeling Nun Tuff Composite A

PARAMETER	UNITS	WEEK 0	WEEK 1	WEEK 5	WEEK 10	WEEK 20
pH	pH units	6.96	7.02	7.14	7.47	6.86
Conductivity	umhos/cm	54	36	11	10	7
Total Acidity	mg/L as CaCO3	<5	<5	<5	<5	<5
Total Alkalinity	mg/L as CaCO3	10	8	6	7	6
Bicarbonate	mg/L	12	10	7	9	7
Carbonate	mg/L	<5	<5	<5	<5	<5
Hydroxide	mg/L	<5	<5	<5	<5	<5
Chloride	mg/L	2.6	2.0	0.5	0.7	0.7
Sulfate	mg/L	10	<10	<10	<10	<10
Fluoride (F)	mg/L	0.2	0.2	0.2	0.1	<0.1
Calcium (Ca)	mg/L	2.1	1.4	1.1	0.8	0.6
Magnesium (Mg)	mg/L	0.8	0.4	0.1	0.6	0.1
Sodium (Na)	mg/L	6.0	5.0	1.9	1.7	1.0
Potassium (K)	mg/L	0.8	0.6	0.5	0.6	<0.3
Aluminum (Al)	mg/L	0.40	0.20	0.10	3.68	0.42
Antimony (Sb)	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01
Arsenic (As)	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01
Barium (Ba)	mg/L	0.015	0.008	0.001	0.006	0.002
Beryllium (Be)	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001
Boron (B)	mg/L	0.04	0.04	0.02	0.01	0.01
Cadmium (Cd)	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001
Chromium (Cr)	mg/L	<0.005	<0.005	<0.005	<0.005	<0.005
Cobalt (Co)	mg/L	<0.005	<0.005	<0.005	<0.005	<0.005
Copper (Cu)	mg/L	0.080	0.014	<0.005	<0.005	<0.005
Iron (Fe)	mg/L	0.20	<0.05	<0.05	<0.05	<0.05
Lead (Pb)	mg/L	<0.003	<0.003	<0.003	<0.003	<0.003
Manganese (Mn)	mg/L	0.024	0.010	0.003	0.009	0.002
Mercury (Hg)	mg/L	<0.0002	0.0003	<0.0002	<0.0002	<0.0002
Molybdenum (Mo)	mg/L	<0.005	<0.005	<0.005	<0.005	0.007
Nickel (Ni)	mg/L	<0.005	<0.005	<0.005	<0.005	<0.005
Selenium (Se)	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01
Silica (SiO2)	mg/L	6.97	13.2	11.8	28.1	12.4
Silver (Ag)	mg/L	<0.005	<0.005	<0.005	<0.005	<0.005
Thallium (Tl)	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01
Vanadium (V)	mg/L	<0.005	<0.005	<0.005	<0.005	<0.005
Zinc (Zn)	mg/L	<0.005	0.008	<0.005	0.005	0.005

TABLE 9

Comprehensive Metals Results - Kneeling Nun Tuff Composite B

PARAMETER	UNITS	WEEK 0	WEEK 1	WEEK 5	WEEK 10	WEEK 20
pH	pH units	6.71	7.19	7.17	7.24	6.59
Conductivity	umhos/cm	49	32	12	8	6
Total Acidity	mg/L as CaCO3	<5	<5	<5	<5	<5
Total Alkalinity	mg/L as CaCO3	8	8	6	6	<5
Bicarbonate	mg/L	10	10	7	7	6
Carbonate	mg/L	<5	<5	<5	<5	<5
Hydroxide	mg/L	<5	<5	<5	<5	<5
Chloride	mg/L	1.7	1.1	<0.5	0.5	<0.5
Sulfate	mg/L	<10	<10	<10	<10	<10
Fluoride (F)	mg/L	0.1	0.2	0.1	<0.1	<0.1
Calcium (Ca)	mg/L	2.1	1.8	0.9	0.8	0.5
Magnesium (Mg)	mg/L	0.8	0.4	0.1	0.2	0.1
Sodium (Na)	mg/L	4.90	4.30	1.60	1.20	0.90
Potassium (K)	mg/L	1.2	<0.3	<0.3	0.4000	<0.3
Aluminum (Al)	mg/L	2.02	0.14	0.170	0.690	0.360
Antimony (Sb)	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01
Arsenic (As)	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01
Barium (Ba)	mg/L	0.01	0.012	0.001	0.002	0.002
Beryllium (Be)	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001
Boron (B)	mg/L	0.030	0.04	0.01	<0.01	<0.01
Cadmium (Cd)	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001
Chromium (Cr)	mg/L	<0.005	<0.005	<0.005	<0.005	<0.005
Cobalt (Co)	mg/L	<0.005	<0.005	<0.005	<0.005	<0.005
Copper (Cu)	mg/L	0.021	<0.005	<0.005	<0.005	<0.005
Iron (Fe)	mg/L	<0.05	<0.05	<0.05	<0.05	<0.05
Lead (Pb)	mg/L	<0.003	<0.003	<0.003	<0.003	<0.003
Manganese (Mn)	mg/L	0.021	0.008	0.003	0.004	0.003
Mercury (Hg)	mg/L	<0.0002	0.0003	<0.0002	<0.0002	<0.0002
Molybdenum (Mo)	mg/L	<0.005	<0.005	<0.005	<0.005	<0.005
Nickel (Ni)	mg/L	<0.005	0.006	<0.005	<0.005	<0.005
Selenium (Se)	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01
Silica (SiO2)	mg/L	12.6	11	7.18	9.96	8.27
Silver (Ag)	mg/L	<0.005	<0.005	<0.005	<0.005	<0.005
Thallium (Tl)	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01
Vanadium (V)	mg/L	<0.005	<0.005	<0.005	<0.005	<0.005
Zinc (Zn)	mg/L	0.012	<0.005	<0.005	<0.005	0.027

ANALYTICAL SUMMARY REPORT

October 18, 2016

Chino Mine Company
PO Box 10
Bayard, NM 88023

Work Order: B16100228

Project Name: STS1U Rock pH

Energy Laboratories Inc Billings MT received the following 5 samples for Chino Mine Company on 10/4/2016 for analysis.

Lab ID	Client Sample ID	Collect Date	Receive Date	Matrix	Test
B16100228-001	LB Draw E #1	06/29/16 9:21	10/04/16	Solid	Metals by ICP/ICPMS, Total or Soluble pH, Saturated Paste Digestion, Total Metals Saturated Paste Extraction
B16100228-002	LB Draw E #2	06/29/16 9:36	10/04/16	Solid	Same As Above
B16100228-003	LB Draw E #3	06/29/16 10:16	10/04/16	Solid	Same As Above
B16100228-004	LB Draw E #4	06/29/16 10:45	10/04/16	Solid	Same As Above
B16100228-005	LB Draw E #5	06/29/16 9:55	10/04/16	Solid	Same As Above

The analyses presented in this report were performed by Energy Laboratories, Inc., 1120 S 27th St., Billings, MT 59101, unless otherwise noted. Any exceptions or problems with the analyses are noted in the Laboratory Analytical Report, the QA/QC Summary Report, or the Case Narrative.

The results as reported relate only to the item(s) submitted for testing.

If you have any questions regarding these test results, please call.

Report Approved By:

LABORATORY ANALYTICAL REPORT

Prepared by Billings, MT Branch

Client:	Chino Mine Company	**Report Date:**	10/18/16
Project:	STS1U Rock pH	**Collection Date:**	06/29/16 09:21
Lab ID:	B16100228-001	**DateReceived:**	10/04/16
Client Sample ID:	LB Draw E #1	**Matrix:**	Solid

Analyses	Result	Units	Qualifiers	RL	MCL/ QCL	Method	Analysis Date / By
SATURATED PASTE EXTRACT							
pH, sat. paste	6.4	s.u.		0.1		ASA10-3	10/14/16 08:55 / srm
METALS, TOTAL - EPA SW846							
Copper	167	mg/kg		1		SW6020	10/17/16 23:03 / jpv

Report Definitions:	RL - Analyte reporting limit.	MCL - Maximum contaminant level.
	QCL - Quality control limit.	ND - Not detected at the reporting limit.

LABORATORY ANALYTICAL REPORT

Prepared by Billings, MT Branch

Client:	Chino Mine Company	**Report Date:**	10/18/16
Project:	STS1U Rock pH	**Collection Date:**	06/29/16 09:36
Lab ID:	B16100228-002	**DateReceived:**	10/04/16
Client Sample ID:	LB Draw E #2	**Matrix:**	Solid

Analyses	Result	Units	Qualifiers	RL	MCL/ QCL	Method	Analysis Date / By
SATURATED PASTE EXTRACT							
pH, sat. paste	5.2	s.u.		0.1		ASA10-3	10/14/16 08:55 / srm
METALS, TOTAL - EPA SW846							
Copper	53	mg/kg		1		SW6020	10/17/16 23:06 / jpv

Report Definitions:	RL - Analyte reporting limit. QCL - Quality control limit.	MCL - Maximum contaminant level. ND - Not detected at the reporting limit.

LABORATORY ANALYTICAL REPORT

Prepared by Billings, MT Branch

Client:	Chino Mine Company	**Report Date:**	10/18/16
Project:	STS1U Rock pH	**Collection Date:**	06/29/16 10:16
Lab ID:	B16100228-003	**DateReceived:**	10/04/16
Client Sample ID:	LB Draw E #3	**Matrix:**	Solid

Analyses	Result	Units	Qualifiers	RL	MCL/ QCL	Method	Analysis Date / By
SATURATED PASTE EXTRACT							
pH, sat. paste	5.2	s.u.		0.1		ASA10-3	10/14/16 08:55 / srm
METALS, TOTAL - EPA SW846							
Copper	72	mg/kg		1		SW6020	10/17/16 23:09 / jpv

Report Definitions:	RL - Analyte reporting limit.	MCL - Maximum contaminant level.
	QCL - Quality control limit.	ND - Not detected at the reporting limit.

LABORATORY ANALYTICAL REPORT

Prepared by Billings, MT Branch

Client:	Chino Mine Company	**Report Date:**	10/18/16
Project:	STS1U Rock pH	**Collection Date:**	06/29/16 10:45
Lab ID:	B16100228-004	**DateReceived:**	10/04/16
Client Sample ID:	LB Draw E #4	**Matrix:**	Solid

Analyses	Result	Units	Qualifiers	RL	MCL/ QCL	Method	Analysis Date / By
SATURATED PASTE EXTRACT							
pH, sat. paste	5.3	s.u.		0.1		ASA10-3	10/14/16 08:55 / srm
METALS, TOTAL - EPA SW846							
Copper	93	mg/kg		1		SW6020	10/17/16 23:12 / jpv

Report Definitions:	RL - Analyte reporting limit.	MCL - Maximum contaminant level.
	QCL - Quality control limit.	ND - Not detected at the reporting limit.

LABORATORY ANALYTICAL REPORT

Prepared by Billings, MT Branch

Client:	Chino Mine Company	**Report Date:**	10/18/16
Project:	STS1U Rock pH	**Collection Date:**	06/29/16 09:55
Lab ID:	B16100228-005	**DateReceived:**	10/04/16
Client Sample ID:	LB Draw E #5	**Matrix:**	Solid

Analyses	Result	Units	Qualifiers	RL	MCL/ QCL	Method	Analysis Date / By
SATURATED PASTE EXTRACT							
pH, sat. paste	5.7	s.u.		0.1		ASA10-3	10/14/16 08:55 / srm
METALS, TOTAL - EPA SW846							
Copper	105	mg/kg		1		SW6020	10/17/16 23:14 / jpv

Report Definitions:
RL - Analyte reporting limit.
QCL - Quality control limit.
MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Billings, MT Branch

Client: Chino Mine Company
Project: STS1U Rock pH
Report Date: 10/18/16
Work Order: B16100228

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: SW6020						Analytical Run: ICPMS202-B_161017A				
Lab ID: QCS		Initial Calibration Verification Standard								10/17/16 12:28
Copper		0.0521	mg/L	0.0010	104	90	110			
Lab ID: ICSA		Interference Check Sample A								10/17/16 12:54
Copper		0.00105	mg/L	0.0010						
Lab ID: ICSAB		Interference Check Sample AB								10/17/16 12:57
Copper		0.0198	mg/L	0.0010	99	70	130			
Method: SW6020										Batch: 103506
Lab ID: MB-103506		Method Blank				Run: ICPMS202-B_161017A				10/17/16 22:44
Copper		ND	mg/kg	0.1						
Lab ID: SRM2-103506		Standard Reference Material				Run: ICPMS202-B_161017A				10/17/16 22:55
Copper		107	mg/kg	2.0	107	70	130			
Lab ID: SRM3--103506		Standard Reference Material				Run: ICPMS202-B_161017A				10/17/16 22:58
Copper		130	mg/kg	1.0	95	76	120			
Lab ID: B16100799-002ADIL		Serial Dilution				Run: ICPMS202-B_161017A				10/17/16 23:50
Copper		ND	mg/kg	10		0	0		10	
Lab ID: B16100799-002APDS1		Post Digestion/Distillation Spike				Run: ICPMS202-B_161017A				10/17/16 23:53
Copper		27.2	mg/kg	2.1	104	75	125			
Lab ID: B16100799-002AMS3		Sample Matrix Spike				Run: ICPMS202-B_161017A				10/17/16 23:56
Copper		104	mg/kg	2.0	105	75	125			
Lab ID: B16100799-002AMSD		Sample Matrix Spike Duplicate				Run: ICPMS202-B_161017A				10/18/16 00:07
Copper		104	mg/kg	2.0	104	75	125	0.4	20	

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Billings, MT Branch

Client: Chino Mine Company

Project: STS1U Rock pH

Report Date: 10/14/16

Work Order: B16100228

Analyte		Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: **ASA10-3**										Batch: 103590
Lab ID: **LCS-R268688**	Laboratory Control Sample					Run: MISC-SOIL_161014B				10/14/16 08:55
pH, sat. paste		7.00	s.u.	0.10	99	90	110			
Lab ID: **B16100228-001A DUP**	Sample Duplicate					Run: MISC-SOIL_161014B				10/14/16 08:55
pH, sat. paste		6.30	s.u.	0.10				1.6	10	

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

Work Order Receipt Checklist

Chino Mine Company

B16100228

Login completed by: Gina McCartney
Reviewed by: BL2000\tedwards
Reviewed Date: 10/5/2016

Date Received: 10/4/2016
Received by: qej
Carrier name: UPS

Shipping container/cooler in good condition?	Yes ☑	No ☐	Not Present ☐
Custody seals intact on all shipping container(s)/cooler(s)?	Yes ☑	No ☐	Not Present ☐
Custody seals intact on all sample bottles?	Yes ☐	No ☐	Not Present ☑
Chain of custody present?	Yes ☑	No ☐	
Chain of custody signed when relinquished and received?	Yes ☑	No ☐	
Chain of custody agrees with sample labels?	Yes ☑	No ☐	
Samples in proper container/bottle?	Yes ☑	No ☐	
Sample containers intact?	Yes ☑	No ☐	
Sufficient sample volume for indicated test?	Yes ☑	No ☐	
All samples received within holding time? (Exclude analyses that are considered field parameters such as pH, DO, Res Cl, Sulfite, Ferrous Iron, etc.)	Yes ☑	No ☐	
Temp Blank received in all shipping container(s)/cooler(s)?	Yes ☐	No ☑	Not Applicable ☐
Container/Temp Blank temperature:	13.8°C No Ice		
Water - VOA vials have zero headspace?	Yes ☐	No ☐	Not Applicable ☑
Water - pH acceptable upon receipt?	Yes ☐	No ☐	Not Applicable ☑

Standard Reporting Procedures:

Lab measurement of analytes considered field parameters that require analysis within 15 minutes of sampling such as pH, Dissolved Oxygen and Residual Chlorine, are qualified as being analyzed outside of recommended holding time.

Solid/soil samples are reported on a wet weight basis (as received) unless specifically indicated. If moisture corrected, data units are typically noted as –dry. For agricultural and mining soil parameters/characteristics, all samples are dried and ground prior to sample analysis.

Contact and Corrective Action Comments:

None

ENERGY LABORATORIES

Chain of Custody and Analytical Request Record

Page 1 of 1

PLEASE PRINT (Provide as much information as possible.)

Company Name: Chino Mines Co.

Project Name, PWS, Permit, Etc.: ~~[illegible]~~ STS1U Rock pH

Sample Origin State: NM

EPA/State Compliance: Yes ☐ No ☐

Report Mail Address (Required):
PO Box 10
Bayard NM 88023

Contact Name: Pam Pinson

Phone/Fax: 575-912-5213

Cell:

Sampler: (Please Print) Nick Lemme

❑ No Hard Copy Email: ppinson@fmi.com

Invoice Contact & Phone: same

Purchase Order: 2N00003C0

Quote/Bottle Order:

Invoice Address (Required):

❑ No Hard Copy Email:

Special Report/Formats:

☐ DW
☐ POTW/WWTP
☐ State: ___
☐ Other: ___
☐ EDD/EDT (Electronic Data)
Format: ___
☐ LEVEL IV
☐ NELAC

Number of Containers
Sample Type: A W S V B O DW
Air Water Soils/Solids
Vegetation Bioassay Other
DW - Drinking Water

ANALYSIS REQUESTED

SEE ATTACHED

Standard Turnaround (TAT)

R U S H → Contact ELI prior to **RUSH** sample submittal for charges and scheduling – See Instruction Page

Comments:

	SAMPLE IDENTIFICATION (Name, Location, Interval, etc.)	Collection Date	Collection Time	MATRIX	Total Cu	pH, Saturated Paste								LABORATORY USE ONLY
1	LB Draw E #1	6-29-16	09:21	rock	X	X								B16100228001
2	LB Draw E #2	6-29-16	09:36	rock	X	X								-002
3	LB Draw E #3	6-29-16	10:16	rock	X	X								-003
4	LB Draw E #4	6-29-16	10:45	rock	X	X								-004
5	LB Draw E #5	6-29-16	09:55	rock	X	X								-005
6														
7														
8														
9														
10														

Shipped by:

Cooler ID(s):

Receipt Temp ___ °C

On Ice: Y N

Custody Seal On Bottle Y N

On Cooler Y N

Intact Y N

Signature Match Y N

Custody Record MUST be Signed

Relinquished by (print): Pam Pinson Date/Time: 9-29-16/12:30pm Signature: Pam Pinson

Relinquished by (print): Date/Time: Signature:

Received by (print): Date/Time: Signature:

Received by (print): Date/Time: Signature:

Received by Laboratory: Date/Time: 10/4/16 09:15 Signature:

Sample Disposal: Return to Client: ___ Lab Disposal: ___

In certain circumstances, samples submitted to Energy Laboratories, Inc. may be subcontracted to other certified laboratories in order to complete the analysis requested.
This serves as notice of this possibility. All sub-contract data will be clearly notated on your analytical report.
Visit our web site at www.energylab.com for additional information, downloadable fee schedule, forms, and links.

APPENDIX L

NMED Comments and Chino Response to Comments

Informal Response to Comments on the Smelter/Tailing Soils Investigative Unit (STSIU) Phytotoxicity and Vegetation Community Study, dated August 2017

September 11, 2018

Please find below Chino responses to the New Mexico Environment Department (NMED) comments on the STSIU Phytoxicity Study. Chino received the informal comments by email dated January 9, 2018 from David Mercer, NMED Chino AOC Manager. Chino's responses follow each comment. Also figures and tables are included or attached to support technical responses.

General Comments

GC-1. Reality Check on the Lower End of the PEL range.

> The report concludes in Section 6 that the pCu PEL range as from 2-6 s.u., and the lowest PEL listed for the two main endpoints (Emergence and Survival) is 2.30 s.u. (Table G-5: PEL for alfalfa, emergence/flat granular). However, these estimates of the lowest PEL are not consistent with the data for the soils tested in the study; the lowest pCu tested in greenhouse studies was 2.93 to 3.07 s.u. for Site 9 in 2013 and 2015, respectively (Table A-1). Greenhouse toxicity testing results for Site 9 soils were 5.8% emergence and 0% survival for alfalfa, and no emergence (and no survival) for sideoats gramma. The low end of the PEL range is nearly 10x lower than the pCu for this site, but these results reflect heavily affected endpoints, and are not consistent with the intent of the PEL corresponding to the EC50.
>
> The low end of the PEL range (pCu = 2) is apparently based on statistical extrapolation from field studies (Table 11). However, the lowest pCu value observed in vegetation community surveys was 3.55 s.u (Site STS-PT-2013-1) (Table F-4). [Note, this excludes Site STS-PT-2013-33, which had an extreme low pCu of -1.85 with 0 cover and 0 species richness).
>
> Overall, the low end of the PEL range recommended in the document requires extrapolation outside the range of data collected, and is inconsistent with data from sites that were tested for phytotoxicity.

Chino: The study used soils collected directly from the Site; therefore, the range of pCu in the soils tested is limited to the range available at the Site. The shape of the curve at the lower end of pCu dose-response regression models is uncertain because there are few datapoints in that range for the greenhouse (none lower than 2.3 in Table A-1) or community study (none lower than 2.93 for measured pCu or 3.05 for calculated pCu in Table F-4)[1]. Therefore, that end of the range is hypothetical and does not represent the Site nor will it affect FS decisions. Extrapolating beyond site conditions is done only to provide insight into mechanisms possibly operating at the Site and to refine conceptual models.

---

[1] The comment cites data for Site 9 incorrectly. The PEL of 2.1 for community dose-response curves or of 2.3 for greenhouse dose-response curves are predicted for flat granular areas, not for Site 9, which is on bedrock. A bedrock PEL is 3.7 to 5.1 (non-flat granular in Table G-5) and since its pCu is lower than the PEL, it is *predicted* to have the observed low endpoint responses for emergence and survival (5.8 and 0%, respectively).

GC-2. Alfalfa seems to be most tolerant species tested

Sideoats gramma (both field and nursery) appears to be substantially more sensitive than alfalfa to low pCu. Section 5.1 indicates that the test results are unclear as to whether alfalfa represents a good replacement for a native forb species, but neglects to identify alfalfa as one of the sources for the wide range of DEL/PELs as discussed in the next to the last paragraph in Section 5.1. However, as shown in all cases where the DEL/PEL is calculated using emergence and survival endpoints (Tables 5,7, and 8), the DEL/PELs calculated for alfalfa are at the lower end of the ranges calculated and are all lower than those calculated for the grasses.

Managing the site to the alfalfa toxicity thresholds could result in substantial inhibition of establishment and growth for other species.

Chino: These ranges detailed below, split out by species and by most ecologically important endpoints (survival and emergence), show alfalfa as the more tolerant species of pCu and there is no disagreement. The purpose of the phytotoxicity and community study is to provide insight into effect levels and the factors affecting the plant community and its effect levels. Alfalfa has a wider range of DELs/PELs for pCu (PEL = 3.68-5.67, DEL = 3.75-7.35) than sideoats grama (PEL = 4.83-5.67, DEL = 6.24-7.74) when estimated across *all* endpoints. The PEL ranges for only emergence and survival are tighter (i.e., 3.68-3.79 for alfalfa and 4.83-5.11 for sideoats grama). The corresponding ranges for the DEL for the two endpoints are 3.75-4.33 for alfalfa DEL and 6.24-6.84 for sideoats grama DEL. The draft FS will discuss how this information will be applied .

GC-3. Generalizations

The presentation tends to mix results and conclusions for individual endpoints/species/soil categories with the generalization across species and soil properties. For example, the text emphasizes the effect soil category may have on results, but R-square values are presented only for data aggregated across species and soil properties. This is partially an outcome of using a multivariate analysis to discern general trends and driving factors, but it becomes important in the conclusions. For example, the overall R-square for emergence is high (>0.8)(e.g., Figs 6, 7 and G-1). But the R-square for the dose response curve for alfalfa emergence on 'non-flat granular' soils must be low (see Figure G-1), because no data points fall near the sigmoid part of the curve. This may seem like a small detail, but this is the relationship on which estimates of the low end of the PEL range are based, and so it's important to the overall interpretation.

Chino: The final report conclusions discuss that the PELs and DELs vary depending on the soil category, soil properties, plant species, and endpoints (Section 6). The ranges of the DELs and PELs in the conclusions are provided only to show the variability and uncertainty across soil types and are not meant to be interpreted in any other way. The R^2 is not needed to interpret these graphs as the relationships are visually clear. Soil category effects are clearly shown visually in Figure 12. For example, the community dose response curves for richness and cover for flat granular soils have curves shifted to the left relative to the other soil categories, indicating plants are more tolerant in flat granular soils. The response by soil/species/seed type are also shown in Appendix G, Figure G-1 (and Figure RTC-1 below) for greenhouse dose-response curves visually. The observed data points fall near each line, indicating a good fit (see RMSE discussion below).

When R^2 is shown, it is used to show that the model is accounting for much of the variability in an endpoint when seed type, species, soil category and soil properties are considered and, therefore, the R^2 does not apply to each individual curve for each seed type and soil condition. The root mean square error (RMSE) is the most important measure for evaluating prediction accuracy for each curve. RMSE measures the spread of the y values around the predicted value for a given value of x in a regression and is in units of the response variable, e.g., the endpoints. The lower it is, the better is the fit. For example, RMSE (standard deviation of unexplained variance) is 0.21 for alfalfa on non flat-granular soils and 0.19 for alfalfa on flat granular soils, which shows a reasonably good and similar fit between the two types of soils, where there are data (shown in Figure RTC-1 below).

Extrapolated areas as discussed below will not be used to estimate PELs or DELs for actual locations on the Site. Points missing along part of the curve are not captured with R^2, nor are they captured with RMSE. This is the part of the model that is extrapolated and very uncertain as discussed in response to GC-1. Fit to the hypothesized model cannot be fully determined for flat granular soils because no low pCu data are available for such soils[2]. See response to GC-1.

A low RMSE or high R^2 value is important for accurate predictions of what will happen to the community when changing pCu in the field (e.g., important for community study) but is not necessary for identifying relationships in the greenhouse study to understand mechanisms, which is the real purpose of the greenhouse study (because conditions in greenhouse are not representative of the field). For example, pCu was found to significantly and adversely affect endpoints of species in the greenhouse study, even though pCu may account for a small proportion of variability in emergence when including other factors such as the seed type and soil properties. When evaluated in the field, it is even a smaller portion because other factors such as compaction, boulders/bedrock cover and slope strongly affect the species in the field. Nonetheless, a high (poor) RMSE in the greenhouse study for a curve does not necessarily mean the relationship with pCu is not important, just that it is not a dominant factor. As pointed out, the important issue for the greenhouse results is whether the curve has enough data in the key range to identify a PEL, not whether its RMSE is low or R^2 is high. This study has enough data in the key pCu range that occurs in the Site, which the 1999 study did not have.

---

[2] **Note that it is assumed the comment meant no data points fall near the sigmoid part of the curve of the flat granular soil curve for alfalfa, which is shown in Figure RTC-1 as the dashed blue line, not the non-flat granular curve, which is solid blue and has many points around it.**

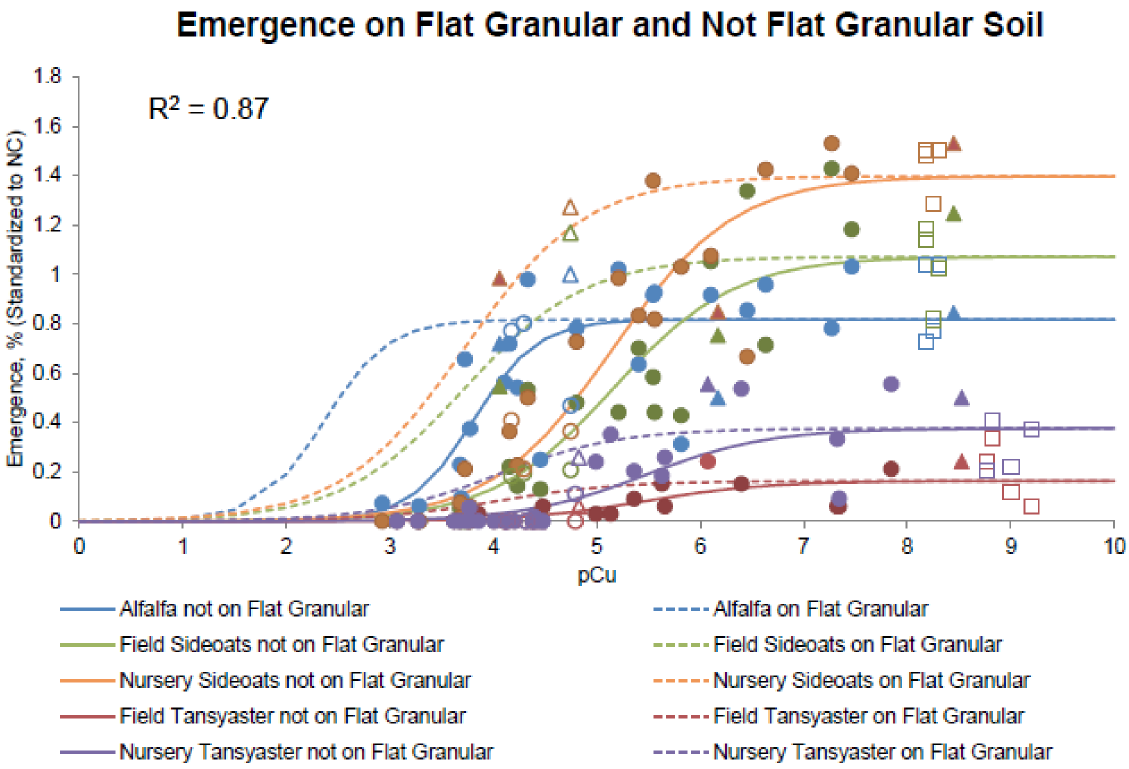


Figure RTC-1. Dose-response models on emergence with the covariate flat granular.

GC-4. Soil Categories and Risk Management Decisions

One outcome emphasized in the report is the importance of soil category associated with results. Mapping of the soil 'categories' relative to the areas where potential cleanup technologies are applicable may be an important consideration in the FS. We're not sure if setting RACs for each soil category is necessary but, as noted in the Report, this should be a consideration.

Chino: The FS will include a map of the soil categories for the STSIU that will help focus on areas where potential cleanup technologies are applicable.

1. Derivation of PEL based on Minimum Reference

A PEL was estimated as the pCu corresponding to one-half of the minimum value for the Reference R. As noted above, the resulting estimated PEL pCu is nearly 10x lower than the lowest pCu actually tested in the field. This approach seems arbitrary, and inconsistent with the results presented in the report. For example, the ratio of the EC50 to the EC10 (pCu values) for emergence in 'non-flat granular' and 'flat granular' soils for alfalfa ranges between 0.78 and 0.85, and for sideoats gramma ranges between 0.74 and 0.80 (see Table G-5). This is substantially higher than the 0.5 multiplier applied to the DEL to calculate the PEL, as reported in the document, and could result in underestimating the pCu value for the PEL using this method.

Chino : The lowest measured pCu in Table F-4 and A-1 is 2.93. The PEL based on the minimum reference method is higher than that (range of 3.69-4.94 range) in the Table 7 results for the greenhouse study without covariates and within the range in Table 11 results for the community study (range of 2.1-3.42). Based on the above, the minimum reference PEL pCu is not in the range of 10x lower than the lowest pCu actually tested in the field and the method has been used at other sites (McDonald et al. 2014). Hence Chino does not find it to be arbitrary as the minimum reference method does not involve multiplying the DEL pCu by 0.5 but rather multiplying the endpoint value at the DEL pCu by 0.5 to find the EC50 relative to background. In other words, this method uses the dose-response curve to find the PEL at the endpoint value that is a 50 percent reduction from background (assigning the DEL the background value, which is conservative because background is an EC0 or zero effect rather than EC10). The less than optimum conditions that occur in background areas for this study (the four agreed-upon flat granular reference areas for this study) should not be attributed to mine operations impact. Use of the EC50 alone without adjusting for background conditions is not a true "probable adverse effects from mine" level but rather a "probable adverse effects from mine plus background factors" level. Secondly, without comparable reference areas for the three other soil categories (which tend to have lower endpoint values), the minimum reference results are overly conservative. Additional reference areas specific to these other soil categories will be documented, but in support of the FS and not necessarily the phytotoxocity study.

The ratios of EC10/EC50 cited are from the greenhouse study, which is difficult to interpret in terms of remedial options unless placed into context of effects of pCu on the plant community in the field relative to background. The greenhouse study evaluates individual species responses, whereas the community study evaluates the integrated response of the plant community composed of many species. The report shows that greenhouse seedling emergence is the best predictor of community metrics within the STSIU. Chino performed a new regression analysis and found that emergence and soil category explain 91% (alfalfa) to 92% (sideoats grama) of the variance in richness in the field in a multiple regression (see Figures RTC-2 and RTC-3 below), leaving only 8-9 percent unexplained. If these regression equations are used to convert emergence to richness in the greenhouse dose-response curve for emergence, it becomes clear that the change of pCu from an EC10 to EC50 level would have a small effect on richness in the actual STSIU plant community, particularly for flat granular soils (see Figure RTC-4). The relative change in richness from remedial improvement from an EC50 to EC10 for richness is very small for flat granular soils, whether more tolerant alfalfa or the more sensitive sideoats grama is selected to represent the change (changes from about 13 species to 11 species/400 ft^2). For bedrock or flat rocky soils, the change is proportionally larger, from 4 species to 6 species (based on sideoats grama) or from 3 species to 5 species (based on alfalfa), but still is only about a 33 to 66 percent improvement in a community that is naturally low in richness.

Note, that sideoats grama richness curves appear to fit observed community data (plotted as squares) on Figure RTC-4 (data from Table F-4) better for all but the slope soils. Alfalfa richness curves fit the slope soils better. However, the data are too limited to assess which greenhouse curve (alfalfa or sideoats grama) best defines a community EC50 and there is much uncertainty as to which is appropriately representing the field conditions in each soil category. The conclusion for the study results is that PELs and DELs are uncertain and dependent on site-specific field conditions. Using the curves to inform management decisions may be a better use of the dose-response curves.

Figures RTC-5, RTC-6, and RTC-7 show the corresponding relationships of pCu with cover rather than richness (after converting emergence to cover). They indicate that a location may show a larger

improvement in vegetative cover when pCu is changed from the EC50 to EC10 of the more tolerant species (alfalfa) than of more sensitive species such as sideoats grama.

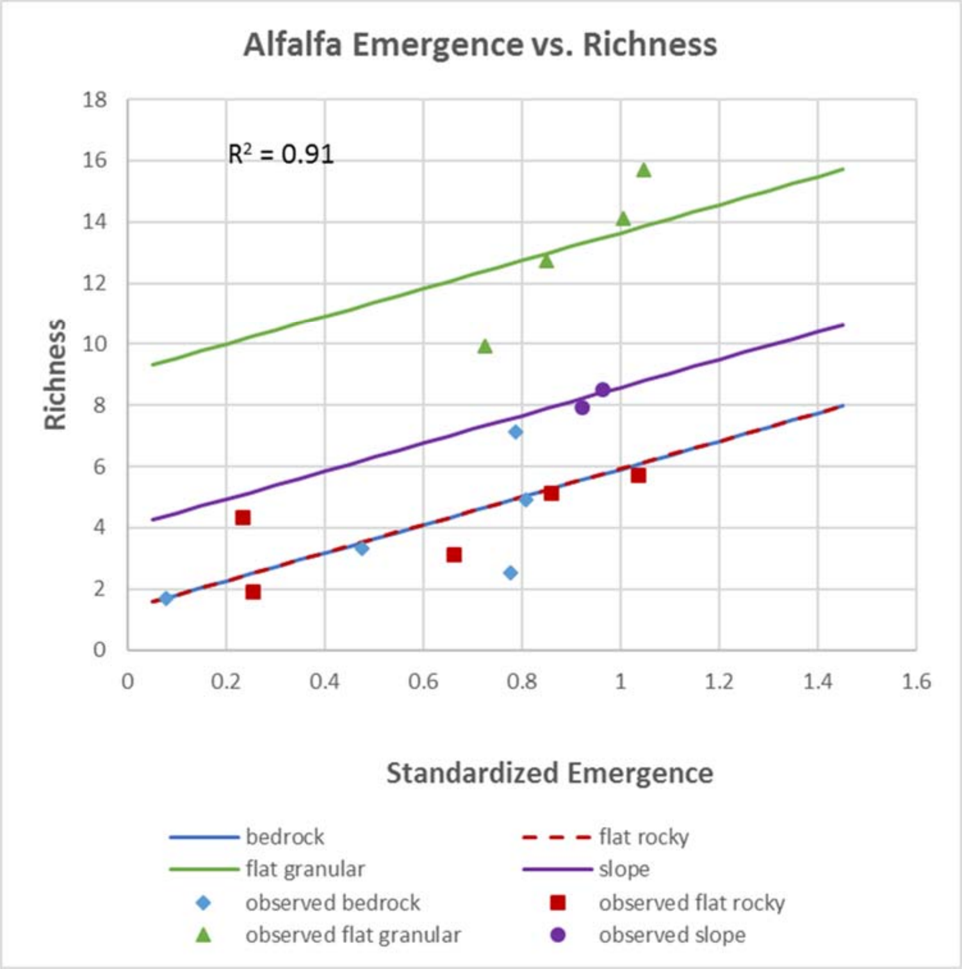


Figure RTC-2. Relationship between alfalfa emergence and richness, showing a strong correlation when separated by soil category.

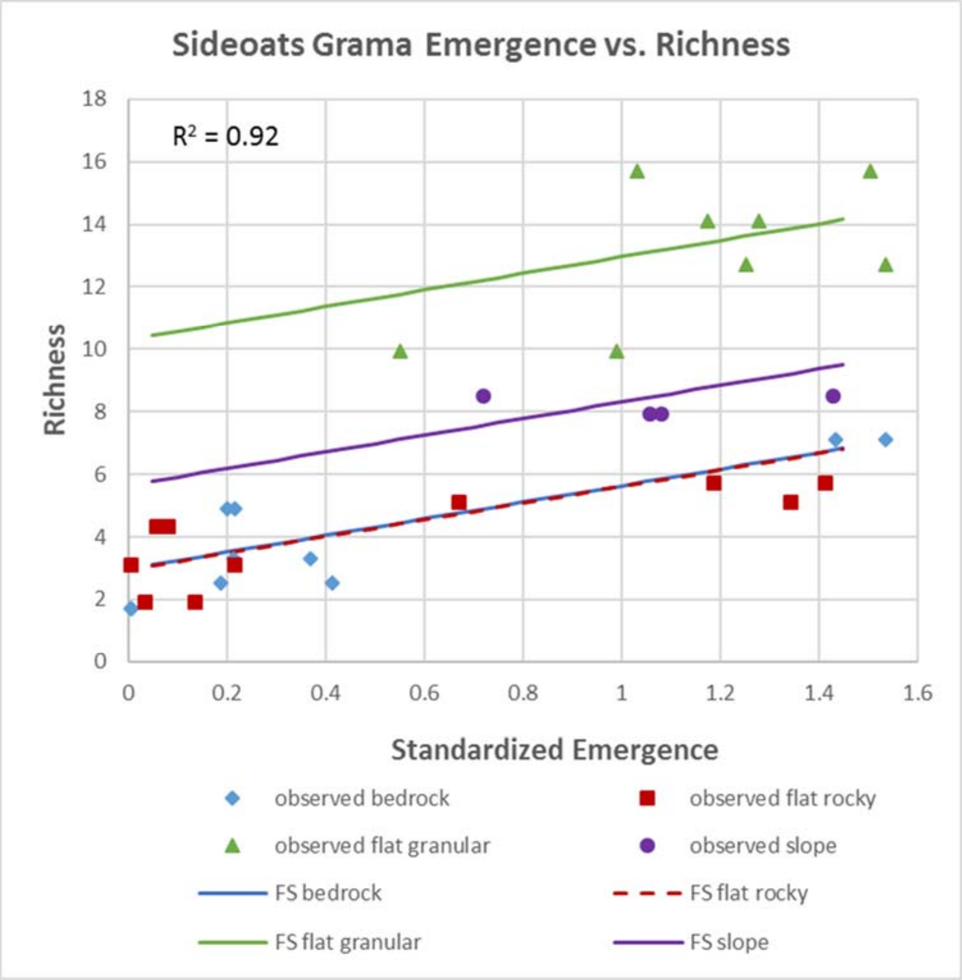


Figure RTC-3. Relationship between field sideoats (FS) grama emergence and richness, showing a strong relationship when separated by soil category. Nursery field sideoats regression line not shown (very similar to FS lines).

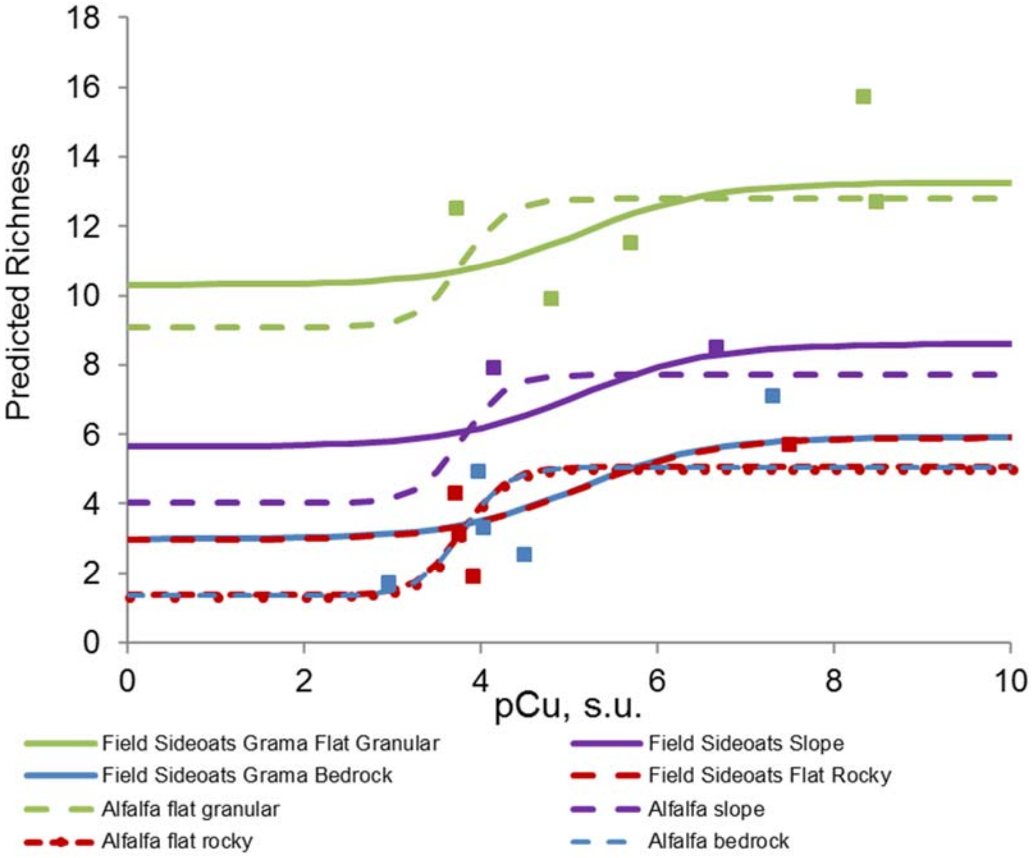


Figure RTC-4. Richness predicted by pCu when emergence replaced by richness calculated from emergence-richness relationships in Figures RTC-2 and RTC-3. Squares represent measured pCu and richness sampled in 100' x 100' community study plots.

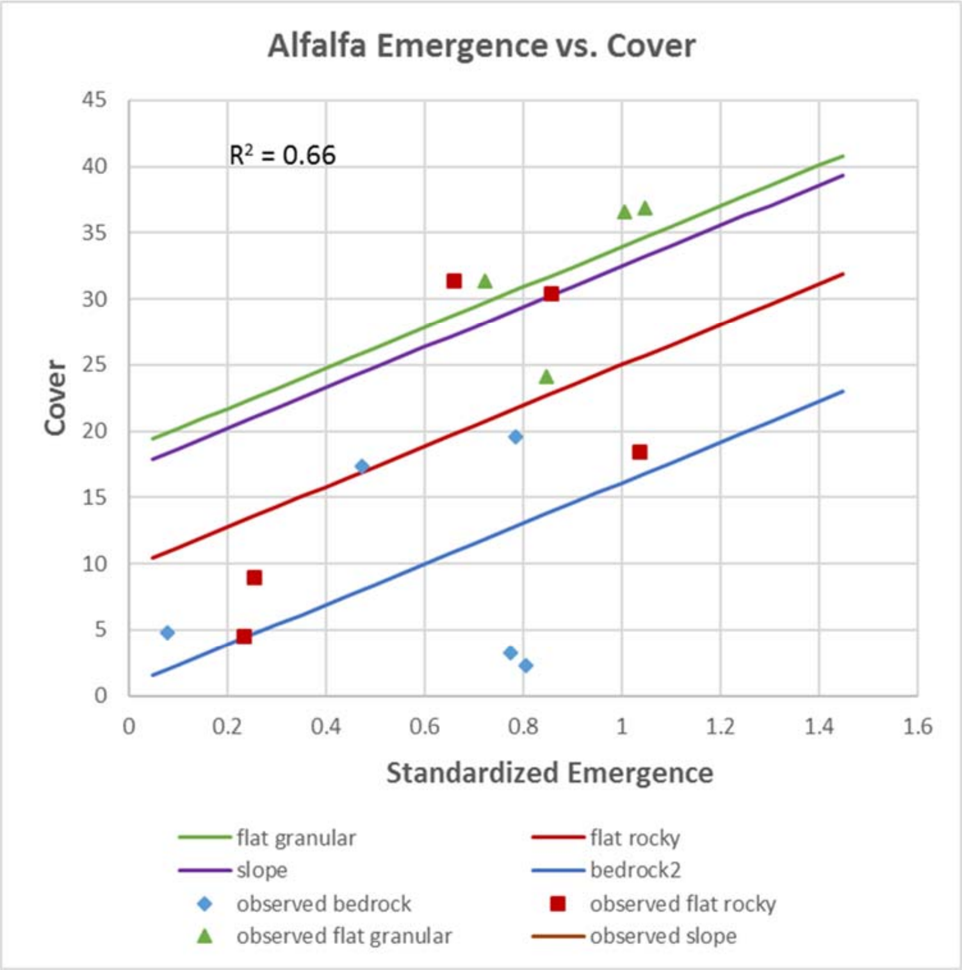


Figure RTC-5. Relationship between alfalfa emergence and percent cover by soil category.

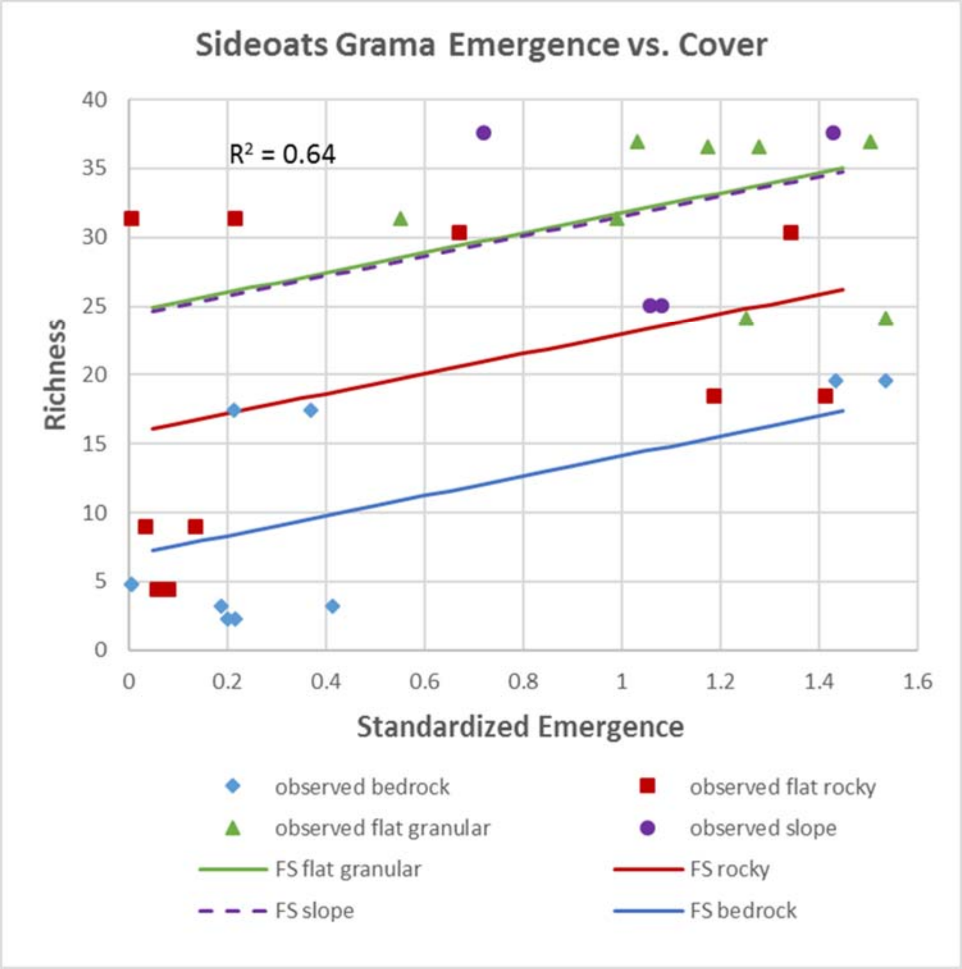


Figure RTC-6. Relationship between field sideoats (FS) grama emergence and percent cover by soil category. Nursery field sideoats regression line not shown (very similar to FS lines).

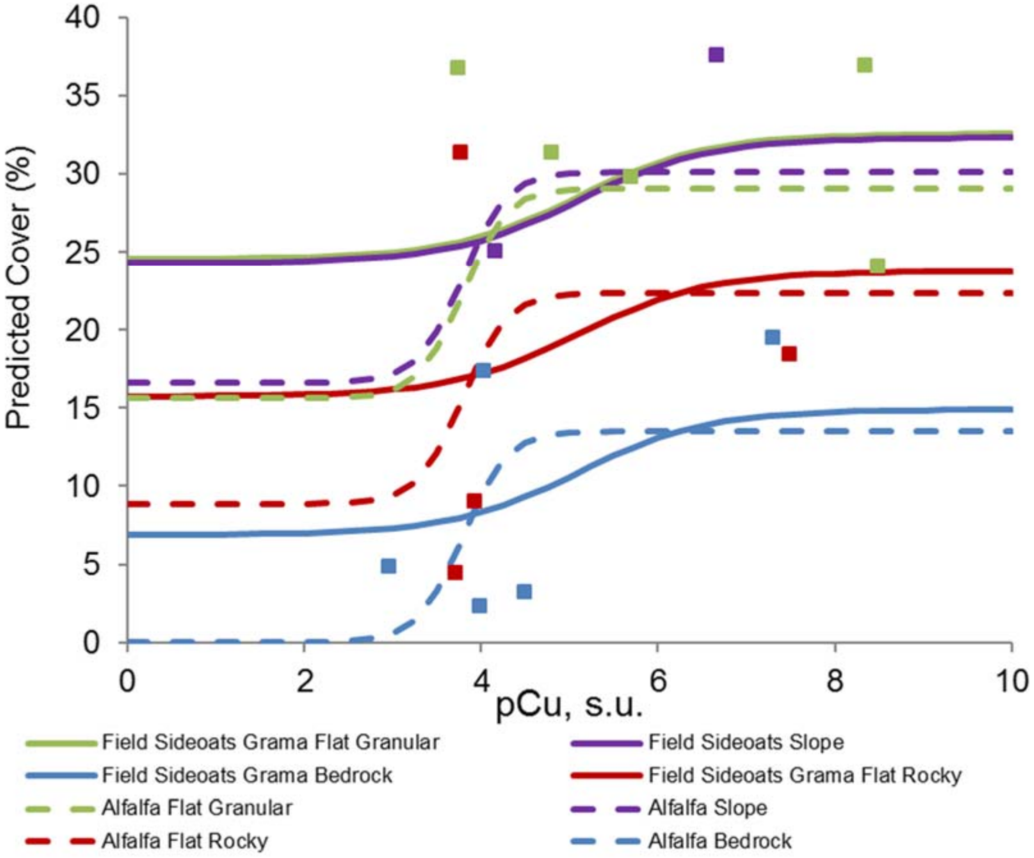


Figure RTC-7. Vegetation cover predicted by pCu when emergence replaced by cover calculated from emergence-cover relationships in Figures RTC-5 and RTC-6.

Additional Comments:

1) On Figure 1, the title notes that the figure presents a hypothetical relationship between pCu and shoot height. While the figure is a good representation of the hypotheses being tested, the figure needs to be more clear in that all of the data shown in the figure are provided to illustrate the hypotheses and are not representative of any real data collected during the study.

Chino: The figure and text associated with the figure will be revised to clarify as requested.

2) Section 5.1 (2nd paragraph) seems to confuse the content of Tables 11 & 12. Also, Table 11 contains results of the GLM for field data, but is not cited at all in the Results sections.

Chino: Table and figure numbers were off in some places when figures were moved during report revisions and will be corrected to reference correct tables or figures.

3) On Figures 11 and 12, please define the ‘t’ label placed above the symbols. It looks as if the ‘t’ values should be ‘g’ representing flat granular soils since no points are labeled with ‘g’ in either figure.

Chino: Yes, the “t” was an old symbol for flat granular soils that inadvertently was not updated to “g” in these two figures. The Figures will be corrected.

4) On Table G-2, the EC20 and EC10 values provided for the 5-seed model on Table G-1 are not provided. These values should be provided to allow for comparison with the 5-seed model results.

Chino: The EC10 and EC20 will be added to Table G-2 (see attached Table RTC-1).

5) On Table G-4, the EC20 and EC10 values provided for the 5-seed model are not provided. However, there are EC10 values provided in the summary of Table G-5. Where are these values presented prior to the summary table?

Chino: The word “summary” will be removed from the title, and the title will be revised to “DEL and PEL Based on Five-Seed Models with Various Combinations of the Covariates”. Table G-5 is not a summary of any tabular information presented before (see next response to comment 6). A footnote will be added to clarify the difference between EC50s in Tables G-4 and G-5. The EC20s were calculated for the covariate models and are presented in the attached Table RTC-2.

(6) The EC50 values presented on Table G-5 do not match those presented on Table G-4. For example, the Emergence EC50 for alfalfa on flat granular soils is shows as equal to 3.806 on Table G-4 and as 2.37 on Table G-5. Sideoats gramma are shown as 5.155 on Table G-4 and 3.72 on Table G-5 in the same example.

Chino: The models with covariates have two EC50s if the covariate has two classifications (i.e., flat granular and non-flat granular) and an infinite number of EC50s if the covariate is continuous. The EC50s in Table G-4 are part of the model equation and are needed to calculate the ECx values in Table G-5. The EC50s in Table G-4 represent values when the covariate value is zero. For the categorical variable of flat granular, the non-flat granular soils have a value of 0. The EC50s in Table G-5 represent the EC50s with the covariate values represented as minimum, mean, and maximum values observed on the Site. Thus, the numbers will not match between the tables because Table G-4 is showing the EC50 when covariates are zero, and Table G-5 is showing values when covariates are not zero. The values in Table G-4 are just examples of EC values that result when using a selected subset of covariate values of the infinite covariate values possible.

(7) On Table G-5, DEL and PEL calculations for alfalfa include values ‘based on minimum reference’. Whereas the other species show values ‘based on de minimis LTL’. We assume all were based on the minimum reference and results for non-alfalfa species are mis-labeled.

Chino: Yes, Table G-5 will be updated to show they are all based on minimum reference.

(8) Also on Table G-5, under Survival, Iron, the DEL based on minimum reference is labeled as NA. If the PEL for this method is based on 0.5x the DEL, on what basis are the PELs ‘based on minimum referenced’ calculated?).

> **Chino: For replacing “NA” with a value, the minimum was changed to the threshold of the curve per discussion below. A footnote will be added describing this change. An effect concentration at 50 percent is the concentration that reduces an endpoint, in this case survival, by 50 percent. Therefore, the PEL is based on the pCu of the endpoint that is 50 percent of the endpoint value at the DEL pCu (0.5*DEL endpoint), not 0.5 of the DEL pCu (not 0.5x* DEL pCu). The minimum of the reference values for alfalfa for survival (1.01) is higher than the Rmax threshold of the curve (0.9432) in Figure G-1 and thus a corresponding value on the curve could not be predicted unless the minimum is set to the threshold of the curve.**

Reference:

MacDonald, D.D., C.G. Ingersoll, J. A. Sinclair, J. A. Steevens, J. K. Stanley, J. D. Farrar, N. E. Kemble, J. L. Kunz, W. G. Brumbaugh, and M. R. Coady. 2014. Evaluation of Relations Between Sediment Toxicity and Sediment Chemistry at the Anniston PCB Site. Chapter 5 in Ingersoll, C.G., Steevens, J.A., and MacDonald, D.D., eds., 2014, Evaluation of toxicity to the amphipod, *Hyalella azteca*, and to the midge, *Chironomus dilutus*; and bioaccumulation by the oligochaete, *Lumbriculus variegatus*, with exposure to PCB-contaminated sediments from Anniston, Alabama: U.S. Geological Survey Scientific Investigations Report 2013–5125, 122 p., *http://dx.doi.org/10.3133/sir20135125*

Table RTC-1. Three-Seed Model Results

Freeport-McMoran Chino Mines Company
Vanadium, New Mexico
Smelter/Tailing Soils IU Phytotoxicity and Vegetation Community Study

Endpoint	n	SSE	Parameters	Pseudo R^2	SAS Formulation	Seed Type	Slope				Rmax				EC50				EC20				EC10			
							Estimate	S.E.	95 LCL	95UCL	Estimate	S.E.	95 LCL	95UCL	Estimate	S.E.	95 LCL	95UCL	Estimate	SE	95 LCL	95UCL	Estimate	SE	95 LCL	95UCL
Emergence																										
Emergence	99	5.348	7	0.74	if seed = 'Alfalfa' then mod = Rmax_a/(1+10**(slope_a*(-measured_pcu + ec50_a))); if seed = 'Side Oats (Field)' then mod = Rmax_fso/(1+10**(slope_so*(-measured_pcu + ec50_so))); if seed = 'Side Oats (Nursery)' then mod = Rmax_nso/(1+10**(slope_so*(-measured_pcu + ec50_so)));	Alfalfa	1.747	0.887	-0.015	3.510	0.812	0.057	0.698	0.925	3.787	0.131	3.526	4.047	4.131	0.202	3.729	4.533	4.333	0.288	3.760	4.906
						Field Sideoats Grama	0.562	0.098	0.368	0.756	1.125	0.088	0.951	1.300	5.147	0.176	4.797	5.497	6.218	0.324	5.574	6.862	6.845	0.425	6.001	7.689
						Nursery Sideoats Grama	0.562	0.098	0.368	0.756	1.472	0.099	1.275	1.669	5.147	0.176	4.797	5.497	6.218	0.324	5.574	6.862	6.845	0.425	6.001	7.689
Survival																										
Survival	90	2.550	7	0.80	if seed = 'Alfalfa' then mod = Rmax_a/(1+10**(slope_a*(-measured_pcu + ec50_a))); if seed = 'Side Oats (Field)' then mod = Rmax_fso/(1+10**(slope_so*(-measured_pcu + ec50_so))); if seed = 'Side Oats (Nursery)' then mod = Rmax_nso/(1+10**(slope_so*(-measured_pcu + ec50_so)));	Alfalfa	14.102	11.167	-8.108	36.312	0.943	0.034	0.876	1.010	3.682	0.017	3.649	3.715	3.725	0.031	3.664	3.785	3.750	0.049	3.653	3.847
						Field Sideoats Grama	0.579	0.088	0.404	0.755	1.244	0.069	1.107	1.381	5.115	0.136	4.844	5.385	6.154	0.259	5.639	6.669	6.762	0.344	6.077	7.447
						Nursery Sideoats Grama	0.579	0.088	0.404	0.755	1.121	0.066	0.991	1.252	5.115	0.136	4.844	5.385	6.154	0.259	5.639	6.669	6.762	0.344	6.077	7.447
Root Length																										
Root Length	84	1.213	6	0.90	if seed = 'Alfalfa' then mod = Rmax_a/(1+10**(slope*(-measured_pcu + ec50_a))); if seed = 'Side Oats (Field)' then mod = Rmax_fso/(1+10**(slope*(-measured_pcu + ec50_so))); if seed = 'Side Oats (Nursery)' then mod = Rmax_nso/(1+10**(slope*(-measured_pcu + ec50_so)));	Alfalfa	0.976	0.140	0.698	1.255	0.705	0.055	0.595	0.815	6.456	0.173	6.111	6.801	7.072	0.214	6.646	7.499	7.433	0.250	6.935	7.931
						Field Sideoats Grama	0.976	0.140	0.698	1.255	0.926	0.048	0.830	1.022	6.120	0.082	5.958	6.283	6.737	0.143	6.453	7.021	7.098	0.189	6.722	7.474
						Nursery Sideoats Grama	0.976	0.140	0.698	1.255	1.106	0.050	1.006	1.206	6.120	0.082	5.958	6.283	6.737	0.143	6.453	7.021	7.098	0.189	6.722	7.474
Shoot Weight																										
Shoot Weight	84	0.635	5	0.70	if seed = 'Alfalfa' then mod = Rmax_a/(1+10**(slope*(-measured_pcu + ec50_a))); if seed = 'Side Oats (Field)' then mod = Rmax_so/(1+10**(slope*(-measured_pcu + ec50_so))); if seed = 'Side Oats (Nursery)' then mod = Rmax_so/(1+10**(slope*(-measured_pcu + ec50_so)));	Alfalfa	0.467	0.094	0.280	0.653	0.305	0.039	0.228	0.383	5.089	0.405	4.282	5.895	6.379	0.556	5.273	7.486	7.134	0.675	5.790	8.478
						Field & Nursery Sideoats Grama	0.467	0.094	0.280	0.653	0.488	0.042	0.404	0.572	5.647	0.262	5.125	6.170	6.938	0.478	5.987	7.889	7.693	0.620	6.460	8.926
Shoot Height																										
Shoot Height	84	1.471	5	0.77	if seed = 'Alfalfa' then mod = Rmax_a/(1+10**(slope*(-measured_pcu + ec50_a))); if seed = 'Side Oats (Field)' then mod = Rmax_so/(1+10**(slope*(-measured_pcu + ec50_so))); if seed = 'Side Oats (Nursery)' then mod = Rmax_so/(1+10**(slope*(-measured_pcu + ec50_so)));	Alfalfa	0.532	0.093	0.348	0.717	0.534	0.061	0.412	0.656	5.486	0.336	4.817	6.154	6.617	0.450	5.720	7.513	7.278	0.540	6.204	8.353
						Field & Nursery Sideoats Grama	0.532	0.093	0.348	0.717	0.817	0.063	0.693	0.942	5.944	0.216	5.515	6.374	7.075	0.376	6.326	7.824	7.737	0.483	6.776	8.698
Shoot Height, Outlier Excluded	83	0.764	5	0.84	if seed = 'Alfalfa' then mod = Rmax_a/(1+10**(slope*(-measured_pcu + ec50_a))); if seed = 'Side Oats (Field)' then mod = Rmax_so/(1+10**(slope*(-measured_pcu + ec50_so))); if seed = 'Side Oats (Nursery)' then mod = Rmax_so/(1+10**(slope*(-measured_pcu + ec50_so)));	Alfalfa	0.586	0.076	0.434	0.738	0.524	0.042	0.441	0.606	5.435	0.224	4.989	5.881	6.462	0.299	5.867	7.057	7.063	0.359	6.348	7.778
						Field & Nursery Sideoats Grama	0.586	0.076	0.434	0.738	0.724	0.038	0.648	0.800	5.728	0.142	5.445	6.010	6.755	0.243	6.271	7.239	7.356	0.314	6.731	7.981

Notes:
Three seed models exclude tansyaster seeds (both field and nursery seeds)
SE = standard error, using Wald statistic in SAS for non-linear regression.
LCL = lower confidence limit
UCL = upper confidence limit
Rmax = upper endpoint threshold of S-shaped dose-response curve (where curve plateaus)
Slope = slope of S-shaped curve
ECx = effects concentration (in pCu units) at x% of the endpoint below Rmax
a = alfalfa, so = sideoats grama, nso = nursery seed sideoats grama, fso = field seed sideoats grama

Table RTC-2. EC20 on Five-Seed Models with Various Combinations of the Covariates

Freeport-McMoran Chino Mines Company
Vanadium, New Mexico
Smelter/Tailing Soils IU Phytotoxicity and Vegetation Community Study

Species	Emergence, not on Flat Granular	Emergence, on Flat Granular	Survival, Minimum Iron	Survival, Mean Iron	Survival, Maximum Iron	Shoot Weight, not on Flat Granular, Minimum Clay	Shoot Weight, not on Flat Granular, Mean Clay	Shoot Weight, not on Flat Granular, Maximum Clay	Shoot Weight, on Flat Granular, Minimum Clay	Shoot Weight, on Flat Granular, Mean Clay	Shoot Weight, on Flat Granular, Maximum Clay	Shoot Height, not on Flat Granular, Minimum Clay	Shoot Height, not on Flat Granular, Mean Clay	Shoot Height, not on Flat Granular, Maximum Clay	Shoot Height, on Flat Granular, Minimum Clay	Shoot Height, on Flat Granular, Mean Clay	Shoot Height, on Flat Granular, Maximum Clay	Root Length, Minimum Clay	Root Length, Mean Clay	Root Length, Maximum Clay
Alfalfa																				
EC20	4.23	2.80	3.87	3.69	2.48	5.52	5.87	6.45	5.03	5.38	5.96	5.87	6.19	6.73	5.37	5.69	6.22	6.54	6.88	7.44
Field Sideoats																				
EC20	5.97	4.53	6.31	6.12	4.91	5.98	6.34	6.91	5.49	5.85	6.42	5.87	6.19	6.73	5.37	5.69	6.22	6.19	6.53	7.09
Nursery Sideoats																				
EC20	5.97	4.53	6.31	6.12	4.91	5.98	6.34	6.91	5.49	5.85	6.42	5.87	6.19	6.73	5.37	5.69	6.22	6.19	6.53	7.09
Field Tansyaster																				
EC20	6.29	4.85	5.49	5.30	4.10	6.87	7.22	7.79	6.37	6.73	7.30	5.87	6.19	6.73	5.37	5.69	6.22	5.30	5.65	6.21
Nursery Tansyaster																				
EC20	6.29	4.85	5.12	4.93	3.73	6.87	7.22	7.79	6.37	6.73	7.30	5.87	6.19	6.73	5.37	5.69	6.22	5.30	5.65	6.21

Notes:

ECx = Effect concentration of x%, which is pCu when endpoint is reduced by x% from the modeled no effect threshold, R_{max}

NA = not available because minimum reference above the curve.

Appendix D

Methods and Results for Upland and Drainage Bank Analysis

Freeport McMoRan Chino Mines Company

APPENDIX D – METHODS AND RESULTS FOR UPLAND AND DRAINAGE BANK ANALYSIS

SMELTER/TAILING SOILS INVESTIGATION UNIT FEASIBILITY STUDY

March 2023

Contents

Table

Figures

Attachments

1. Introduction

This Appendix documents the tasks and methodology conducted to fulfill the upland data needs and analysis identified in the Smelter/Tailing Soils Unit (STSIU) Feasibility Study (FS) Proposal (FS Proposal; Arcadis 2011c). The FS Proposal was designed to generate data necessary to evaluate the area affected by pre-FS remedial action criteria (RAC) issued by New Mexico Environment Department (NMED) on March 3, 2011. This Appendix describes the field investigation objectives, sampling methods, and the final analysis of the soil and vegetation community data collected in terrestrial areas for that purpose. Sampling procedures and analysis are consistent with those detailed in the Upland Sampling Work Plan (Appendix A) of the FS Proposal (herein referred to as the FS Work Plan), except as noted in the sections below. Sampling activities were conducted following Standard Operating Procedures (SOPs) and in accordance with quality assurance/quality control (QA/QC) protocols outlined in the FS Work Plan and specifically stated in the RI Quality Assurance Project Plan (QAPP; Chino 1997). The QAPP defines how site-wide QA/QC activities were implemented during the RI sampling and analysis. The objective of the QAPP is to ensure that data are of adequate quality for their intended use. Standard Operating Procedures (SOPs) have been developed as part of the QAPP and are incorporated by reference in this FSP.

2. Site Background

In accordance with the Administrative Order on Consent (AOC) Scope of Work, a Remedial Investigation (RI; SRK 2008) for the STSIU was conducted to generate the data necessary to evaluate the potential effects to human health and the environment from historically-affected media in the STSIU. Data were collected in the STSIU starting in 1995 and continuing to 2019 to determine potential impacts to soil, sediment, and surface water from historical mineral processing activities. The approved RI human health risk assessment (HHRA; Gradient 2008) and ecological risk assessment (ERA; NewFields 2008) for the STSIU have shown that areas of the STSIU have elevated metals concentrations and depressed pH in soil and surface water. Based on these evaluations, the NMED established pre-FS RAC for the STSIU for arsenic, copper, iron, and cupric ion activity (calculated as $pCu^{2+} = -\log[Cu^{2+}]$, herein referred to as "pCu"). The pre-FS criteria for remedial action (Pre-FS RAC) for surface soils, the focus of this Appendix, include (NMED 2011a,b):

- Arsenic concentrations greater than 27 mg/kg in 0-1 inch depth soils to protect human health;
- Copper concentrations greater than 5,000 mg/kg in 0-1 inch depth soils to protect human health;
- Iron concentrations greater than 100,000 mg/kg in 0-1 inch depth soils to protect human health;
- 95 upper confidence limit (UCL) on the arithmetic mean concentration of the area-weighted average concentration of copper greater than 1,600 mg/kg in 0-6" depth soils within an exposure unit for small ground-feeding birds (SGFB);
- Monitoring of exposure units where the 95 UCL on copper concentrations is greater than 1,100 mg/kg but less than 1,600 mg/kg in 0-6" depth soils for SGFB; and,
- pCu less than or equal to 5 where copper is greater than 327 mg/kg to reduce soil toxicity to plants.

The FS and Record of Decision (ROD) will be completed consistent with the National Contingency Plan (NCP). Pre-FS RAC are consistent with the use of preliminary remediation goals (PRG) by EPA in the NCP; therefore, new information can be used to refine the pre-FS RAC and selection of alternatives (§300.430(e)(2)(i) NCP). Evaluation of the RAC is summarized in Sections 9 and 10 of this Appendix, below; final remediation goals will be documented in the ROD.

The FS Proposal evaluated the data available in 2010 for all COCs and recommended additional sampling for copper and pCu. Prior to 2008, the two most wide-spread constituents of concern (COC), copper and pCu, had been sampled across the Chino Mine site to characterize the concentrations for ecological and human health risk assessment purposes (Gradient 2008; SRK 2008). For the FS delineation of potential areas for remediation, more extensive sampling of the soil was needed and has since occurred following the FS Work Plan. The results are presented herein.

In addition to soil sampling, rangeland condition for livestock and the quality of habitat (vegetation cover and richness) for wildlife were assessed within the exposure units. Because destruction of vegetation and reduction in soil stability associated with remediation may do more harm than good in areas with good range and wildlife habitat conditions, the areas with pCu less than 5 were evaluated for their rangeland and wildlife habitat quality. Rangeland condition for livestock was initially assessed at Chino using a variety of methods within polygons of unique soil and vegetation combinations in 1997 (Woodward Clyde, 1997 and unpublished data). For purposes of the FS, rangeland condition was evaluated in the field again in areas on and off the site. The field data, collected between 2011 and 2018, were combined with remote sensing training to map rangeland conditions within the STSIU using the observed apparent trend (OAT) method. Comparison of offsite reference OAT scores with onsite scores within exposure units indicates whether pCu is of concern in the exposure unit in terms of adversely affecting the vegetation for livestock.

For wildlife habitat evaluations, plant species richness and vegetation cover were initially assessed in 1999 in relatively low slope, lower elevation, non-bedrock areas for the ERA to represent wildlife habitat quality relative to pCu impacts (Newfields 2006). These areas surveyed in 1999 do not represent the diversity of habitat types in the STSIU, which include steep slopes and areas with a high percentage of bedrock. Also, the white rain in January 2008 (see Appendix B of FS Report) increased pCu and possibly improved these vegetation indices as well as the rangeland condition (ARCADIS, 2011a). Therefore, additional soil pCu and vegetation assessments of richness and cover were completed for the FS to compare the post-white rain condition to offsite reference conditions to determine if adverse effects of pCu remain.

In addition to sampling for the nature and extent of copper and pCu impacts after the white rain, a phytotoxicity and vegetation community study was completed to evaluate the pCu effects on the STSIU plant community (Appendix C to the FS Report). This study expanded upon the initial phytotoxicity study conducted for the sitewide ERA and evaluated effects in more depth. Thresholds called *de minimis* effect levels (DEL) and probable effect levels (PEL) were developed from that study and are discussed in this Appendix. Because reference areas representative of the major soil and topographic conditions discovered in the STSIU during FS field sampling were missing for that study, additional sampling in new reference areas was completed in 2018. Rather than revising the phytotoxicity study report (Appendix C to FS Report), those results are presented in the reference area investigation (Attachment A).

3. Objectives

As described in the FS Work Plan, the soil and vegetation sampling program addressed the following specific objectives:

- Fill in the data gaps in the distribution of total copper and pCu in the STSIU soils, estimating concentrations throughout the STSIU in areas where the levels of constituents are changing from safe levels to potential levels of ecological (total copper and pCu) or human health (copper) concern;
- Identify exposure units for copper and pCu for calculating the pre-FS RAC using existing vegetation maps and refine unit boundaries as needed using field data and remote sensing.
- Evaluate if upland and drainage habitats differ to determine if separate drainage habitat exposure units are necessary to evaluate risk to SGFBs;
- Identify and tally the acreage of exposure units for SGFB that have copper in soil exceeding (1) the pre-FS RAC of 1,600 mg/kg (requiring remediation) and (2) the monitoring pre-FS RAC of 1,100 mg.
- Identify and tally the acreage of exposure units for human health that have copper in soil exceeding the pre-FS RAC of 5,000 mg/kg.
- Sample and map rangeland condition, cover, and richness to assess if these vegetative attributes fall within the range of natural variability of reference areas (are acceptable). The pCu exposure units not meeting the pre-FS RAC of < 5 pCu that show no real vegetative difference from unimpacted reference areas do not need to be remediated to protect the vegetation community and will be screened out from remedy consideration;
- Identify remaining exposure units with both unacceptable rangeland condition and wildlife habitat quality that have mean pCu < 5 in areas with copper concentrations greater than 327 mg/kg; and
- Of exposure units identified in the previous bullet, identify those with mean pCu below the probable effects level (PEL) for the soil category the unit occurs in, and tally the acreage of those areas that will be considered for remediation.

This program of soil or vegetation sampling and exposure unit field verification was employed to meet the above objectives. The sampling program is described in detail in the FS Work Plan and later documents (Appendices A, B, C) and is summarized or elaborated upon in Sections 4 through 9, below.

4. Soil Field Investigation Methods

This section describes the September and October 2011 upland soil investigation activities dictated by the FS Work Plan, which consisted of collecting upland soil samples for laboratory analysis to fill in data gaps in the nature and extent of the distribution of copper and pCu in the STSIU within exposure units. This section also describes sampling updates to the FS Work Plan in terms of data collected in later years (after 2011) that were useful in the FS.

In 2011, additional copper sampling was needed for the FS to evaluate the pre-FS RAC for SGFB and human health; 57 samples were collected at the blue triangle locations in 2011 shown in Figure D-1 to fill in spatial data gaps on the nature and extent of the copper distribution (within area of copper distribution uncertainty). Figure 3-2 in the FS Report shows the extent of copper samples evaluated as part of the FS work plan (includes 2011-2012 sampling, data from the pH monitoring study [Appendix B to the FS Report] and older data but excludes data collected in 2012 to 2019 as part of interim remedial actions [IRAs] or from the phytotoxicity study).[1]

---

[1] Unlike pCu for which STSIU had only had 61 samples representing post-white rain conditions prior to development of the FS Work Plan, 294 copper samples were available to estimate copper distributions at the time of the FS Work Plan. Thus, the sampling design focused on filling gaps in the spatial data in the current copper dataset needed for a good interpolation model. The area of uncertainty (red polygon in Figure D-1) included locations with concentrations ranging from 800 to 2,700 mg/kg. There were 88 existing samples within this area as shown in Figure D-1. Also, a gradient of copper from the smelter emissions exists and thus good spatial coverage across the gradient in the area of uncertainty was required, necessitating transect sampling that spanned the gradient.

For the pCu extent, copper and pH were sampled together at 41 locations shown in Figure D-2 in 2011. Figure 3-7 in the FS Report shows all pCu sample locations evaluated in the FS Report, updated to include 2013 soil data from the phytotoxicity study (shown in Figure 4 of Appendix C of FS Report, also in Figure 3-10 of FS Report). The pCu at each location was calculated from the copper and pH data using the upland pCu predictive ($R^2 = 0.97$) equation in NewFields (2006):

$$pCu = 7.34+(0.93*pH)-(1.15*\ln[Cu_{total}])$$

Newfields (2006) provides other predictive equations that included ephemeral drainage bank locations. This upland equation was used because all soil samples were in the upland areas. The methodology for soil sample collection was implemented in accordance with the QAPP (Chino 1997) and applicable SOPs in the FS Work Plan (Attachment A of Arcadis 2011c) to meet the data quality objectives in that plan.

Deviations from the FS Work Plan included:

1. Instead of using XRF to collect copper samples, all copper soil samples for avian pre-FS RAC analysis were analyzed in the laboratory, as it was found to be as efficient to send samples to the laboratory as to measure in the field.
2. A proposed phytotoxicity and vegetation community study was approved and completed (field work completed in 2014) that collected additional soil copper and pH data on the STSIU site as well as offsite to evaluate reference areas. These data were used to calculate pCu and included for evaluation in the FS. During this study, four soil/topographic units (referred to herein as “soil categories”) were found to influence the plant community and phytotoxicity. Thus, in 2018, more soil data were collected offsite in reference areas that represented the four soil categories, in addition to some onsite soil sampling as discussed in Attachment A. These 2018 reference and site data were included in the FS evaluation.
3. The amendment study (with a last year of monitoring in 2013) and a pH monitoring study (with a last year of monitoring in 2014) included soil sampling for copper and pH at four amendment and adjacent untreated plots (Appendix A of the FS Report) and at long-term pH monitoring locations (Appendix B of the FS Report) that were included in the FS evaluation of copper and pCu.
4. Locations in bedrock were sampled for copper and pH to obtain pCu in 2012 in potential reference areas to obtain a better understanding of bedrock exposure more distant from the former smelter, and these data were included in the FS pCu interpolation. The results indicated these bedrock locations have lower pH and were classified as *de minimis* effect locations, rather than as reference locations for bedrock.
5. All vegetation investigation locations identified in Section 5 were sampled for pCu in the soil in 2013 as part of the phytotoxicity study (see Figure 3-10 of the FS Report, which illustrates years plots were sampled and data collected each year). These were included in the FS evaluation.
6. IRAs for human health protection in the Golf Course area in 2008 (Arcadis 2009), Railroad area in 2012 (Golder 2013), Razorback Ridge in 2013 to 2014 (Golder 2015), and B Ranch in 2020 (Arcadis 2020) included confirmation sampling that were included in the copper interpolations, adjusted to 0-6” and sieved to < 2 millimeters (mm) when applied to ecological analyses.

As a result of the additional sampling outlined above, the dataset available for delineating concentrations or copper and pCu within exposure units was larger than originally planned. The development of the FS was delayed until all the various supporting studies (Appendices A, B, and C of the FS Report and Attachment A of this Appendix; Arcadis 2009; Golder 2013; Golder 2015; Arcadis 2020) were completed to better inform remedial decisions, resulting in an expanded and more robust dataset.

URS (2012) completed a data validation report on all the data collected in 2011 for the FS (Attachment B) to identify the data to be used in the FS evaluation. The data quality and SOPs of the other supplemental investigations are described in the indicated appendices (A,B,C) and their corresponding attachments for each investigation.

In accordance with the objectives of the QAPP, SOPs were implemented during field activities to maximize consistency in field activities, as outlined in the FS Work Plan and described briefly herein. The SOPs are provided as Appendix B of the RI QAPP (Chino 1997). General SOPs implemented during soil sampling activities included Field Document Control (SOP-1), Field Logbook and Field Sample Data Sheets (SOP-2), Field Quality Control (SOP-3), Sample Custody Procedures (SOP-4), Packaging and Shipping of Environmental Sample Containers (SOP-5), Decontamination of Equipment Used to Sample Soil and Water (SOP-6), Requesting Environmental Laboratory Services (SOP-7), and Sampling, Preservation and Containerization (SOP-14).

SOP-22 “Surface Soil Sampling” was followed for 2011 field sampling procedures focused on SGFB and plant pre-FS RACs. Each soil sample was a composite of five sub-samples taken over a sample interval of six inches in sample depth as measured from the ground surface. Following the FS Work Plan, the five sub-samples were collected over a 50 x 50 m area (rather than 20 feet in the original SOP) at the corners and center to reduce microscale variability; the locations were chosen to be representative of the area. Samples were sieved to less than 2 mm.[2] The coordinates for the 2011 copper and pCu sample locations are presented in Table 6 of the STSIU FS Work Plan (also see Table 3-2 and Table 3-4 of FS Report for all samples used for copper and pCu interpolation in FS). Following standard EPA methods, the soils sampled were analyzed at ACZ laboratory for copper sampled at the new locations shown on Figure D-1 and for pH and copper for pCu locations shown on Figure D-2. Analysis used ICP (EPA 6010) with a method detection limit of 1 mg/kg.

In accordance with SOP-3 “Field Quality Control”, field QC samples (one per 10 samples) and rinsate blanks (one per 20 samples) were collected as part of the sampling program. These blind field duplicate samples and rinsate blanks were submitted for laboratory analyses. The comparison of duplicates to parent samples for copper and pH met the QAPP criteria of 50 percent or less (Table E-2 in Attachment E).

Additionally, copper was sampled in soil and analyzed in the laboratory on transects along drainage banks in conjunction with woody cover sampling described in Section 5.1, below. During the field sampling, 12 composite soil samples from the same locations sampled for vegetation on the banks were collected (FS Work Plan stated samples would be on a 50-m transect for soil and 100-m transect for woody cover, but 300-foot transect was actually used for both for efficiency). The soil samples were taken from the start (0 feet), middle (150 feet), and end (300 feet) of the transect at a depth of 0-6 inches bgs, composited, and sieved to less than 2 mm. The soil samples were collected to verify that the three drainages evaluated had high copper concentrations, which was suggested based on the limited data collected during earlier investigations. These bank data were included in the upland copper interpolations.

5. Vegetation Field Investigation Methods

This section discusses the vegetation investigation activities described in the FS Work Plan, which, in upland areas, consisted of defining exposure areas for avian and vegetation communities for copper and pCu, respectively, and collecting rangeland and wildlife habitat quality survey data at the 23 locations shown on Figure D-3, collected in September and October 2011 and 2012. No chemical data were collected in the vegetation assessment plots in 2011, although all plots were revisited in 2013 and sampled for soil copper and pH to obtain an estimate of pCu for the phytotoxicity study (see Figure 4 in

---

[2] These samples were used for ecological evaluations. Human health samples generally were sampled at 0-1” and represented samples sieved at 0.25 mm in interim remedial action areas focused on human health.

Appendix C of FS Report). As stated above, potential reference area bedrock locations were missing from the FS Work Plan and thus, locations STS-RWU-2012-B1, STS-RWU-2012-B2, and STS-RWU-2012-B3 in Figure D-3 were sampled for vegetation in 2012. These areas were found to have some smelter influence when pCu was estimated from data collected at these sites in 2013 (see Appendix B of FS report) and were treated as *de minimis* effect locations. All other locations in Figure D-3 were surveyed for vegetation community characteristics in 2011.

Deviations from the FS Work Plan included:

- The FS Work Plan identified 15 locations in rangeland polygons believed to represent the range of vegetation conditions in the STSIU. However, the field team, which included NMED representatives, added 2 more in the field in 2011.
- Additional vegetation sampling occurred in new plots in 2014 as part of the phytotoxicity and community study (see Figure 4 in Appendix C of FS Report), and these data were included with the 2011 and 2012 data for development of the richness, cover, and rangeland condition maps used for the FS.
- Additional reference plots east of the STSIU were added for vegetation sampling in 2018, as discussed in Attachment A.

All the data described in the bullets above were used in the FS evaluation.

5.1 Delineation of Exposure Units for Copper and pCu

In the FS, the pre-FS RAC are compared to a representative statistic calculated for copper and pCu within exposure units to identify exceedances of the RAC. The exposure units were preliminarily identified in the FS Work Plan as vegetation alliance polygons for copper and rangeland polygons for pCu. For copper, the SGFB pre-FS RAC value of 1,600 mg/kg was estimated as a 95UCL area-weighted average concentration within an exposure unit representing a habitat unit for the SGFB, as requested by NMED (NMED 2011a,b). The existing alliance level vegetation maps developed by DBS&A (1999, 2000) and used in the site-wide ERA (NewFields 2006) were designated as the habitat unit. However, NMED highlighted a concern related to drainage banks, especially those drainages with valued ecological habitat in this semi-arid ecosystem such as riparian woodland. The ephemeral drainage banks in the STSIU are potentially of high value to SGFB because they may have denser woody vegetation than adjacent upland areas. Section A4.4 in the FS Work Plan (Arcadis 2011c) discussed that different remedial technologies may be required along the ephemeral drainage banks when compared to the adjacent upland if there were large differences in overall habitat. Specifically, NMED was interested in evaluating if separate exposure units for drainage banks with elevated copper should be delineated. To evaluate the concern for the FS, woody cover of drainage bank habitats was mapped using remote sensing to determine if the bank habitat significantly differed from the adjacent upland habitats. If it differed, the banks would be included as separate exposure units from adjacent upland vegetation alliance polygons. If not different, the upland polygons would include the drainage banks. Therefore, not just riparian areas along streambanks, but also their immediately adjacent upland areas were mapped for woody cover percentages to evaluate if upland and drainage habitats differ, an objective presented in Section 3.

The vegetation alliance map of the STSIU (Figure 3-3 in main FS Report taken from Figure 2.1-2 in NewFields 2006) was used to identify the drainages to map for woody cover using remote sensing. The alliance map identified two woodland vegetation alliances that frequently occur in drainages and are expected to have higher woody density than the other grassland/shrubland alliances, specifically the (1) fluvial forest and shrubland alliance and the (2) alligator-juniper oak woodland alliance. For portions of drainages in the STSIU that fall within these alliances and that are also expected to have elevated copper (three drainages shown in Figure D-4), woody cover was mapped, and its percentages measured to determine if the banks of these drainages have higher quality habitat than adjacent upland areas. Chino mapped woody cover percentages not only along the three STSIU drainages but also in the adjacent uplands of the same drainages (Figure D-5, see Attachment D for more details). These three drainages were selected because they potentially had copper concentrations in excess of the avian RAC on their banks and were identified as occurring in the woodland or fluvial forest alliances (see Figure 8 in the FS Work Plan).

Additionally, field data were collected on woody cover along 12 ground transects to ground-truth the remote sensing map of woody cover percentages that would be developed in these drainage areas (Figure D-4). At each of the 12 locations, field data consisted of estimates of percent woody cover on one 300-foot transect along one bank parallel to the drainage and one 300-foot transect in the nearby upland (at least 500 m away) at each sampling point in Figure D-4. The line intercept method was used, measuring the percent of the transect intersecting open versus woody vegetation canopy.[3] Upland transects were parallel to bank transects. The photographs of the transects are in Attachment C, and data collected from the woody cover sampling and analysis results are in Attachment D.

Because field cover probably can generally only be estimated to within 10% accuracy with consistency for line intercept methods for woody vegetation,[4] woody cover modeled to within about 10 percentage points of ground reference was considered "correct" in the accuracy assessment of the map created using remote sensing. The accuracy requirement in the FS Work Plan was that at least 70% of the transects are correctly classified to be able to use the remotely sensed results to compare upland and drainage vegetation. If such accuracy is obtained, the woody canopy cover of the drainage area based on the remote sensing map must be at least 25 percentage points different from the adjacent upland cover to be considered different. If the map does not meet the accuracy requirement, the mean cover values of the field data were statistically compared to see if those data change the interpretation of the remote sensing results. Remote sensing results for woody cover and results of the field investigation are discussed in Section 8.

Exposure units also were delineated for pCu calculations. Cupric ion activity can be phytotoxic to the plant community. Thus, the exposure units need to represent exposure units for the plant community, which is the assessment endpoint for pCu . Because the ERA discusses protecting the vegetation community for its function as wildlife habitat and rangeland for livestock, rangeland polygons (defined in Woodward Clyde 1997) representing a variety of habitat conditions for plants, were selected as the exposure unit for pCu (Figure 3-9 of the FS Report). To estimate pCu in each rangeland polygon, first the spatial distribution of pCu across the STSIU after the January 2008 white rain event was estimated using interpolation. As discussed in Section 4, pCu was estimated from pH and copper (0-6" bgs, sieved to < 2 mm) using the upland regression equation at each field sample location that was sampled for both constituents after the January 2008 white rain (Table 3-4 of the FS Report). When interpolating pCu across the STSIU using these data, however, some pre-white rain samples had to be included on the borders of the STSIU to bound the interpolation

---

[3] Because banks undulate along the drainages, rather than providing a straight line, the transect laid out with a measuring tape where one could walk approximated the bank line. The intersecting portion of the tape was extended up to 7.5 feet on either side to capture the bank vegetation. If a woody plant intersected the tape within that band, its entire length was measured and included as intersecting the tape. This same technique was used in the upland transect. Therefore, woody cover is actually an index of woody cover that is nevertheless closely comparable between the bank and upland transects.

[4] This 10% in the work plan was optimistic as it did not consider the challenge of sampling the irregularities of the bank line, which often is eroded and not well defined (see photos in Attachment C). Nor did it consider the ground cover would be an approximate index, not actual woody cover estimates.

because of lack of data in such areas. The resulting pCu interpolated raster map was averaged within each rangeland polygon to estimate mean pCu for each exposure unit.

As described in the FS Work Plan, the rangeland polygon borders were evaluated in the field and on aerial imagery, with the intent to split the polygons if sharp boundaries in rangeland or wildlife condition were observed within polygons on aerial photos, spectral images, or in the field. No sharp boundaries were observed, and thus the rangeland polygons delineated in 1997 were not changed.

5.2 Upland Vegetation Sampling and Mapping

In upland areas, data representing rangeland quality (OAT score), plant richness, and plant cover were collected in the field in 100 x 100 square foot plots (for richness and cover) or along a 200-m transect that included one side of the plot and extended beyond (OAT score). These data were used to calibrate remote sensing maps that depict the spatial distribution of these three vegetation community characteristics.

Because the sampling effort of the 1997 rangeland study was too low at too coarse of a resolution to assess effects to rangeland condition within the pCu < 5 contour, OAT score sampling was conducted for the FS in representative rangeland polygons across the STSIU, following the FS Work Plan. The OAT score is one measure of rangeland condition that Woodward Clyde (1997) quantified on the STSIU in some of the rangeland polygons in 1997. This metric was subsequently re-sampled and mapped for use in the FS to assess rangeland conditions in all areas with pCu < 5, as described in the FS Work Plan. The OAT method is a rapid assessment technique promoted by the Bureau of Land Management (BLM) and Natural Resources Conservation Service (NRCS) whereby the investigator walks through a defined area and visually estimates scores. The method was used to estimate “apparent” trend in rangeland condition without sampling more than one time period. A high score represents good rangeland condition. Before sampling the transect for the condition factors that are summed to calculate the OAT score, the 200-m transect was walked to evaluate the criteria used in developing the OAT score. The score on the 200-m long transect (observations were up to 50 feet on either side of transect) was only used to train or ground truth the OAT score of the corresponding 100 x 100 foot map pixel that contained the start of the transect. The OAT scores were then mapped for every pixel in the STSIU using remote sensing techniques and then were averaged within rangeland polygons to represent the final polygon scores.

The field investigators from NMED and Chino jointly decided on the OAT scores and did not refer to the 1997 OAT score. Their joint approach differed from the investigators’ approach in 1997 because the FS focus was on the quality of the vegetation along the entire transect including its abundance, whereas in 1997, if vegetation was minimal (e.g., in bedrock), the score was based only on the small patches of vegetation that were present (e.g., within the cracks of the bedrock). Therefore, the 1997 OAT scores were not used in the FS, only scores collected for the FS or phytotoxicity study. The methodology for the vegetation survey data was implemented in accordance with the applicable SOP (the SOP is in Appendix F within Appendix C of the FS Report) .

Reference areas for richness and cover were preliminarily identified and sampled in 2011, referred to as Wildlife Reference Plot North and Wildlife Reference Plot South. Soil sampling to estimate pCu at these plots in 2013 indicated only the Wildlife Reference Plot North was a good reference plot and the Wildlife Reference Plot South is actually a *de minimis* plot. Also, the FS Work Plan assumed north and south-facing slopes would strongly affect vegetation conditions but analysis of the cover and richness data did not support that assumption. Instead, four soil/topographic categories had the largest effect (see Appendix C of FS report). Thus, additional reference sampling occurred in 2018 to better represent these categories, as described in Attachment A.

For the OAT score reference area, several reference locations were identified in 2011 to calibrate the field investigators' estimates of OAT score on the site to areas with very high scores, and to allow for visual comparison and score adjustment for the varying climatic conditions when sampled again in the future (in 2012, 2014 and 2018; conditions were very dry in 2011 and 2012). This adjustment for climatic conditions was performed in the investigator's rating scale while in the field, and thus did not require adjustment during the desktop analysis (whereas richness and cover were adjusted during the desktop analysis). The locations used for reference were the cell phone hill NW and SW and the Lampbright outcrop (Figure F-2 in Appendix C of the FS Report).

The 2011 and 2012 sampled locations were supplemented with additional plots sampled for the same three vegetation characteristics (OAT, richness, cover) in 2014 as part of the phytotoxicity and vegetation community study (Appendix C of the FS Report) and again in 2018, as part of the reference area investigation (Attachment A).

Procedures for sampling vegetation were as follows. OAT scores were the sum of ratings for plant characteristics (vigor of desirable plants, seedling establishment, and litter) and soil characteristics (pedestals, crusting, and gullying; Table D-1). Methods for sampling vegetation for richness and cover were consistent with those used for the amendment plots (see Appendix A of the FS Report) following DBS&A (1999) dog-leg sampling protocol with subplots, except the size of the plots was 100 feet by 100 feet (as used in the amendment study described in the SOP in Attachment A to Appendix A of the FS Report).

As was done in the phytotoxicity and vegetation community study (Appendix C of the FS Report), cover data collected in years other than 2011 (i.e., in 2014 and 2018) were adjusted to conditions in 2011 using a normalized difference vegetation index (NDVI) calculated from Landsat imagery collected those years to account for climatic differences among years (see Attachment A). Photographs of each plot and survey field data sheets are presented in Attachments I and F within Appendix C of the FS Report, respectively.

6. Soil Results and Interpolation Maps

This section describes the interpolated maps of copper and pCu on the STSIU, data used to create the spatial interpolation of those maps, and the procedures for selecting and evaluating the interpolation method.

6.1 Data Used for Spatial Interpolation

6.1.1 Copper

Figure D-7 shows the locations of the samples used to develop the understanding of copper distributions in STSIU in 2010 when the FS Work Plan was first developed, with the samples overlaid on the vegetation alliance polygons as the exposure units. Unlike for pCu (described in Section 6.1.2, below), this map of locations was not limited to post-2008 data locations as the white rain event is not expected to have changed copper concentrations. This initial map is based upon soil data collected from 1995 to 2010 and includes data from the following reports: Chino 1995; Arcadis 2001; NewFields 2006, 2008; SRK 2008; Arcadis 2009; Arcadis 2010a; Arcadis 2010b; Arcadis 2011a; Arcadis 2011b.

Samples collected as part of the FS Work Plan and subsequent IRAs were added to these existing samples to create an updated, more precise understanding of copper concentrations within habitat polygons and potential exceedances of the pre-FS RAC; their addition resulted in a total of 1,947 copper samples, shown in Table 3-2 of the FS Report. All copper samples shown in Table 3-2 were analyzed in the laboratory with the exception of the Golf Course and supplemental IRA confirmation samples to the north and west of Hurley (Arcadis 2009; Golder 2013). These samples, taken in 2008 and 2012, were analyzed using XRF and corrected using the regression equation based on a subset of the samples analyzed by a laboratory. The regression equation and methodology used are described in the IRA Completion Report (Arcadis 2009).To combine the datasets for copper for the SGFB, soil samples collected at 0-1 inch bgs for human health purposes prior to sampling outlined in the FS Work Plan were multiplied by the median ratio between the two depths (0.7 unless in windblown tailing area, where it was 1.5) to represent the 0-6 inch bgs; details on the development and selection process for this correction factor are provided in the FS Work Plan, and the adjustment is shown in Table E-2 of Appendix B of the FS report.

At the conclusion of all field sampling up to 2019, copper concentrations were developed across the STSIU using an interpolation routine in ArcGIS on the data in Table 3-2, as described in Section 6.2 below. After determining the best interpolation method (Thiessen polygons) for copper following the flow chart in Figure D-6, the datasets for each exposure unit were determined by intersecting ArcGIS interpolated copper Thiessen polygons with the DBS&A vegetation alliances, as shown in Figure 3-4 of the FS Report. Figure 3-4 in the FS Report illustrates all the Thiessen polygons, where the center represents the location of a copper sample. This revised soil sampling map shows coverage of samples across the site without any remaining distinct data gaps. Thus, existing soil data are considered sufficient to define the current nature and extent of the COCs of surface soil. The laboratory data for each location collected for the FS in 2011 are in Attachment E.

6.1.2 pCu

Figure D-8 shows the locations of the samples used to develop the understanding of pCu distributions in STSIU in 2010, when the FS Work Plan was first developed, and their exposure units (rangeland polygons). This map shows locations and concentration classes of soil data collected in 2009 and 2010 to evaluate and monitor pH and pCu changes in the soil following the white rain event in January 2008 (Arcadis 2011a) and soil data sampled during the insect bioaccumulation study in 2010 (Arcadis 2010b). Only data collected after the white rain event (shown in Table E-2 of Appendix B of the FS Report) were initially included because that alkaline rain event altered the soil pH and thus changed the pCu.

Many samples collected as part of the FS Work Plan or later studies were added to the existing point samples to create an updated, more precise understanding of pCu concentrations and potential exceedances of the pre-FS RAC. Post-white rain samples best define areas that might require remediation because they best represent current conditions. Of 155 final pCu locations, 102 were sampled in the STSIU after the white rain event. These 102 samples did not fully cover the outer edges of the STSIU, however, and 56 pre-white rain samples were added to fill in the gaps (Figure 3-7 and Table 3-4 of the FS Report). All pre-white rain samples used to bound the post-white rain samples had pCu > 5 with the exception of a few locations directly north of Hurley and just east of Tailing Pond 7. The use of pre-white rain pCu concentrations in the map is conservative as there is no new source of acidity, and natural attenuation is currently taking place.

These samples were used for the spatial interpolation of pCu (raster files produced with natural neighbor interpolation) and copper (Thiessen polygons), as described in Section 6.2, below. Figure 3-8 of the FS Report illustrates the binned pCu values for all the data and the interpolation using all the data.

6.2 Spatial Interpolation Methods

6.2.1 Copper

The distribution of copper across the STSIU was interpolated using the Thiessen polygon method. Figure D-6 provides the decision tree that was used to select this spatially-weighted averaging method to calculate a 95 UCL of total copper concentration in the exposure units in ArcGIS. The interpolation techniques in Figure D-6 are discussed in greater detail in USEPA (2004). The spatial interpolation/estimation choices included Thiessen polygons, inverse distance weighting (IDW), natural neighbor, or kriging. Factors that affected the decision included frequency of detections, spatial autocorrelation, relationship between polygon weights and concentration, exposure concentration relative to RAC, and semi-variogram fit. A plot of copper concentrations vs. weights of those samples as developed by Thiessen polygons showed a trend of generally higher concentrations for lower weights, reflecting increased samples in areas of higher copper concentration. Because there were no significant peaks in this trend, Thiessen polygons were determined to be an appropriate method for the copper interpolation. Figure 3-4 of the FS Report presents the Thiessen polygons and their binned concentrations for polygons that exceed 1,100 mg/kg of copper.

6.2.2 pCu

Using the Figure D-6 flow chart, natural neighbor was selected as the best interpolation method for pCu. The natural neighbor method was used instead of kriging (which was proposed in the FS Work Plan) because the final dataset supplemented with 2011 data did not produce a semi-variogram that met assumptions of a kriging model. The pCu data showed poor spatial autocorrelations (Moran's I z-score < 1.65), indicating that kriging was an inappropriate interpolation method for the dataset. Natural neighbor was chosen as an interpolation method requiring fewer up-front assumptions which also requires no choice of parameterization. A natural neighbor interpolation uses a Thiessen polygon surface created using existing samples to interpolate a raster grid. Each output grid cell is treated as a new sample and used to create a new Thiessen polygon layer adjusted using the additional point. The value of each cell is calculated as a weighted average of the portions of the original Thiessen polygon that intersect the new polygon. This is done for all raster grid cells to create an interpolated surface. This is a simple method of interpolation that favors the local neighborhood over more distant samples by basing interpolated values only on the closest sample locations. Unlike more complex interpolations such as kriging, natural neighbor has few prerequisites or data distribution requirements for use, and no varying parameters. The resulting map has pCu values for every grid cell, which can be used to create pCu contours as shown in Figure 3-8 of the FS Report. However, contours were not used; rather, the average value of all interpolated pCu grid cells within each rangeland polygon was determined using zonal statistics in ArcPro (results are in Table D-2).

6.2.3 Spatial Model Assessment

The concentrations on the site range from 2.7 to 10.2 s.u. for pCu and from 14 to 21,350 mg/kg for total copper.[5] The more nearby sampling points available to inform the estimated concentration of a given pixel or Thiessen polygon, the less uncertainty is associated with the final interpolated map. The consequences of decision errors (incorrect classification of an area) of the magnitude of one contour interval are low at pCu concentrations < 4 and > 7, and at copper concentrations < 800 and > 1,900 mg/kg. Consequences of errors at concentrations between these values that encompass the pre-FS RAC threshold are of more concern, and thus were targeted in the sampling to ensure most values obtained for the FS (pre-IRAs) fall within these ranges.

7. Exposure Unit Finalization

As described in Section 5.1, woody cover was evaluated to determine if drainage banks should be delineated as exposure units separate from upland exposure units for copper. Remote sensing was used to obtain the full coverage of three drainage banks on both sides of the drainage (Figure D-5 shows the most northern drainage, D3), and field data were used to validate the woody cover map of the drainages. Using the line intercept method, percent cover of woody vegetation was estimated in the field on 300-foot transects at 12 locations along three STSIU drainages of concern (Figure D-4) and their adjacent uplands;

---

[5] Copper data adjusted to represent 0 to 6-inch soil depth and sieved to < 2 mm, as needed (Table 3-2 of the FS Report).

This ground-truthing field data and more detailed maps of the bank and upland field transects are presented in Attachment D.[6]

The Normalized Difference Vegetation Index (NDVI), calculated on IKONOS 4-band imagery, was employed to estimate the percent of the vegetation in these areas that is woody. NVDI is high in dense, healthy, growing vegetation, and previous work has shown spectral bands in NDVI, particularly in the near-infrared, have a unique signature for dense woody versus non-woody vegetation (Huete et al. 1997). The four-band IKONOS imagery of the STSIU obtained is described in the next section (Section 8.1). Remote sensing of bank vegetation along ephemeral drainages on this imagery focused on the near-infrared portion of the electromagnetic spectrum to assess percent woody cover using a scaled NDVI (see Section 8.1 for details) but also evaluated shape to identify objects that are shrubs or trees. Thus, two approaches were evaluated: using scaled NDVI alone, and a hybrid approach of combining shape and spectral reflectance of clusters of similar pixels. Both methods do not use a training dataset. Although results were similar between the two methods, the scaled NDVI was found to best identify woody plants and estimate woody cover (Figure D-5), when compared to the field estimates of woody cover. The percent of the ground area with woody canopy cover was estimated with the scaled NDVI for the entire area of the two banks in the imagery and in the adjacent uplands (see Figure D-D-4 for length of drainage evaluated and Figure D-D-2 in Attachment D for width of buffers used).

Only one composite sample on one of the three sampled drainages had copper concentrations along the banks greater than the SGFB pre-FS RAC (2,110 mg/kg at STS-BWC-2011-7 in Figure D-4; also, see Table D-D-1 in Attachment D), which indicates copper exposure units along the other two drainage banks are not needed.[7] Woody cover for the entire stream bank of the high-copper drainage (called Drainage D3) was estimated using remote sensing from the 0.8 m resolution imagery (Figure D-5) as 70%. The adjacent upland mean woody cover estimate for this drainage was higher at 77% (7% difference), which was opposite from what was expected and too small a difference (< 25%) to differentiate upland from drainage banks. Moreover, both the banks and upland in Drainage D3 were mostly dominated or co-dominated by the same species, oak (see Table D-D-1 in Attachment D). These remote sensing estimates are reasonably accurate for Drainage D3, within 3% of the field estimate of woody cover for the banks on average and within 16% for the upland on average (with R^2 of predicted vs. observed cover for banks and upland each > 0.97; see Figure D-D-1 in Attachment D). The average accuracy for upland and banks combined for Drainage D3 is within 10 percentage points of field measurements (Figure D-D-1 in Attachment D), which meets the goal accuracy of being within 10 percentage points. However, less than 70% of all the transects of all the drainages were within 10%, which was a target almost met (3 of 4 were within 10.7%, 2 of 4 within 10%; data in Table D-D-1 in Attachment D-1). Nonetheless, if field data are relied upon, the field data for Drainage D3 also showed a small mean difference between upland and bank woody cover of 13% (but in opposite direction, with higher cover on banks), which is not statistically significant (paired t-test, P = 0.21), and still less than the threshold of 25%. Both the field and remote sensing data support the difference is small and within the expected plus- or minus error range, given the irregularity of the bank line that was difficult to sample in the field. Therefore, the existing vegetation alliance polygons that encompass the upland and banks of the drainages were used as the ecological exposure units for SGFB, without differentiating between upland and banks of drainages.

---

[6] In Attachment D, Table D-D-1 has summary field data, Table D-2 has the line intercept lengths, Figure D-D-1 shows the accuracy assessment, Figure D-D-2 illustrates buffer sizes used for remote sensing, and Figure D-D-3 presents the locations of the 4 field transects on Drainage D3.

[7] Relative percent difference in copper on bank sample with duplicate sample was 59%, which is slightly higher than targeted $\leq$ 50% in QAPP.

For pCu, exposure units were rangeland polygons that were in areas with copper greater than 327 mg/kg (shaded rows in Table D-2). The 327 mg/kg criterium is needed to evaluate pCu only in areas that may require remediation, which are greater than 327 mg/kg based on the pre-FS RAC.

8. Upland Vegetation Results and Mapping

The data available for rangeland condition, cover, and richness in key areas of the site with lower pCu were limited, and thus field sampling and remote sensing was proposed in the FS Work Plan to produce a map of these metrics across the STSIU. Only four ERA samples that had habitat sampling in Newfields (2006) fall within the current estimated pCu < 5 contour zone (in purple on Figure 3-8 in the FS report). Therefore, OAT scores, percent cover and richness maps in the pCu < 5 area were developed using remote sensing with ground truthing data to update knowledge of wildlife habitat quality in this area. The upland vegetation data collected in the field are reported in Appendix C of the FS Report and Attachment A of this Appendix for all plots and OAT score transects evaluated for the FS. Data not used to train the remote sensing classifications were used to test the accuracy of the remote sensing maps of OAT score, vegetation cover, and vegetation richness.

8.1 Map Development using Remote Sensing

Rangeland condition, vegetative cover, and species richness were assessed using IKONOS satellite imagery of the site collected on September 4, 2011 (Figure D-4). The IKONOS image has four multispectral bands, blue, green, red, and near-infrared. The sensor also collects imagery in a panchromatic band that senses across the visible portion of the electromagnetic spectrum. The raw multispectral bands have a ground sample distance of 3.2 m at nadir, while the panchromatic band senses at 0.8 m at nadir. The panchromatic band was used to pan-sharpen the multispectral imagery, bringing the final imagery to the full 0.8 m ground sample distance while retaining its more detailed spectral information.

Rangeland condition was classified using a maximum likelihood supervised classification of the IKONOS imagery. The reference sites were randomly divided into training and independent validation datasets and classified as acceptable or unacceptable, with an OAT score of 22 (see Section 9.3) or higher considered acceptable (unless it was bedrock and then the threshold for bedrock specified in Attachment A was used because good rangeland on bedrock is never as high as 22). Training data were used to train a maximum likelihood classifier. Reflectance intensity in all four bands (blue, green, red, and near-infrared) of the unsampled cells in the Ikonos image was compared to the values of the training clusters and assigned the class they were closest to in terms of spectral distance. The reserved independent reference sites were used to assess the accuracy of the classification (described in Section 8.2, below). The final OAT score map with two classes of acceptable (fair to good) and unacceptable (poor) rangeland condition is shown in Figure D-9.

Percent vegetative cover was classified using a scaled NDVI derived from the IKONOS imagery. As discussed above, NDVI is an index that uses near-infrared reflectance, which correlates strongly with healthy vegetation, to classify the presence of vegetation. NDVI uses the relative difference of near-infrared and red bands to differentiate between vegetation and other types of cover (e.g. concrete or bare soil) that also reflect near-infrared solar radiation. A standard NDVI score is a unitless value ranging from -1 to 1, with values influenced both by conditions on the ground, time of year, and atmospheric effects during image collection. The scaled NDVI method uses areas of known full vegetation and zero cover to calibrate a given NDVI image so that it ranges from 0 to 100% cover. Known full vegetation and zero cover areas selected were based on discussions with field biologists and were selected after reviewing photos of the general area and comparing photos to the imagery. The vegetation cover map was converted into a map of acceptable and unacceptable cover (Figure D-

10), using acceptability thresholds for each mapped soil category defined in Attachment A (also see brief discussion of reference area-based thresholds in Section 9.3).

Species richness was classified using a hybrid maximum likelihood classifier. Because species richness is not a meaningful metric when applied to a single cell of pan-sharpened IKONOS imagery, which has a ground sample distance and thus small pixel size of 0.8 m, richness was assessed over larger, 30 m by 30 m cells. A mean and standard deviation of the NDVI values of each IKONOS pixel were derived for each 30 m by 30 m cell, and these derived values, rather than primary IKONOS reflectance intensity, were used as input for a maximum likelihood classifier of richness. The species richness map was converted into a map of acceptable and unacceptable richness (Figure D-11) using acceptability thresholds for each mapped soil category defined in Attachment A.

An exposure unit had to be unacceptable for both rangeland and wildlife habitat to be unacceptable. Unacceptable wildlife habitat is defined as having either unacceptable richness or cover. Figure D-12 maps the unacceptable wildlife habitat with the pCu contours overlaid on the habitat map. This map was joined with the rangeland condition (OAT) map in Figure D-9 to create the final map of unacceptable rangeland polygons (unacceptable for both rangeland and wildlife habitat) that average pCu < 5, which is shown in Figure 3-11 of the FS report.

8.2 Accuracy Assessment of Remote-Sensing Derived Vegetation Maps

The target accuracy of the remote sensing maps of vegetation characteristics in Figures 3-9, 3-10, and 3-11 was set to 70% correct classification in the FS work plan. The FS work plan indicated jackknife cross-validation would be used for assessing accuracy, but the approach was changed for the OAT score to using a randomly selected subset to train the supervised classification and using the remaining independent set to assess accuracy, as discussed in the previous section.[8] For cover and richness, the mapping method did not use any plot data for training, and thus all the ground data could be used in the accuracy assessment and a jackknife method was not required. A level of 80% is desirable for well-defined remote sensing methods (ESRI 1994) but may not be attainable given the high, often undetectable small-scale variability that affects the vegetation; thus 70% was the target, which is often acceptable for management purposes.

For rangeland condition and species richness/cover mapping, the variables mapped (for example, acceptable versus unacceptable OAT scores for the rangeland condition map) have two classes that were evaluated for accuracy. Errors of omission are instances where an acceptable condition is classified as unacceptable and errors of commission are where unacceptable condition is classified as acceptable. In general, it is desirable to make the rates of these errors approximately equal. But to be conservative, the focus was on finding all areas on the ground of unacceptable condition even at the expense of missing some areas of acceptable condition. The goal was to attain no more than a 15% error of commission for the class mapped as acceptable. The FS work plan stated that, if the remote sensing data are inadequate at differentiating these two classes for OAT scores and species richness, then the two classes of vegetation cover (acceptable or unacceptable) may be the main criteria used to screen areas with pCu < 5 for remediation because vegetation cover may be easier to identify using remote sensing. However, as discussed below, overall accuracy was relatively similar between cover and richness and best for the OAT score, although error of commission was poorer for richness.

For rangeland condition, three-fourths of the 31 available ground samples were used for training and one-fourth of the samples were used for accuracy assessment. The accuracy of the OAT score maps in identifying the two classes on the independent data that was one-fourth of the dataset (8 locations) was very good at 88% (Table 3-5 of the FS Report). The error of commission was 17%; this error rate

---

[8] Jackknife method is less certain than using a completely independent dataset.

is above the targeted 15% but likely would have met the goal if more than 6 locations were available to compare (only 1 of 6 was misclassified, meaning minimum error can only be 0% or 17%, not the targeted 15%).

For vegetation cover, more data were available to assess accuracy. Because locations were independent of the high and low value endpoints used to calibrate the vegetative cover model, all field data (19 sites in Figure D-3 plus data from 12 supplemental locations available on the STSIU from later studies up to 2018) were used to assess the accuracy of vegetation cover. Overall accuracy of vegetation cover was 74% (Table 3-5 of the FS Report), meeting the target of at least 70% and considered adequate for FS purposes. Error of commission for the “acceptable” mapped class was 18%, only slightly over the goal of 15% error. This means that areas of actual acceptable cover were generally identified correctly as acceptable on the map, although a small percentage (18%) of areas of unacceptable cover were classified as acceptable.

As with vegetation cover, all field sites were used to evaluate map accuracy of species richness. Overall accuracy of the richness map was 71%, with a 40% error of commission for the “acceptable” class (Table 3-5 of the FS Report). The error of commission target was missed for richness, but, as described above and in the FS Work Plan, richness may be challenging to model, and results should rely more heavily on vegetation cover. However, if relying only on vegetation cover for screening polygons, more areas would be screened out of consideration for remediation than if richness were included. Since the objective is to ensure the rangeland polygon has *both* acceptable cover and richness before being screened out from remediation, richness was still included to ensure areas with potentially poor richness were retained for further evaluation.

9. Copper and pCu Decision Criteria

As discussed in Section 2, the pre-FS RAC are evaluated within exposure units delineated based on habitat. The term “habitat unit” had not been defined for the AOC. The habitat polygons in the existing Alliance Level vegetation maps from the site wide ERA were used as habitat units for upland and bank areas, which was supported by the evaluation presented in Section 7 for drainage bank versus upland habitats. The vegetation alliance map, developed by DSB&A (2000), used more than 350 sampled areas and 1:18,000 scale black and white aerial photos for interpretation, an approach considered to be sufficient to define general vegetation boundaries and for defining habitat units for SGFB exposure. Field reconnaissance of these boundaries supported the boundaries were adequate. Exposure unit concentrations compared to decision criteria for evaluating exceedances of the pre-FS RAC are discussed below.

9.1 Exposure Units Evaluated for Different Receptors

The pre-FS criteria for copper of 1,600 mg/kg for protection of the SGFB (and 1,100 mg/kg for monitoring) was applied to the spatially-weighted 95 UCL concentrations in the vegetation alliance polygons used as exposure units, of which a number exceeded 1,600 mg/kg before IRAs and reclamation borrow activities occurred. Spatially-weighted 95 UCL concentrations were re-calculated with the IRA dataset included; the results are discussed in Section 10.1, below.

In contrast, the copper human health RAC of 5,000 mg/kg was applied on a point-by-point basis to human health copper concentrations (points are the centers of the Thiessen polygons, see Table 3-2 of the FS Report for human health concentrations at all the locations) similar to methods described in the STSIU Interim Action Work Plan (IRAWP; Arcadis 2006).

As discussed previously, the vegetation-based exposure units for pCu are the existing rangeland polygons (Woodward Clyde 1997, Figure 3-11 of the FS Report) defined by combinations of different soil and vegetation types. Only rangeland polygons within areas with mean copper concentrations greater than 327 mg/kg were included (Table D-2). The rangeland polygons were overlaid on the map of IRA and borrow areas, and the portion of the polygon in a removed or remediated area was removed from its acreage. Over 40 polygons were preliminarily identified in the STSIU areas with potentially low pCu and ranged from less than one acre to greater than 859 acres (Figure 3-9 of the FS report).

9.2 Decision Criteria for Comparing to Copper pre-FS-RAC

For assessing areas that might need remediation for birds represented by the SGFB, if an exposure unit (vegetation alliance polygon) contained copper concentrations greater than or equal to the pre-FS RAC for SGFB exposure monitoring (1,100 mg/kg for 6 inch depth and sieved at 2 mm), a spatially-weighted 95UCL of the mean copper concentration was calculated for the given exposure unit using the percentile bootstrap method.[9] The area of each Thiessen polygon surrounding the sample point was used for the spatial weighting, and the bootstrap method provided the standard deviation of the mean used in the calculation of the 95UCL. For these calculations, when soil was removed in a borrow area or interim action area without concentrations (Figure 3-7 of the FS report shows borrow pit and IRA areas where soil was excavated and removed), the 95UCLs for the SGFB exposure units were recalculated by replacing the Thiessen polygon values with 327 mg/kg (assumed post-removal copper concentration is at background, given depth of excavation). All exposure units with a spatially-weighted 95UCL greater than the pre-FS RAC criteria of 1,600 mg/kg that were not removed as borrow or in IRAs would be evaluated for remedial alternatives in the FS Report. Figure 3-5 of the FS Report presents the results spatially, showing none of the exposure unit 95UCL estimates exceeded 1600 mg/kg. Exposure units with copper 95UCLs greater than 1,100 mg/kg but less than 1,600 mg/kg (yellow exposure units on Figure 3-3 of the FS Report) will require biotic and/or abiotic media monitoring to evaluate risk to SGFBs, as requested by NMED (2011a,b) with specifics of monitoring to be decided in the future. If an exposure unit did not have a 95UCL copper result greater than 1,100 mg/kg, it was not considered further. Table 3-3 of the FS Report includes the alliance-sized exposure units that have concentrations in excess of 1,100 mg/kg for at least one of the Thiessen polygons within each alliance polygon and tabulates each exposure unit's final 95UCL concentration.

For human health criteria, if an individual sample point within a Thiessen polygon (the exposure unit for human health) contained a copper concentration greater than the 5,000 mg/kg human health pre-FS RAC (evaluated with 0.25 mm sieve and at 0-1 inch depth) after all the remediation and borrow activities were accounted for, the polygon will be retained for remedial evaluation for compliance with the human health pre-FS RAC. However, those few locations that remained after the large areas were remediated or removed (see Tables 3-2 in FS report) either had bedrock with unimportant exposure (sample result represents dust that could be wiped off the rock), were too steep for remedy, had infrastructure present, or were part of the right-of-way and could not be remediated. Thus, copper remediation or monitoring alternatives in the FS are focused on compliance with the avian pre-FS RAC, as human health remediation has been completed as part of interim action plans and borrow activities.

9.3 Decision Criteria for Comparing to pCu pre-FS-RAC

A challenge with defining areas for remediation based solely upon the pCu pre-FS RAC criteria is that in many areas that may have pCu < 5, good rangeland or habitat conditions may still exist; more harm than good may be done if remediated. The assumption of environmental benefit is based on the likely amount of time required for the ecosystem to recover after remedial disturbance. For fair to good

---

[9] 5,000 iterations (USEPA 2010) implemented by a macro developed for EXCEL.

rangeland, these ecosystems are predicted to require at least 1 to 2 decades to regain an equivalent level of function assuming that soil loss is minimal (see Section 7.8 and Appendix B-3 within Appendix A of the FS Report for a more detailed evaluation). The inherent climatic variability in this region complicates the predictability of the plant response and likelihood of near-term success. Furthermore, range conditions likely improved since 1997 following cessation of smelter activities in 2003 and the white rain event in 2008 (see Appendix A and B of the FS Report). Therefore, the decision to remediate areas with pCu < 5 was based upon consideration of the current rangeland condition and wildlife habitat quality.

The assumption of the pre-FS RAC is that pCu can adversely impact and be correlated to rangeland condition and wildlife habitat quality, with the latter shown by correlations with vegetation richness and cover (see Figure 5 relationships in Attachment A). However, the soil surface pCu may be a poor correlate or predictor if certain conditions apply. One condition is when grazing is strongly affecting the vegetation community's condition, as seen for vegetative cover in flat rocky soils that have had heavy grazing (Figure 5 in Attachment A). A second condition is when the soil chemistry contains a buffer not accounted for by pCu that reduces vegetative degradation, as seen for cover in steep slope soils that are well-buffered (Figure 5, Attachment A). Therefore, thresholds for defining an unacceptable condition likely resulting from pCu need to be derived separately for each soil category before applying the pre-FS RAC.

Only areas in unacceptable vegetative condition that are also in areas with concentrations below the pre-FS RAC for pCu were considered for remediation. The threshold between unacceptable and acceptable rangeland condition in the STSIU was set to 22 for the STSIU non-bedrock areas based on data in the area. Notably, the threshold can vary depending on the area, and the selected value of 22 is higher than thresholds used in some areas outside of the STSIU and is also too high for the bedrock soil category within the STSIU. For example, BLM Environmental Impact Statement, Drewsey Resource Area in Oregon used 17 as the threshold (BLM 1984), which was also used by NRCS in Wyoming. The threshold for the STSIU was determined by evaluating all soil stability and plant distribution data collected for the rangeland evaluation in 1997 in the STSIU (see worksheet in Appendix B of Woodward Clyde 1997), which produced preliminary rangeland classifications ranging from Excellent, Good, Fair, to Poor. Comparing the OAT score to these classifications for rangeland polygons that potentially have pCu < 5 suggested an OAT score greater than 22 mostly represented fair to good rangeland condition in habitats that are not dominated by bedrock. Photographs from the vegetation investigation conducted for the FS further supported that 22 and above represents fair to good rangeland (see photos of sites in Appendix I within Appendix C of the FS Report). For bedrock areas in the STSIU, the OAT score threshold is lower, set at 13; this threshold is based on bedrock reference areas in the vicinity of the STSIU, as described in Attachment A.[10]

---

[10] The following information further supports using an OAT score of 22 as the threshold for unacceptable condition for non-bedrock areas. Past grazing management has affected the amount and composition of vegetation independent of chemical stressors due to historical mineral processing. In New Mexico, grazing alone has depressed vegetation cover levels by up to 39% (Gamougoun et al. 1984; Weltz and Wood 1986), which can result in poor to fair rangeland condition. The impacts of past grazing practices are compounded on soils with inherent productivity limitations. Many of the soils in the STSIU have limitations associated with high clay contents and restricted thickness over bedrock or indurated caliche layers (SCS 1983). The combined effects of these conditions are seen at Chino on the rangeland to the east of the tailing impoundments. Some of these areas had OAT scores < 22 where pCu was > 5 (based on OAT score data collected, see Section 5.1), a result of moderate to heavy grazing over the last 100 years on areas with marginal soils. A "fair" rangeland condition, defined as 25 to 50 percent of theoretical optimum for the soil type and slope, is consistent with what would be expected of a system exposed to over 100 years of grazing without other stressors such as copper and is consistent with the range of foliar cover observed within the area

The adequacy of wildlife habitat in ungrazed areas was defined in the FS Work Plan as acceptable if cover was greater than 32% and richness was greater than 8, in accordance with MMD guidance and revegetation success guidelines developed for Chino, assuming climatic and grazing conditions are relatively similar to conditions of the reference plots used to assign these criteria (DBS&A 1999). However, those guidelines apply to ungrazed areas. All areas with pCu < 5 were grazed; as such, these numeric criteria do not apply. Rather, as was done in DBS&A (1999), proportional success guidelines were applied to the endpoints measured on grazed reference areas. Eight grazed reference areas east of Lampbright Draw with little impact from the smelter were found to represent the range of topographic and soil conditions of impacted, grazed locations on the STSIU. The methods used to select and sample these reference areas and the results from the sampling of the selected reference areas are presented in Attachment A. Additionally, the phytotoxicity and vegetation community study on the STSIU (Appendix C of the FS Report) demonstrated that four “soil/slope categories” (soil categories) have a strong influence on STSIU plant community richness and cover, and NMED agreed that the effect of these soil categories on the RAC should be considered in the STSIU FS Report (see NMED comments at end of Appendix C). The vegetation community study that was part of that phytotoxicity report, conducted in 2014, identified and sampled two additional reference locations for the community analysis, which were also included as reference areas for the FS, resulting in a total of ten reference areas used for comparing plant communities on site to reference areas. Sampling of these ten reference areas provided background values for community metric endpoints of cover, richness, and rangeland condition (via OAT score) across the following four soil categories identified in the phytotoxicity and vegetation community study (Appendix C of the FS Report):

1. Flat granular
2. Flat rocky
3. Bedrock
4. Steeper slopes (>13%).

The decision criteria for remediation was to identify rangeland polygons with pCu < 5 and a poor (unacceptable) rangeland condition that also have unacceptable richness or cover.[11] Specifically, as determined in the reference area investigation (Attachment A), the following criteria were used to remove polygons from remedial consideration where the destruction of the existing vegetation and inevitable increase in soil erosion associated with remediation could lead to a loss of environmental benefits, causing more harm than good.

- If the OAT score of the rangeland polygon was ≥ 22 for all soil categories except bedrock, the polygon was considered to have “fair-good” rangeland condition, was acceptable, and, therefore, was excluded from further evaluation. For bedrock, the threshold for being acceptable was ≥ 13. If the OAT score

---

with pCu < 5 (SCS 1976). Similarly, wildlife habitat is classified as fair to poor throughout Grant County (SCS 1983). Consequently, in accordance with the pre-FS RAC, areas with pCu < 5 and an OAT score of less than 22 were evaluated for remedial alternatives. In contrast, areas with pCu < 5 and an OAT score of greater than or equal to 22 were not further evaluated for remedial alternatives because an OAT score of 22 or greater represents a rangeland condition of mostly fair to good.

[11] If all or most of the reference sites of a soil category were considered unacceptable rangeland condition, however, as found for bedrock types, the numerical threshold of 22 for the OAT score was considered too high as a target, and a value consistent with reference was used instead. Note that the FS Work Plan indicated one reference plot would be used east of Lampbright Draw to define acceptability thresholds but the number was increased to capture the variability in the vegetation condition across the soil categories.

was < 22 (or < than 13 for bedrock, see Attachment A), the polygon's rangeland condition was considered "poor" and therefore unacceptable, and it was retained for further evaluation.

- If the percent cover was ≥ a targeted percentage of reference mean area values based on variability of the reference values, which differed for the four soil categories, the polygon was considered to have "acceptable" wildlife habitat for cover.
- If the species richness was ≥ a targeted percentage of reference area mean values based on variability of the reference values, which differed for the four soil categories, the polygon was considered to have "acceptable" wildlife habitat for richness.
- A rangeland polygon must have acceptable vegetation cover and richness to be considered acceptable wildlife habitat. However, if the rangeland polygon had unacceptable wildlife habitat but acceptable rangeland condition or the opposite (acceptable wildlife habitat and unacceptable rangeland), then the polygon was not retained for further remedial evaluation because any remediation will negatively affect either the wildlife or livestock using the area.

To determine proportional success guidelines, vegetation cover measured in 2018 at the reference location first was adjusted to vegetation cover expected at the same location in 2011 (the year of vegetation cover estimates for the STSIU locations in the phytotoxicity study) by applying a correction factor calculated from NDVI derived from Landsat 7 and 8 Images for 2011 and 2018, respectively. No correction factor was applied to richness due to lack of an adjustment method. Climatic differences that change the OAT score were taken into account by the investigators prior to assigning scores each year (by comparing the OAT score of the same plot each year). After these adjustments for interannual differences, a threshold value based on 2011 data, was selected for each soil category.

The guideline for establishing target thresholds for richness and cover was based on a proportion of the mean reference value for each soil category, determined by the spatial variability observed in the reference locations. Specifically, the spatial variability was measured using the relative percent difference (RPD = difference/mean) between the maximum and minimum value of reference locations in each soil category. This RPD was used to determine the proportion of the reference mean to be used as the target to classify a rangeland polygon on the STSIU as acceptable (if above target) or unacceptable (below target) for the screening step (e.g., if the RPD of a soil category is 50%, then the threshold for acceptability was based on half the reference value of that soil category). Reference means for the plant community endpoints for each soil category are presented in Table 4 of the reference area investigation (Attachment A). Figure D-9 shows the final remote-sensing based map of acceptable and unacceptable rangeland polygons, which were produced using the Table 4 target thresholds for acceptability. The areas remediated or that had soil removed during borrow activities (discussed in main FS report) were overlaid on the map of these exposure units, and those acres were assumed to be changed to pCu > 5 and were not further evaluated.

In summary, for pCu, if an area's rangeland condition was determined to be fair to good (based on OAT score) or wildlife habitat is acceptable (based on cover and richness data) or if the area was remediated or used for borrow, the area was not considered for remediation and is not discussed further in the FS Report. The criteria for acceptable wildlife habitat and fair to good rangeland condition was determined using proportional success guidelines relative to corresponding reference plots for each soil category, as described above. All areas with unacceptable rangeland and wildlife habitat condition as described above were identified and their respective pCu values were compared to the pre-FS RAC. Figure 3-11 of FS report shows the exposure units (rangeland polygons) with average pCu < 5 (before removing areas with IRAs or borrow activities).

A problem with this "one RAC fits all areas" approach, even after adjusting for habitat quality to prevent more harm done than good, is that the pre-FS RAC does not consider that the "response" of vegetation to pCu varies by soil category (see Appendix B and C). Therefore, before being considered for remedial alternatives in the FS report, the pCu of retained exposure units with unacceptable rangeland and wildlife condition and with mean pCu < 5 based on the spatially interpolated pCu map, were compared to a probable effect level (PEL) of pCu that depends on the soil category of the rangeland polygon, as described in Attachment A. The pCu PELs for each soil category are developed in Attachment A and are as follows:

Flat Granular: 2.97

Slopes: 2.97

Flat Rocky:4.60

Bedrock: 3.83

Each exposure unit (rangeland polygon) has a soil category assigned (see Figure 2 in Attachment A), based on its dominant soil category, or if split almost evenly between two types, the exposure unit was split into two separate units. If the exposure unit is less than the PEL, the unit was retained for remedial alternative evaluation. This approach and development of the PEL is discussed further in the next section.

10 Results and Estimate of Acreage to Consider for Remediation

10.1 Copper

The IRA and borrow area activities removed all habitat polygons with copper exceeding 1600 mg/kg. All Thiessen polygons with copper exceeding 5,000 mg/kg that could be remediated have been remediated. The FS report describes the habitat units that exceed 1,100 mg/kg that would require monitoring to protect the SGFB. Approximately 140 acres exceeded the monitoring pre-FS RAC for SGFB of 1,100 mg/kg and will be evaluated as part of a monitoring program, and these acres are discussed in the main FS report.

10.2 pCu

As described in this Appendix and Attachment A, additional soil sampling and vegetation community measurements were conducted in new locations in 2018 in cooperation with NMED to identify reference vegetation community target thresholds for unacceptable richness, cover, and OAT scores in pCu exposure units. However, this sampling was also used to develop soil category-specific PELs for pCu. The pre-FS RAC outlined in this Appendix are consistent with EPA use of pre-remedial goals (PRGs) in the NCP, which can be modified as new information becomes available; therefore, this new information can be used to refine the pre-FS RAC for pCu, which affects the selection of areas retained for remedial evaluation (§300.430(e)(2)(i) NCP).

The pre-FS RAC is generic in that it does not vary by soil category; yet soil category and its buffering capacity, have a strong influence on the relative effect of pCu on the plant community. To better understand actual adverse effect thresholds for plant communities in exposure units retained for remediation (retained based on the pre-FS RAC and habitat conditions as described in section 9.3), DELs and PELs for pCu were calculated for each soil category. These DELs and PELs were first calculated in the phytotoxicity study (Appendix C of FS Report). However, reference community data for all four soil categories was missing. The DELs and PELs were revised once data from the reference area investigation in 2018 were attained (Attachment A) by correlating community metrics with pCu and using the reference area metric values that represent each soil category to identify the corresponding DEL. A

50 percent effect level relative to the reference metric value was used to represent the corresponding PEL. In other words, the DEL and PEL are the respective pCu effect thresholds corresponding to 100 percent and 50 percent of the reference community endpoint value for each community endpoint and soil category (see Figure 5 in Attachment A).

The revised DELs and PELs, presented in Table 6 of the reference area investigation (Attachment A), provide context for net environmental benefit when evaluating remediation approaches. The average PELs across the soil types ranged from 2.97 to 4.60, with the highest values in the flat rocky soil category. Based on this new, site-specific refined information, the PELs for each soil category are used to identify acres for remedial alternative evaluation in this FS Report in accordance with the soil category of the exposure unit. This identification occurs after percent cover, richness and OAT score are used to identify exposure units with acceptable rangeland or wildlife habitat, as described in the approved FS Work Plan (Appendix A in Arcadis 2011c) and detailed in previous sections of this Appendix. The comparison to PELs occurs after these acceptable areas are removed from further consideration, and after areas with IRAs or borrow activities are removed from further evaluation.

The identified acres that remain after the PEL screening are reviewed for remedial alternatives in the main FS Report. The mapped acres with pCu < PELs for each soil category consisted of 113 acres of flat rocky soil areas (Table D-3). The pCu of exposure units in the other three soil categories did not exceed their PELs (Table 3-7 in FS report). If a retained rangeland polygon had an average pCu ≥ its PEL, it was removed from further analysis. Thus, the retained rangeland polygons were all in flat rocky soils with average pCu ≤ 4.6, which is the flat rocky PEL, and the acreage of these polygons totaled 113 (Figure 3-12 of the FS Report). The FS Report evaluates remedial alternatives for these 113 acres to restore the plant community adversely affected in those areas by pCu.

10.3 Summary

In summary, no exposure units for SGFB exceed the pre-FS RAC of 1600 mg/kg of copper. For pCu, 113 acres are considered for remediation of pCu to protect the vegetation that serves as rangeland for livestock and habitat for wildlife. Additionally, 140 acres are considered for monitoring to ensure SGFB are protected at copper concentrations that occur in some polygons between 1,100 mg/kg and 1,600 mg/kg.

11 References

Arcadis. 2001. Phase RI II Report for the Ecological Investigation Unit. Prepared for Chino Mines Company, Hurley, New Mexico.

Arcadis. 2006. Interim Removal Action for Smelter/ Tailing Soils Investigation Unit, Health and Safety Plan. Prepared for Chino Mines Company, Hurley, New Mexico.

Arcadis. 2009. Interim Removal Action for Smelter/ Tailing Soils Investigation Unit. Prepared for Chino Mines Company, Hurley, New Mexico.

Arcadis. 2010a. Administrative Order on Consent Soil pH Monitoring Plan Smelter/Tailing Soils Investigation Unit. Prepared for Freeport McMoRan Chino Mines Company, Vanadium, New Mexico.

Arcadis. 2010b. Terrestrial Invertebrate Copper Bioaccumulation and Bioavailability Study for Smelter/ Tailing Soils Investigation Unit. Prepared for Freeport McMoRan Chino Mines Company, Vanadium, New Mexico.

Arcadis. 2011a. Year 1 pH Monitoring Report for Smelter/ Tailing Soils Investigation Unit. Prepared for Freeport McMoRan Chino Mines Company, Vanadium, New Mexico.

Arcadis. 2011b. Year 2 Monitoring Report for Smelter/ Tailing Soils Investigation Unit Amendment Study Plots. Prepared for Freeport McMoRan Chino Mines Company, Vanadium, New Mexico.

Arcadis. 2011c. Administrative Order on Consent Feasibility Study Proposal. Smelter Tailings Soils Investigation Unit. Prepared for Chino Mines Company, Hurley, New Mexico. October.

Arcadis. 2020. B-Ranch Interim Removal Action for Smelter/ Tailing Soils Investigation Unit. Prepared for Chino Mines Company, Hurley, New Mexico, August.

Bureau of Land Management (BLM). 1984. John Day Resource Management Plan and Environment Impact Statement. U.S. Department of the Interior. 96-00422-HA.

Chino Mines Company (Chino). 1995. Administrative Order on Consent, Investigation Area, Remedial Investigation Background Report, Chino Mines Investigation Area, Prepared by Chino Mines Company, Hurley, New Mexico, October 5.

Chino. 1997. Administrative Order on Consent, Quality Assurance Plan, Chino Mine Investigation Area. March.

Daniel B. Stephens & Associates (DBS&A). 1999. Interim Technical Standards for Revegetation Success. Chino Mines Company. Prepared for Chino Mines Company, Hurley, New Mexico. November 30.

DBS&A. 2000. Comprehensive Vegetation Survey of the Chino Mine. Grant County, New Mexico. Prepared for Chino Mines Company, Hurley, New Mexico. June 5.

Environmental Systems Research Institute (ESRI). 1994. Accuracy assessment procedures. Prepared for U.S. Department of Interior, National Biological Survey and National Park Service.

Gamougoun, N.D., R.P. Smith, M.K. Wood, and R.D. Pieper. 1984. Soil, Vegetation, and Hydrologic Responses to Grazing Management at Fort Stanton, New Mexico. J. Range Mang 37(6). November.

Golder. 2013. Supplemental Completion Report, Interim Removal Action, Smelter/Tailing Soils Investigation Unit. May 28.

Golder. 2015. Supplemental Completion Report, Razorback Ridge Area, Interim Remedial Action, Smelter/Tailings Soils Investigation Unit. August.

Gradient. 2008. Chino Mines Administrative Order on Consent, STSIU Human Health Risk Assessment, July.

Huete, A.R., H.Q. Liu, K. Bathily, and W. van Leewen. 1997. A comparison of vegetation indices over a global set of TM images for EOS-MODIS. Remote Sens. Environ 59:440-451.

NewFields. 2006. Chino Mines Administrative Order on Consent, Site-Wide Ecological Risk Assessment, February.

NewFields. 2008. Chino Mines Administrative Order on Consent, STSIU Ecological Risk Assessment, July.

New Mexico Environment Department (NMED). 2011a. Chino AOC Informal Dispute Resolution, STSIU, Chino Administrative Order on Consent; March 3.

NMED. 2011b. Letter to Mr. Ned Hall from Mr. Bill Olsen Regarding Resolution of Information Dispute Resolution. March 3.

Soil Conservation Service (SCS). 1983. Soil Survey – Grant County, New Mexico, Central and Southern Parts.

SCS. 1976. National Range Handbook. Soil Conservation Service, U.S. Department of Agriculture. July 13.

SRK. 2008. Administrative Order on Consent Remedial Investigation Report for the Smelter/Tailing Soils Investigation Unit, Revision 2. February 2.

URS Corporation. 2012. Data validation report feasibility study proposal- Smelter/Tailings Soil Investigation Unit. Prepared for Freeport-McMoRan Copper & Gold. May 21.

USEPA. 2004. Developing Spatially Interpolated Surfaces and Estimating Uncertainty. U.S. Environmental Protection Agency, 454/R-04-004.

USEPA. 2010. ProUCL Version 4.1.00 Technical Guide. Office of Research and Development. EPA-600-R-07-041. Draft. May.

Weltz, M. and M.K. Wood. 1986. Short Duration Grazing in Central New Mexico: Effects on Infiltration Rates. J. of Range Management 39(4). July.

Woodward Clyde. 1997. Administrative Order on Consent Phase I Ecological Remedial Investigation Proposal, Chino Mine Investigation Area. Prepared for New Mexico Environmental Department and Chino Mines Company.

Tables (1 in-text, below; 2 in .xls file)

Table D-1
Criteria used to score Observed Apparent Trend (OAT)
Freeport-McMoran Chino Mines Company
Vanadium, New Mexico
Appendix D of Smelter/Tailings Soils Feasibility Study

Check appropriate box in each category which best fits area being observed. Points may vary within each category. Points are summed to derive final OAT score.

☐ **VIGOR** (10 points)	Desirable grasses, forbs and shrubs are vigorous, showing good health. These plants have good size, color, and produce abundant herbage.
☐ (6 points)	Desirable grasses, forbs and shrubs have moderate vigor. They are medium size with fair color, and produce moderate amounts of herbage. Some seed stalks and seed heads are present.
☐ (2 points)	Desirable grasses, forbs and shrubs have low vigor. They appear unhealthy with small size and poor color. Portions of clumps or entire plants are dead or dying. Seed stalks and seed heads are non-existent, except in protected areas.
☐ **SEEDLINGS** (10 points)	There is seedling establishment of desirable grasses, forbs and shrubs. Seedlings are present in open spaces between plants and along edges of soil pedestals. Few seedlings of invader or undesirable plants are present.
☐ (6 points)	Some seedlings of desirable grasses, forbs and shrubs may or may not be present in open spaces between plants. Some seedlings of invader or undesirable plant species may or may not be present.
☐ (2 points)	Few if any seedlings of desirable grasses, forbs and shrubs are being established. Seedlings of invader or undesirable plants are present in open spaces between plants.
☐ **SURFACE LITTER** (5 points)	Surface litter is accumulating in place.
☐ (3 points)	Moderate movement of surface litter is apparent and deposited against obstacles.
☐ (1 point)	Very little surface litter is remaining.
☐ **PEDESTALS** (5 points)	There is little visual evidence of pedestalling. Those pedestals present are sloping or rounding and accumulating litter. Desirable forage grasses may be found along edges of pedestals.
☐ (3 points)	There is moderate pedestalling with no visual evidence of healing or deterioration. Small rock and plant pedestals may be occurring in flow patterns.
☐ (1 point)	Most rocks and plants are pedestalled. Pedestals are sharp-sided and eroding, often exposing grass roots.
☐ **SURFACE CRUSTING** (5 points)	There is little visual evidence of surface crusting.
☐ (3 points)	There is moderate surface crusting, with no visual evidence of healing or deterioration. (Note reason for cause)
☐ (1 point)	Severe surface crusting. (Note reason for cause)

Table D-2
Rangeland polygon mean copper and pCu values.
Freeport-McMoran Chino Mines Company
Vanadium, New Mexico
Appendix D of Smelter/Tailings Soils Feasibility Study

Rangeland Polygon ID	Acres	Mean copper (mg/kg)	Mean pCu
HW112/163	2883	1271	6.88
HE189/191	495	1177	5.45
HW168	1837	1125	5.97
HE186	768	1076	5.04
HE216	1309	1064	3.87
HW125	177	1024	5.47
HW111/165	5589	1020	7.06
HE192	3449	993	4.61
HE193B	523	916	4.19
HE187	568	897	5.33
HW120	820	876	5.74
HE196	964	856	4.50
HE309	460	831	4.79
HE305/306	126	814	6.30
HE193	5738	802	4.48
HW112B	810	795	5.69
HW116	460	785	5.94
HE196B	1158	767	4.69
HW121	163	741	5.83
HE190	447	732	5.59
HE382	105	710	7.96
HW161	795	626	7.50
HW161	694	626	7.50
HE291	3116	620	5.13
HE308	2020	615	4.77
HW124	332	607	5.52
HW118	320	606	5.74
HE32A	976	603	4.70
HE292	279	600	5.65
HW184	10	598	8.24
HE176	39	598	5.67
HW156/157	39	597	7.19
HE311	19	595	5.16
HE211	67	595	4.98
HE195	24	584	4.76
HE533A, HE203/204/205/206	652	579	5.43
HE93F	132	563	5.37
HE312	126	561	4.86
HE533B	44	555	5.31
HW155/160	349	536	7.74
HE337	24	534	5.15
20221107-1	1694	524	6.43
HE179	53	510	5.82
HW142/153/154	102	501	7.66
HW136A	17	497	7.02
HE4	143	492	6.02
HE46A	69	491	5.02
HE180	13	481	5.85
HE177	0	481	5.99

Table D-2
Rangeland polygon mean copper and pCu values.
Freeport-McMoran Chino Mines Company
Vanadium, New Mexico
Appendix D of Smelter/Tailings Soils Feasibility Study

HE177	27	481	5.99
HE93D	136	479	5.16
HE413	3	477	3.65
HE213	45	470	5.17
HE412	17	463	3.85
HE214	36	456	5.27
HW136/152	305	451	7.89
HE212	104	450	6.02
HE315	23	447	4.74
HE365/369/373	99	438	6.72
HE370/371/372	210	437	7.59
HE178	5	430	6.00
HE319	25	429	4.60
HE336A	64	429	5.28
HE314	37	427	4.85
Hurley/Smelter/Tailings	5280	426	6.39
HE14	214	426	5.92
HE317	43	425	4.60
HE5	47	423	6.07
HE183	92	423	5.56
HE2	112	421	6.12
HE409	45	418	6.43
HE200D	40	417	5.05
HE6/9	10	407	6.04
HE32B	287	403	5.40
HE192B	42	398	5.55
HE417	11	397	7.73
HE10/7	61	395	6.00
HE18	212	392	5.82
HE368	390	388	7.01
HE411	133	386	5.07
HE392	16	385	5.64
HE397	674	383	5.53
HE45A	0	383	5.45
HE45A	0	383	5.45
HE45A	133	383	5.45
HE45A	35	383	5.45
HW170	2607	383	8.11
HW170	547	383	8.11
HE318	45	381	5.57
HE44	117	380	5.31
HE416	717	378	7.84
HE401	11	371	4.61
HE8	18	369	6.06
HE200A	66	367	5.47
HE395	209	366	5.17
HE339	39	364	5.80
HE31	138	363	5.53
HE200B	47	362	5.48
HE363	724	361	7.22
SR14	182	361	6.51

Table D-2
Rangeland polygon mean copper and pCu values.
Freeport-McMoran Chino Mines Company
Vanadium, New Mexico
Appendix D of Smelter/Tailings Soils Feasibility Study

HE320	25	360	4.26
HE93E	250	356	4.86
HE328	386	353	5.27
HE1	5	351	6.18
HE407	121	351	5.66
HE222D	36	349	5.14
HE340	29	346	5.33
HE390	54	345	4.97
HE402	3	344	5.61
HE228B	54	343	5.28
HE45C	38	343	5.40
HE326	17	343	5.26
HE316	123	340	4.71
HE359/360/362	241	339	6.07
HE393/394	69	337	4.94
FS2	96	336	6.00
HE364	26	335	6.57
HE17	16	333	6.04
HE343	20	333	4.98
HE387	51	332	8.59
HE85	105	332	5.72
HE400	20	331	4.35
HE336B	128	330	5.41
FS1	15	329	6.52
HE334	130	328	4.85
WATER	2	327	6.57
WATER	0	327	6.57
WATER	0	327	6.57
WATER	1	327	6.57
WATER	1	327	6.57
WATER	0	327	6.57
WATER	1	327	6.57
WATER	1	327	6.57
WATER	0	327	6.57
HE346	5	327	5.74
HE93C	36	327	5.21
20221107-2	11	326	5.34
HE408/410	102	325	6.55
HE321	60	323	4.54
HW158/159	412	323	7.99
FS20	15	322	6.46
HE345	17	322	4.88
HE351	10	321	6.30
SR7/8/10/11	143	319	7.04
HE21	34	319	6.00
HE45B	143	319	5.62
HE11	30	318	6.12
HE333	171	317	5.20
HE205	859	316	5.59
HE367	81	315	5.57
HE405	5	315	6.19

Table D-2
Rangeland polygon mean copper and pCu values.
Freeport-McMoran Chino Mines Company
Vanadium, New Mexico
Appendix D of Smelter/Tailings Soils Feasibility Study

SR13	21	314	6.19
HE220	161	311	5.40
HE93B	31	311	5.78
HE93B	22	311	5.78
HE342	64	310	6.02
HE327	32	307	5.50
20221107-4	5	306	6.62
HE403	1	304	5.03
HE19	164	304	6.24
HE20	28	302	6.07
HE35	57	301	5.75
HE344	47	300	5.59
HE347/348	198	299	5.91
HE282A	15	299	6.81
HE22	139	293	6.06
HE338	67	293	5.90
HE356	15	293	6.71
HE93A	58	292	5.24
HE406	8	291	6.59
HE349	41	291	6.19
HE352	42	288	7.04
HE228	33	288	5.87
HE46	29	286	5.91
No Data	56	286	5.68
HE86B	2	285	5.69
HE86B	21	285	5.69
HE12	6	285	6.25
HE223	6	282	5.71
HE229	353	281	6.12
HE13	67	281	6.28
SR5	102	277	7.62
HE87/88	32	276	6.13
HE335	27	271	4.71
HE29	107	271	6.06
HE240	19	271	5.81
HE330	58	271	5.17
HE241	86	264	5.98
HE230	91	263	5.45
HE86	27	261	6.25
HE350	4	260	7.34
HE227	267	260	5.82
SR20	29	259	
HW185/388	84	256	8.58
HE16/15	42	256	6.42
HE222B	189	253	5.24
HE257	373	251	6.09
SR18	95	248	
HE24A	53	244	6.39
SR26	20	243	
HE34	49	243	6.16
HE80/90/91/92/94/95/96/97	466	240	6.34

Table D-2
Rangeland polygon mean copper and pCu values.
Freeport-McMoran Chino Mines Company
Vanadium, New Mexico
Appendix D of Smelter/Tailings Soils Feasibility Study

HE381/FS7/FS8/FS9	584	240	8.42
HE381/FS7/FS8/FS9	185	240	8.42
HE33C	39	237	6.16
HE258	150	234	6.70
HE23/27	47	232	6.50
HE26	45	231	6.41
SR19	63	229	7.61
HE255	60	226	6.15
HE222A	62	226	5.24
HE102A	72	226	5.96
HE227B	105	226	5.73
HE33B	117	225	6.32
HE226	45	225	5.18
SR42	15	223	6.77
SR27	33	222	
HE238	167	221	6.52
SR30	4	221	
HE519	85	219	6.78
SR9/12/15/16/38/41	684	217	6.99
HE103A	53	216	6.02
HE103A	98	216	6.02
SR44	95	211	6.71
SR210B	25	206	
FS11	43	205	8.24
HE263	50	205	6.64
HE236	7	204	6.84
SR118	230	203	
SR75	6	202	
HE25	115	202	6.64
HE82	33	200	6.51
HE82	6	200	6.51
HE82	48	200	6.51
HE254	13	197	6.41
SR91	33	197	
SR74	4	196	
SR89	12	193	
SR102A	67	193	
SR36	63	193	7.55
20221107-3	27	191	
SR120	84	191	
SR122	12	189	
HE232	62	189	6.53
SR37	15	188	7.30
HE36	37	188	6.56
SR85	46	187	
HE81	53	186	6.70
HE84	9	185	6.50
SR103	69	183	
SR88	39	183	
SR210A	153	182	7.48
SR87	26	182	

Table D-2
Rangeland polygon mean copper and pCu values.
Freeport-McMoran Chino Mines Company
Vanadium, New Mexico
Appendix D of Smelter/Tailings Soils Feasibility Study

HE43	49	180	6.55
HE28	33	177	6.76
SR92	19	176	
SR31	4	176	
SR182	51	176	
SR32	13	175	
SR35	94	175	7.52
HE42	99	173	6.64
HE36A	24	173	6.70
HE235	24	173	6.56
SR100C	24	173	
SR73	6	173	
SR72	39	173	7.45
SR129	116	172	
HE37	11	171	6.69
SR123	130	171	
SR100A	34	171	7.40
HE83	63	170	6.65
SR67	10	170	
SR104	99	169	
HE154	181	168	6.98
HE389	97	168	8.86
SR141C	3	168	
HE98D	77	167	7.02
HE231	31	166	6.93
HE151	92	166	7.10
SR141A	52	164	
HE24B	81	164	7.02
SR181	17	163	
SR99	22	162	7.45
SR170	132	161	
HE33A	28	161	6.85
SR100B	39	160	7.50
SR124	15	160	
SR68	8	160	7.51
HE128	37	160	7.80
SR141B	108	159	8.08
SR97	11	159	7.37
SR173/174	66	159	
SR94	20	157	7.30
HE157	24	156	7.55
SR95	8	155	7.36
SR176	34	154	
HE120	226	153	7.85
SR96	16	153	7.40
SR98	80	153	7.69
SR110	44	153	7.71
SR111	31	152	7.71
SR112B	22	152	7.67
SR112A	93	151	7.66
SR108	80	151	7.90

Table D-2
Rangeland polygon mean copper and pCu values.
Freeport-McMoran Chino Mines Company
Vanadium, New Mexico
Appendix D of Smelter/Tailings Soils Feasibility Study

SR101	70	150	7.87
SR71	106	150	7.39
SR40	40	149	7.34
SR84	11	149	7.38
HE119	71	149	7.93
HE71	59	149	7.83
HE129	9	149	7.74
HE116	21	149	7.93
HE228A	68	149	7.27
SR113	15	149	7.52
SR105	62	148	
SR116	66	148	7.93
HE105	117	148	7.28
HE105	110	148	7.28
HE115	74	148	7.96
SR53	24	148	7.77
HE114	180	148	7.98
SR114	45	148	7.85
HE68	54	147	7.99
HE98C	59	147	7.22
HE117	14	147	7.99
HE300	120	147	7.75
HE63	9	147	7.91
HE69	46	147	7.99
HE70	26	146	7.99
HE62B	6	146	7.83
SR117	37	146	8.01
HE65	19	146	8.00
HE62A	15	145	7.73
HE67	39	145	8.01
HE113	86	145	8.00
SR82	82	145	7.49
HE122	108	145	8.00
HE122	1	145	8.00
HE40B	48	145	7.05
HE53	22	144	7.57
HE144	49	144	7.44
HE60	7	144	7.63
HE54	5	143	7.58
HE58	19	143	7.59
HE89	11	143	7.58
HE61	7	143	7.58
HE40A	51	142	7.09
SR124X	128	141	
SR109	83	141	8.09
HE126	178	141	7.75
HE57	6	140	7.52
SR130	130	140	
HE73	57	140	7.57
SR39A	35	140	7.66
SR81	32	140	7.43

Table D-2
Rangeland polygon mean copper and pCu values.
Freeport-McMoran Chino Mines Company
Vanadium, New Mexico
Appendix D of Smelter/Tailings Soils Feasibility Study

HE123/124	118	139	8.00
HE145	251	139	8.05
HE72	95	139	7.39
HE41	26	139	7.09
HE98B	47	138	7.66
HE52	49	138	7.49
HE55	10	138	7.49
SR69	7	137	7.45
SR142	271	137	8.08
HE38	45	136	7.27
HE77	137	136	7.20
HE125	52	135	7.75
HE75	72	135	7.62
SR137	48	135	
HE39	165	135	7.40
HE130	5	135	7.71
SR136	17	135	
HE134	38	134	8.01
SR39B	50	134	7.75
SR138	28	134	
SR127A	27	134	
SR139	22	133	
SR127F	86	132	
SR80A	31	132	7.45
HE98A	31	132	7.67
HE51B	23	132	7.45
HE99	122	132	7.62
SR132	119	132	
SR143	15	132	
HE104	275	132	7.51
HE50	25	131	7.36
SR127B	117	131	
HE148	123	131	7.33
SR52/59	337	130	7.70
SR144	11	129	
SR70	43	129	7.50
SR83	6	129	7.39
HE51A	25	128	7.42
HE146	108	127	7.70
SR77	63	126	7.47
SR64B	33	126	7.47
SR178A/177	92	125	
SR127E	68	125	
SR146	142	125	7.71
SR126C	63	124	
HE49B	16	124	7.37
HE49A	23	124	7.32
SR145	53	124	7.96
SR66	42	124	7.62
SR80B	29	124	7.44
SR55	8	124	7.36

Table D-2

Rangeland polygon mean copper and pCu values.

Freeport-McMoran Chino Mines Company

Vanadium, New Mexico

Appendix D of Smelter/Tailings Soils Feasibility Study

HE110	130	123	8.08
HE127	24	123	7.56
HE48	21	122	7.32
HE109/108/107	201	121	7.98
HE160	15	120	8.32
HE112/121/139	340	120	8.22
SR65	84	120	7.58
SR79C	3	119	7.43
SR54	104	119	7.42
SR135	14	119	
SR63	21	118	7.63
SR79A	21	118	7.49
HE286A	157	118	7.35
SR127D	6	118	
HE159	23	118	8.16
SR79B	4	117	7.48
HE143/161	271	117	8.27
HE147	64	117	7.40
HE47	13	117	7.39
SR133	106	117	
SR78	18	116	7.46
SR198	15	116	
SR198	19	116	
SR186	348	116	
HE131	9	116	7.58
SR126B	13	115	
SR64	175	115	7.47
SR127C	18	114	
SR147	93	113	7.72
SR56	91	112	7.43
HE174	25	112	7.54
HE135	36	111	7.60
HE137	50	110	7.77
SR60	8	110	7.45
HE133	0	110	7.46
HE133	92	110	7.46
HE140/141/142/160	221	109	8.47
HE284	4	109	7.36
HE173B	62	108	7.49
HE136	34	108	7.62
SR192	7	108	
HE138	256	105	8.38
SR194	15	104	
SR196	46	104	
SR200/201/202	138	104	
HE166	169	103	7.40
SR149	84	102	
HE175	0	102	7.37
HE175	163	102	7.37
SR150	63	102	
HE287A	184	102	7.45

Table D-2
Rangeland polygon mean copper and pCu values.
Freeport-McMoran Chino Mines Company
Vanadium, New Mexico
Appendix D of Smelter/Tailings Soils Feasibility Study

SR189	17	101	
SR58	97	100	7.68
SR126A	61	97	
HE302	37	95	7.59
SR190	36	92	
SR195	71	90	
SR128	3	87	
SR197	123	82	
SR61	6	82	7.77

*Note: Gray shaded rows denote rangeland polygons that fall under the pCu pre-FS RAC (pCu < 5 where Cu > 327 mg/kg)
Blank indicates the copper and pCu interpolation did not cover that polygon.

Table D-3
Unacceptable Rangeland Polygons Exceeding their Probable Effects Level (PEL) for pCu
Freeport-McMoran Chino Mines Company
Vanadium, New Mexico
Appendix D of Smelter/Tailings Soils Feasibility Study

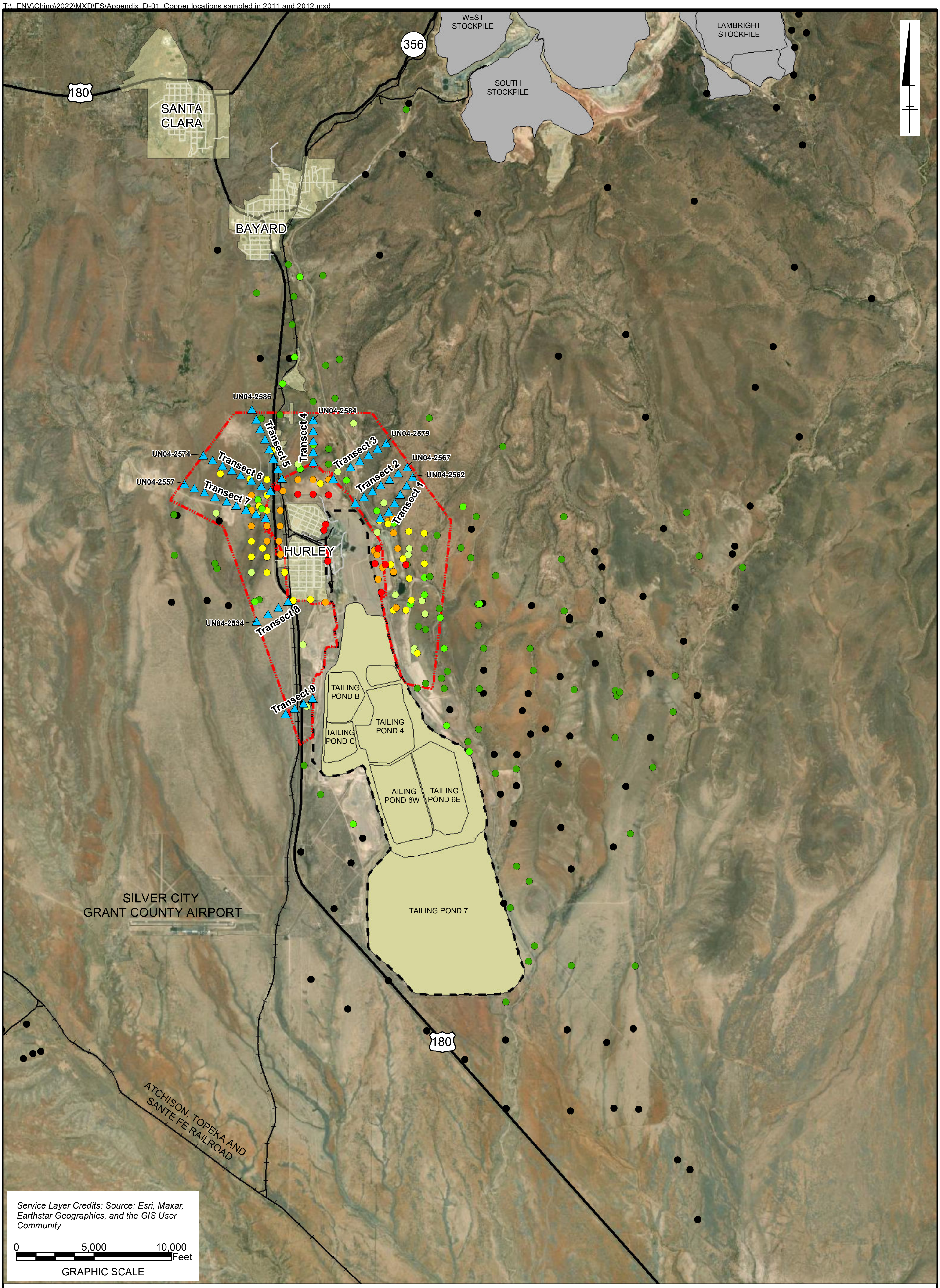
Rangeland Polygon ID	Acres	Soil Category	Mean Copper (mg/kg)	Mean pCu	PEL threshold	Lower than PEL
HE193	533.05	Bedrock	802	4.5	3.83	N
HE46A	68.56	Slope > 13%	491	5.0	4.48	N
HE196B	107.54	Bedrock	767	4.7	3.83	N
HE216a	64.26	Flat Rocky Soil	1064	**3.9**	4.6	**Y**
HE312	125.62	Flat Rocky Soil	561	4.9	4.6	N
HE316	122.78	Bedrock	340	4.7	3.83	N
HE315	22.94	Flat Rocky Soil	447	4.7	4.6	N
HE319	25.17	Flat Rocky Soil	429	**4.6**	4.6	**Y**
HE320	25.14	Flat Rocky Soil	360	4.3	4.6	N
HE343	19.72	Flat Rocky Soil	333	5.0	4.6	N
HE334	129.69	Slope > 13%	328	4.8	4.48	N
HE390	54.28	Flat Rocky Soil	345	5.0	4.6	N
HE393/394	69.23	Flat Rocky Soil	337	4.9	4.6	N
HE400	20.19	Flat Rocky Soil	331	**4.4**	4.6	**Y**
HE401	10.66	Flat Rocky Soil	371	4.6	4.6	N
HE413	3.45	Flat Rocky Soil	477	**3.7**	4.6	**Y**
HE216b	46.73	Bedrock	1064	3.9	3.83	N

Notes:

Bolded are less than PEL for soil category.

Figures

OFFICE: LAKEWOOD DB: MLM TM: MB PM: AT
PROJECT# B0063543.0000
T:\ ENV\Chino\2022\MXD\FS\Appendix D-01 Copper locations sampled in 2011 and 2012.mxd



Service Layer Credits: Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community

LEGEND:

🟥	Copper Area of Uncertainty
▲	New Copper Sample Location For FS

Copper Concentration (mg/kg) at Locations Sampled before 2011

●	<327
●	327 - 800
●	800 - 1,100
●	1,100 - 1,600
●	1,600 - 2,700
●	2,700 - 5,000
●	>5,000
▭	City Limits
▨	Stockpile
▨	Tailing Pond

FREEPORT-MCMORAN CHINO MINES COMPANY
VANADIUM, NEW MEXICO

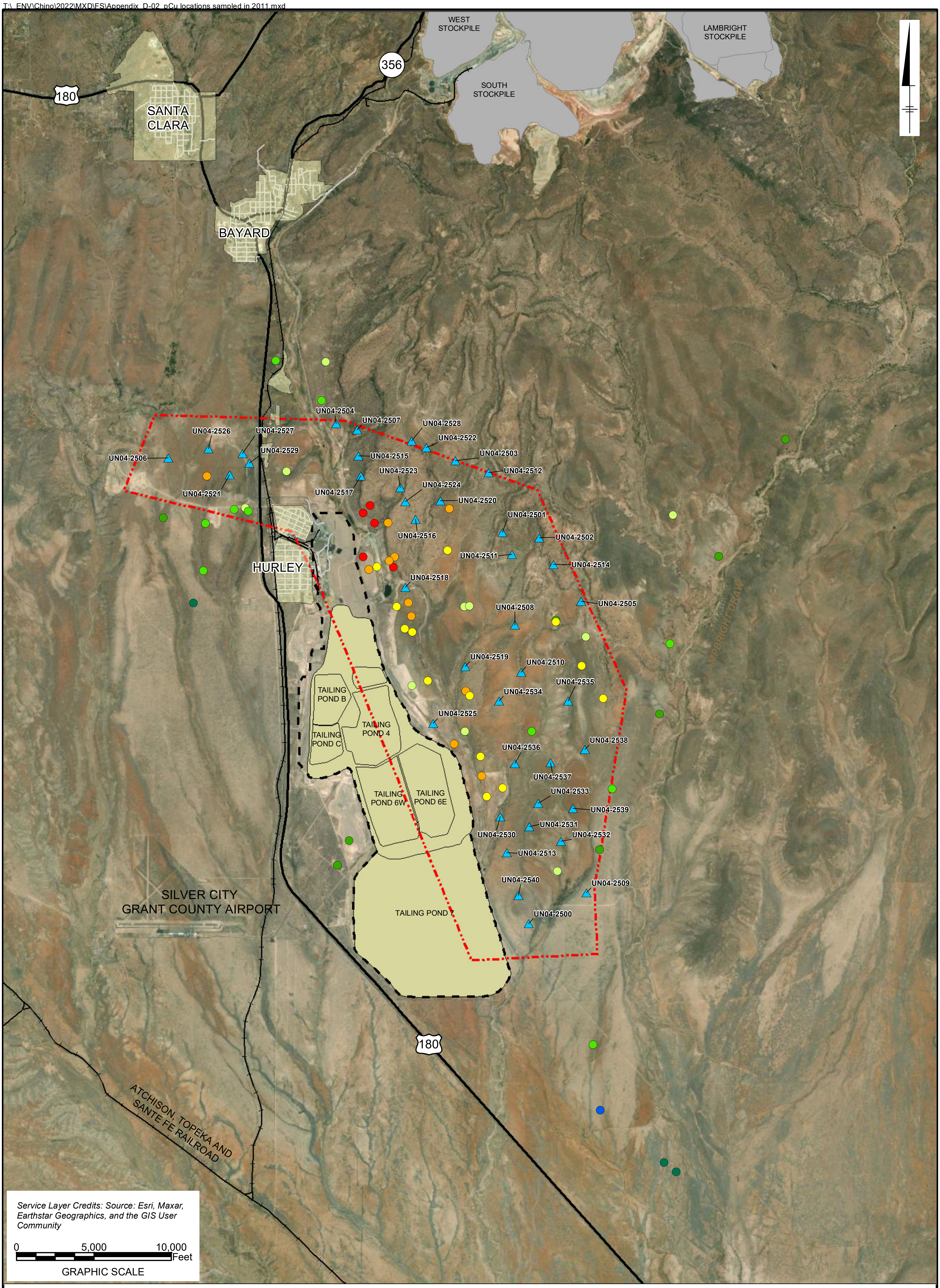
SMELTER/TAILINGS SOILS IU FS

COPPER LOCATIONS SAMPLED IN 2011 AND 2012

ARCADIS

APPENDIX
D-1

OFFICE: LAKEWOOD DB: MLM TM: MB PM: AT
PROJECT# B0063543.0000
T:_ENV\Chino\2022\MXD\FS\Appendix_D-02_pCu locations sampled in 2011.mxd



Service Layer Credits: Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community

LEGEND:

- ▲ New Sample Location for FS
- pCu Area of Uncertainty
- Railroad
- Town Roads
- Major Roads
- City Limits
- Stockpiles
- Tailing Ponds
- Smelter Taililng Boundary

pCu at Locations Sampled Before 2011

- ● 3 - 4
- ● 4 - 5
- ● 5 - 6
- ● 6 - 7
- ● 7 - 8
- ● 8 - 9
- ● 9 - 10
- ● >10

FREEPORT-MCMORAN CHINO MINES COMPANY
VANADIUM, NEW MEXICO

SMELTER/TAILINGS SOILS IU FS

pCu LOCATIONS SAMPLED IN 2011

ARCADIS

APPENDIX
D-2

OFFICE: LAKEWOOD DB: MLM TM: MB PM: AT
PROJECT# B0063543.0000
T:_ENV\Chino\2022\MXD\FS\Appendix_D-03_Vegetation_SampleLocations.mxd

LEGEND:

- 🟢 Sample Location
- ☐ City Limits
- ☐ Rangeland Polygon
- ⬚ Operations Boundary
- ┼┼ Railroad
- — Town Roads
- ━ Major Roads

Imagery Sources:
1. Ikonos, dated 09/04/2011.
2. Esri, Maxar, Earthstar Geographics, and the GIS User Community

0 3,000 6,000
Feet
GRAPHIC SCALE

FREEPORT-MCMORAN CHINO MINES COMPANY
VANADIUM, NEW MEXICO

SMELTER/TAILINGS SOILS IU FS

VEGETATION COMMUNITY SAMPLING LOCATIONS IN 2011 AND 2012

ARCADIS

APPENDIX
D-3

OFFICE: LAKEWOOD DB: MLM TM: MB PM: AT
PROJECT# B0063543.0000
T:_ENV\Chino\2022\MXD\FS\xFig_3-4_WoodySample_Results.mxd

LEGEND:

Copper Concentration (mg/kg)

- ▲ 327 - 1,100
- ▲ 1,100 - 1,600
- ▲ >1,600
- ▬ Drainage Banks Sampled
- ☐ City Areas
- ☐ Rangeland Condition Boundaries
- ☐ Vegetation Allaince Boundaries
- ╌ Smelter Tailings Boundary
- ┼ Railroad
- ─ Town Roads
- ━ Major Roads

0 1,000 2,000 Feet
GRAPHIC SCALE

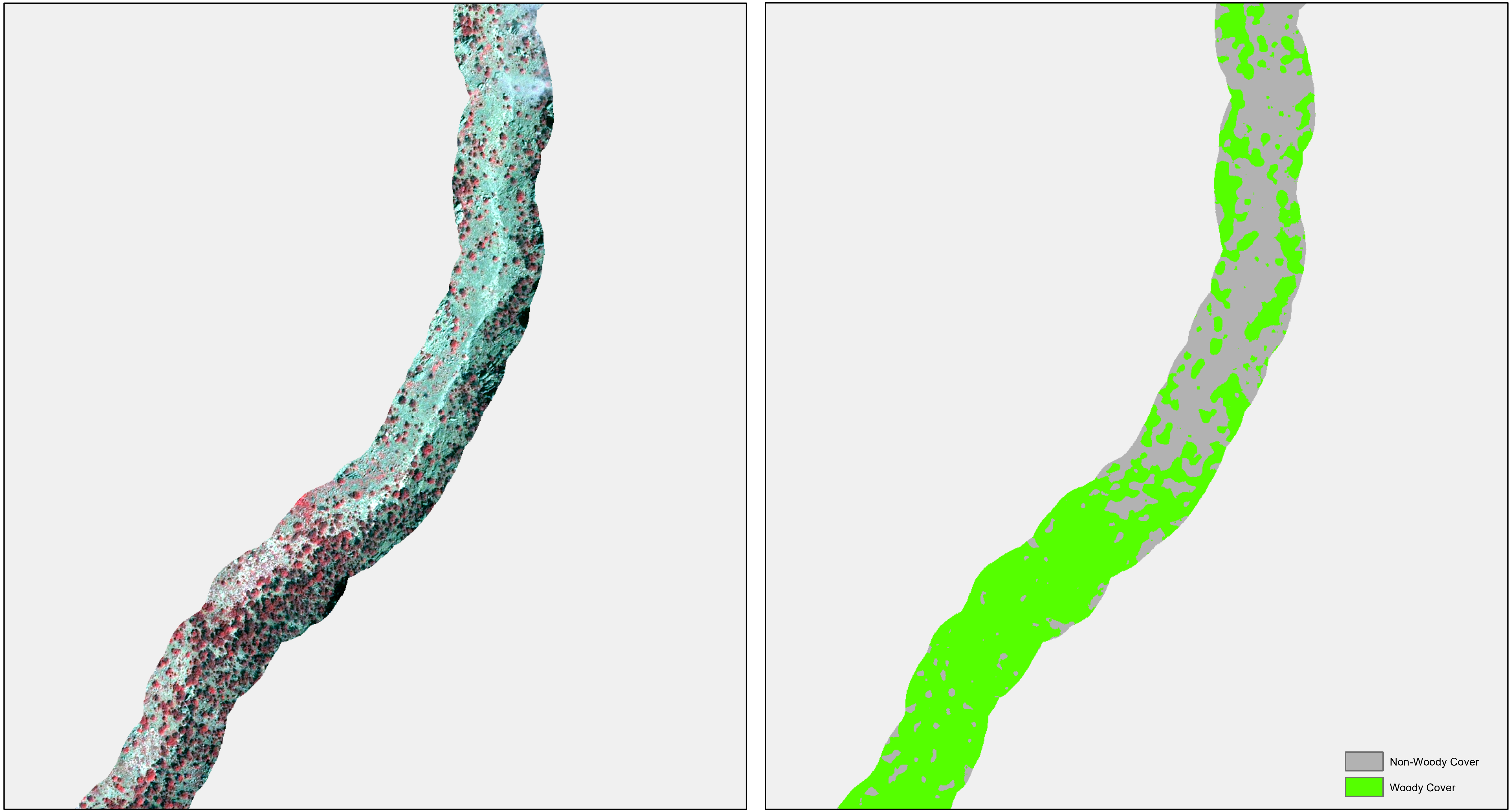
FREEPORT-MCMORAN CHINO MINES COMPANY
VANADIUM, NEW MEXICO

SMELTER/TAILINGS SOILS IU FS

SAMPLING LOCATIONS FOR WOODY COVER AND COPPER IN DRAINAGES

ARCADIS

APPENDIX
D-4



Source: IKONOS, 2011

Left Image: IKONOS image; red, green, and near-infrared bands.
Right Image: Classification of woody vegetation based on scaled Normalized Difference Vegetation Index (NDVI).

0 400 800 Feet
GRAPHIC SCALE

FREEPORT-MCMORAN CHINO MINES COMPANY
VANADIUM, NEW MEXICO
SMELTER/TAILINGS SOILS IU FS

IKONOS IMAGE AND CLASSIFICATION OF WOODY VEGETATION

ARCADIS

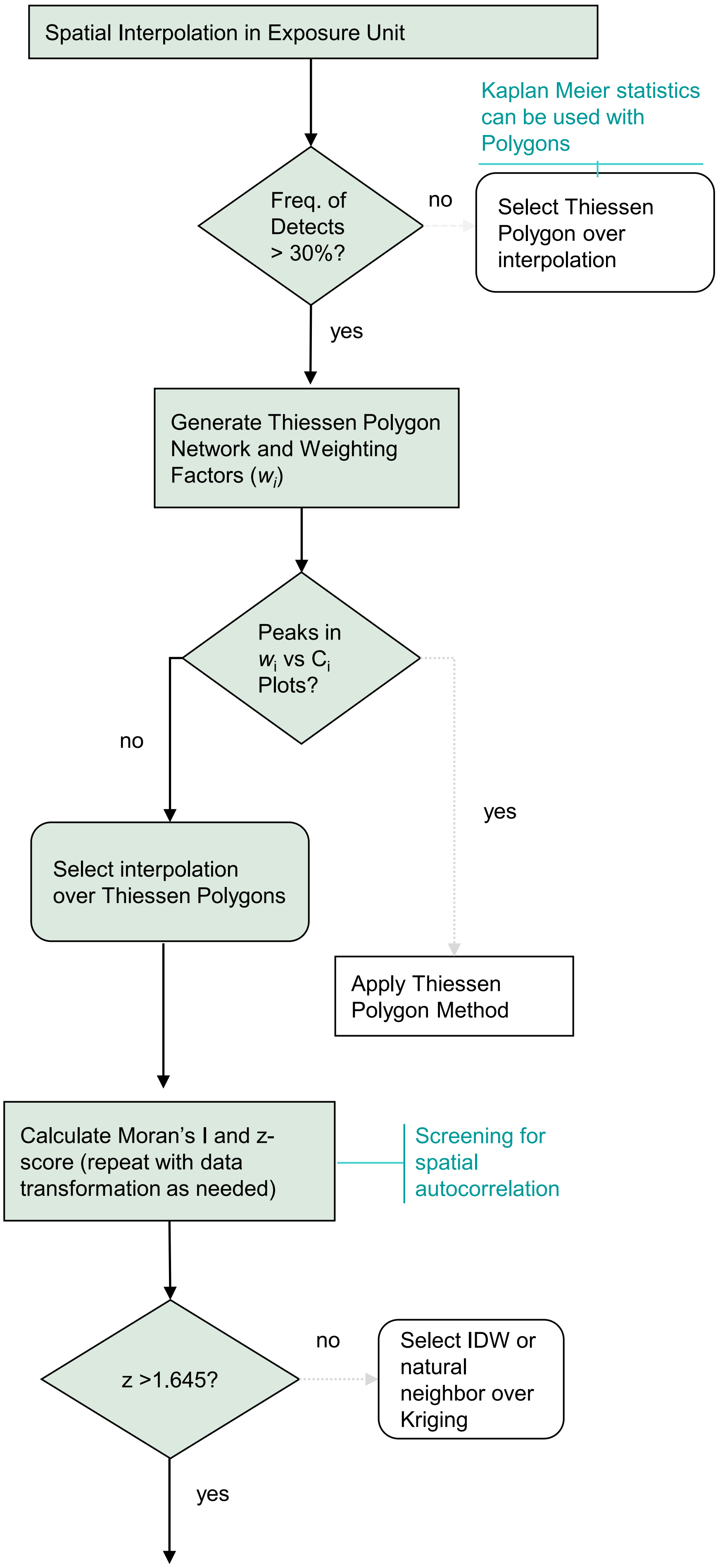
APPENDIX
D-5

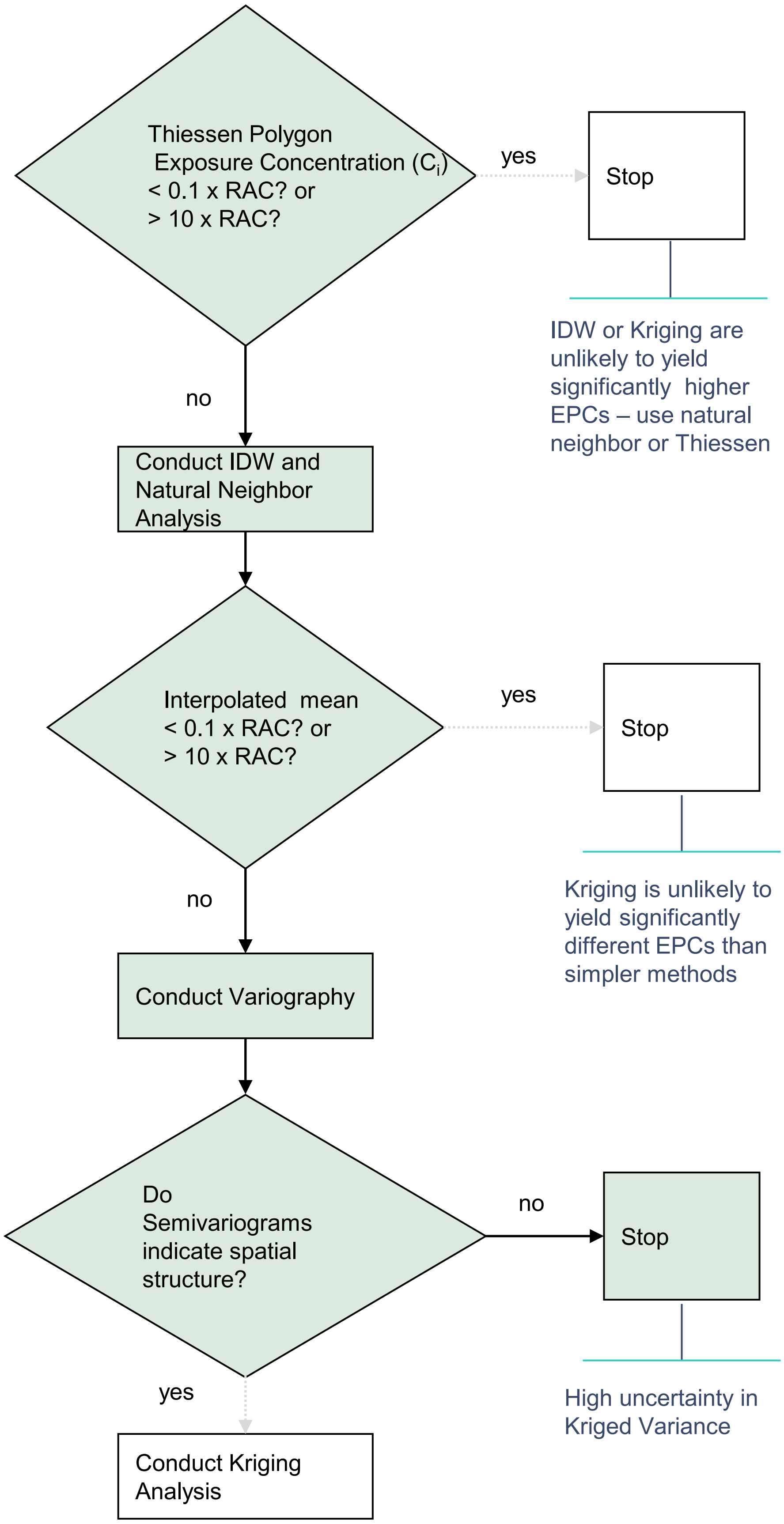
OFFICE: LAKEWOOD DB: MLM TM: MB PM: AT
PROJECT# B0063543.0000
T:\ ENV\Chino\2022\MXD\FS\Appendix_D-05_IKONOS Image and Classification of Woody Vegetation.mxd

FIGURE D-6

DECISION TREE FOR INTERPOLATION METHOD USED TO DERIVE THE 95 UCL IN AN EXPOSURE UNIT

Smelter/Tailings Soils IU FS
Freeport-McMoran Chino Mines Company
Vanadium, New Mexico





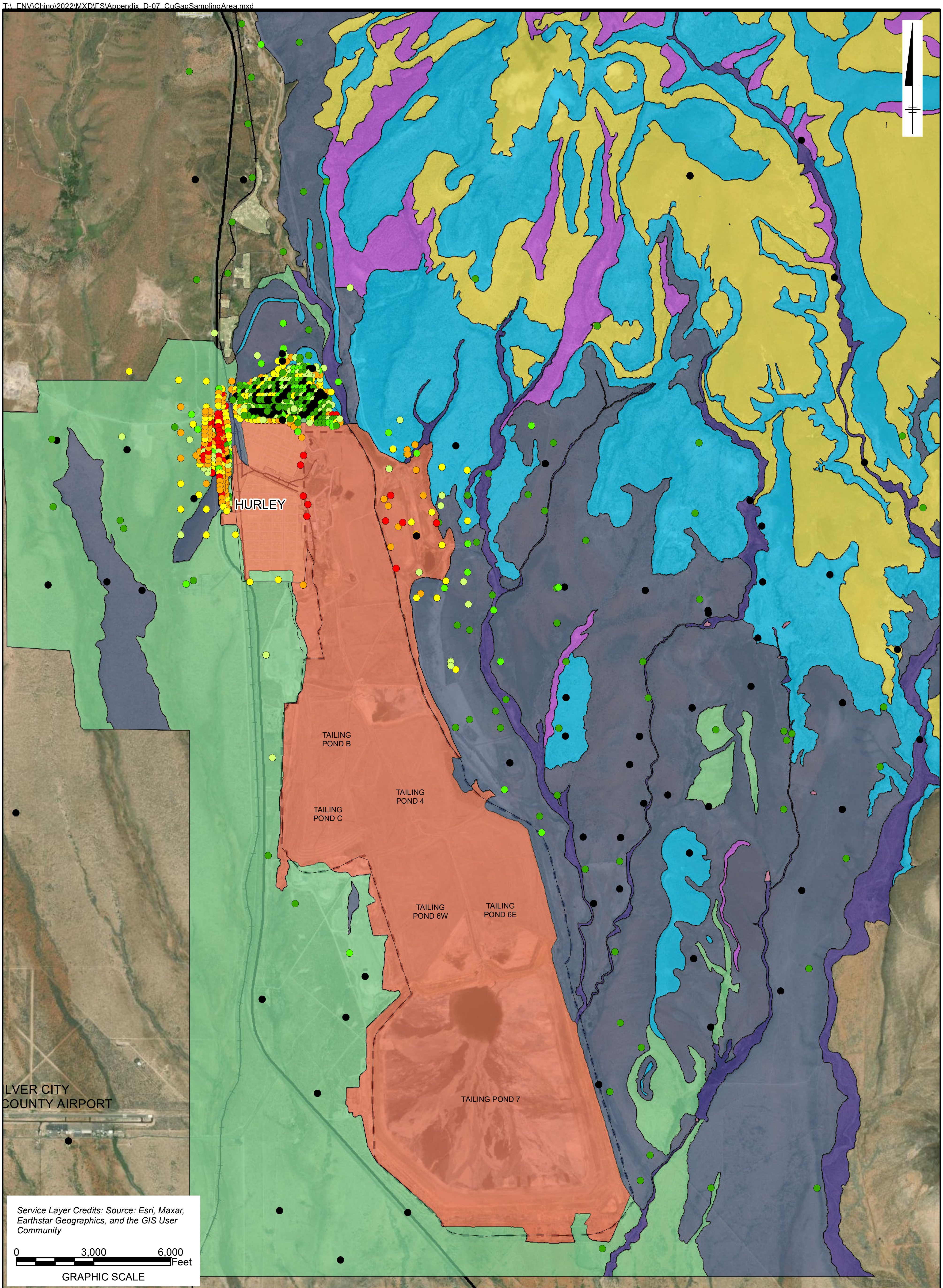
The decision to use IDW versus Natural Neighbor should be based on the spatial distribution of sample points. Natural Neighbor requires no parameterization decisions and fewer assumptions, but uneven point distribution may cause unusual behavior because of the lack of consideration of absolute distance

IDW = Inverse Distance Weighting

EPC = Exposure Point Concentration

C_i = Exposure Concentration

RAC = Risk Assessment Criteria



LEGEND:

Copper Concentration (mg/kg)

- ● <327
- ● 327 - 800
- ● 800 - 1,100
- ● 1,100 - 1,600
- ● 1,600 - 2,700
- ● 2,700 - 5,000
- ● >5,000

Vegetation

- ■ Fluvial Forest and Shrubland Alliance
- ■ Mesquite/Mixed Grama Shrubland Alliance
- ■ Mine Facilities/Urban
- ■ Ponderosa Pine-Oak Forest Alliance
- ■ Alligator Juniper-Oak Woodland Alliance
- ■ Mountain Mahogany Shrubland Alliance
- ■ Not Classified
- ■ Mixed-Grama Herbacious Alliance
- ■ Alligator Juniper-Oak/Grama Woodland Alliance

Note:
Vegetation alliances will be used as the exposure unit for the SGFB.

FREEPORT-MCMORAN CHINO MINES COMPANY
VANADIUM, NEW MEXICO

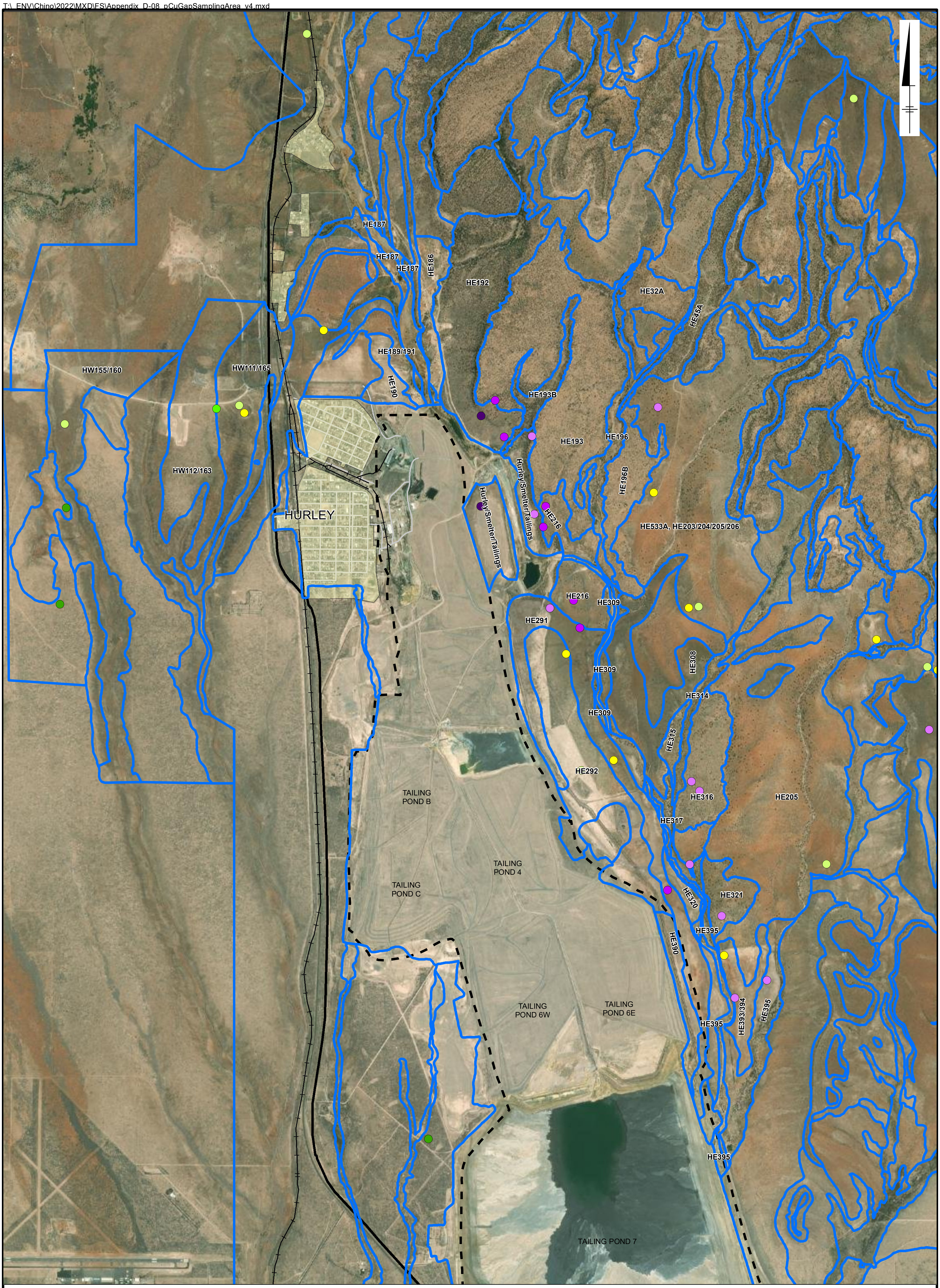
SMELTER/TAILINGS SOILS IU FS

COPPER CONCENTRATION DATA COLLECTED THROUGH 2010 USED IN INTERPOLATIONS

ARCADIS

APPENDIX
D-7

OFFICE: LAKEWOOD DB: MLM TM: MB PM: AT
PROJECT# B0063543.0000
T:_ENV\Chino\2022\MXD\FS\Appendix_D-08_pCuGapSamplingArea_v4.mxd



LEGEND:

pCu

- ● <3
- ● 3 - 4
- ● 4 - 5
- ● 5 -6
- ● 6 - 7
- ● 7 - 8
- ● 8 - 9
- ● 9 - 10
- ● >10
- Railroad
- Town Roads
- Major Roads
- Smelter Tailing Boundary
- Rangeland Polygons (Exposure Unit for pCu)
- City Limits

Service Layer Credits: Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community

0 2,500 5,000 Feet
GRAPHIC SCALE

FREEPORT-MCMORAN CHINO MINES COMPANY
VANADIUM, NEW MEXICO

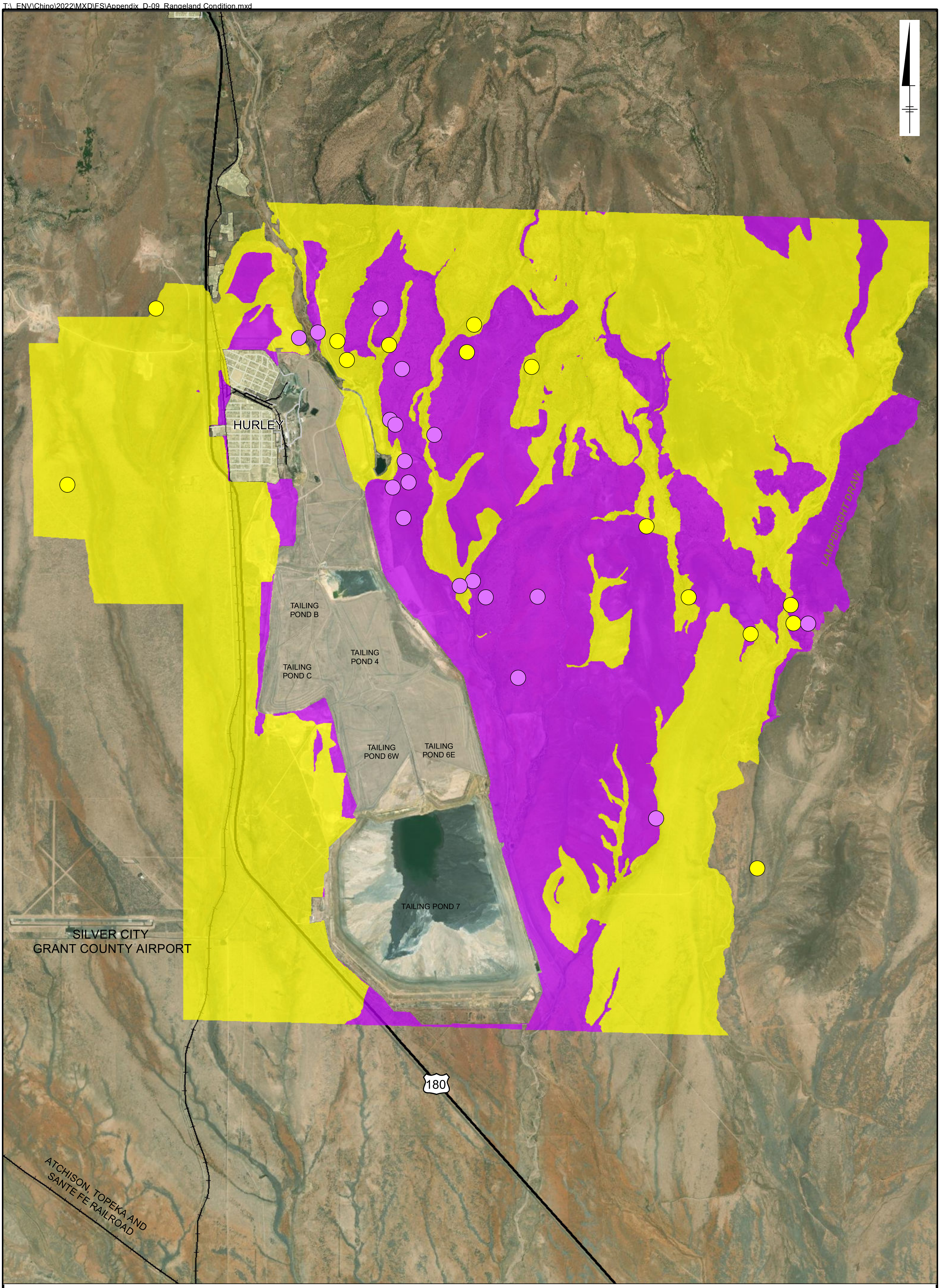
SMELTER/TAILINGS SOILS IU FS

pCu DATA COLLECTED THROUGH 2010 USED IN INTERPOLATIONS

ARCADIS

APPENDIX
D-8

OFFICE: LAKEWOOD DB: MLM TM: MB PM: AT
PROJECT# B0063543.0000
T:_ENV\Chino\2022\MXD\FS\Appendix_D-09_Rangeland Condition.mxd



LEGEND:

Field Sampled Rangeland Condition Location

- ● Acceptable
- ● Unacceptable

Range Condition Class Derived from Remote Sensing

- ■ Acceptable
- ■ Unacceptable

- ☐ City Limits
- Railroad
- Town Roads
- Major Roads

Service Layer Credits: Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community

0 4,000 8,000 Feet
GRAPHIC SCALE

FREEPORT-MCMORAN CHINO MINES COMPANY
VANADIUM, NEW MEXICO

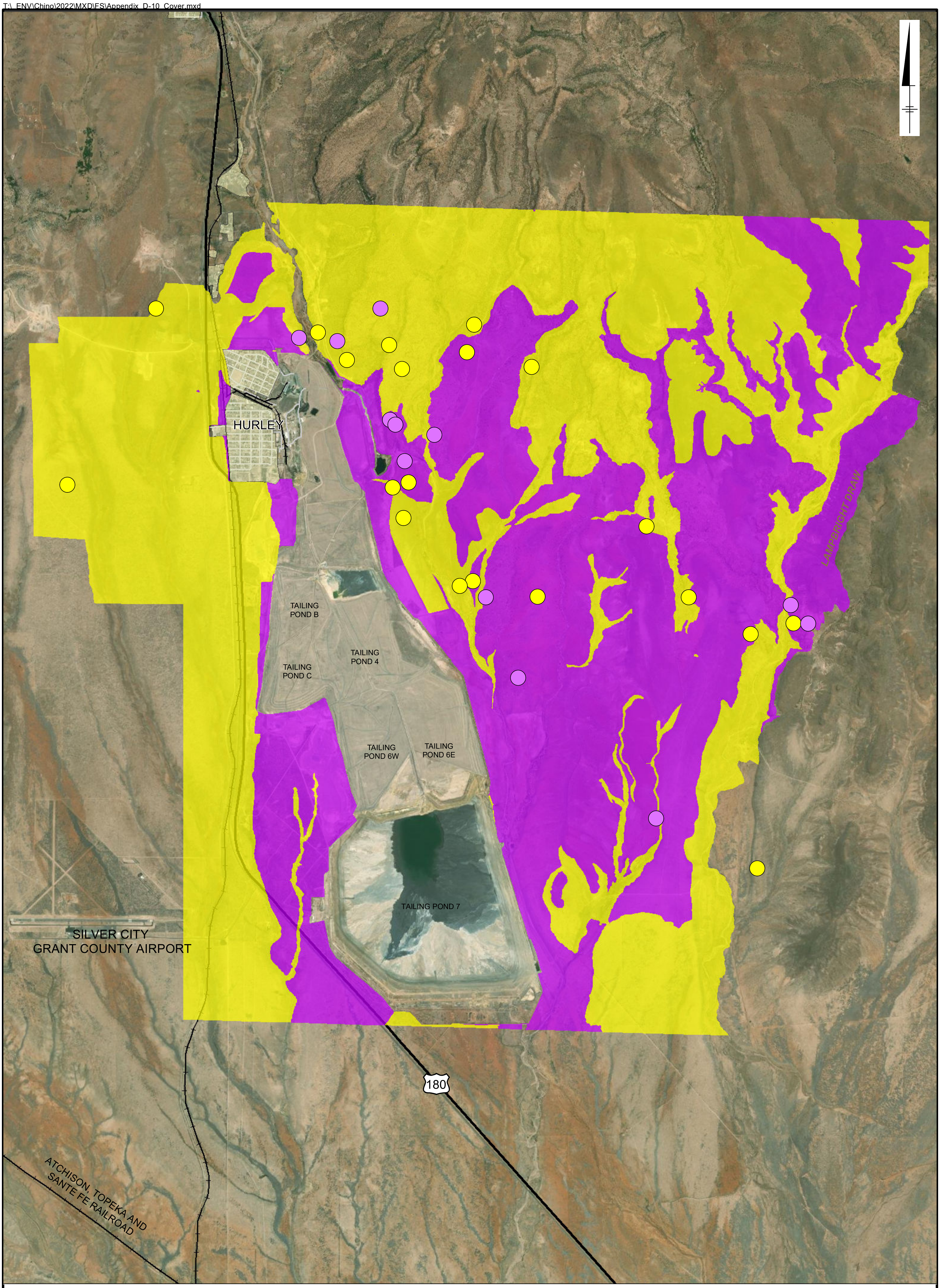
SMELTER/TAILINGS SOILS IU FS

FIELD SAMPLED RANGELAND CONDITION LOCATIONS vs. CLASS DERIVED FROM REMOTE SENSING

ARCADIS

APPENDIX
D-9

OFFICE: LAKEWOOD DB: MLM TM: MB PM: AT
PROJECT# B0063543.0000
T:_ENV\Chino\2022\MXD\FS\Appendix_D-10_Cover.mxd



LEGEND:

Field Sampled Cover Location
● Acceptable
● Unacceptable

Cover Class Derived from Remote Sensing
🟨 Acceptable
🟪 Unacceptable

☐ City Limits
Railroad
Town Roads
Major Roads

Service Layer Credits: Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community

0 4,000 8,000 Feet
GRAPHIC SCALE

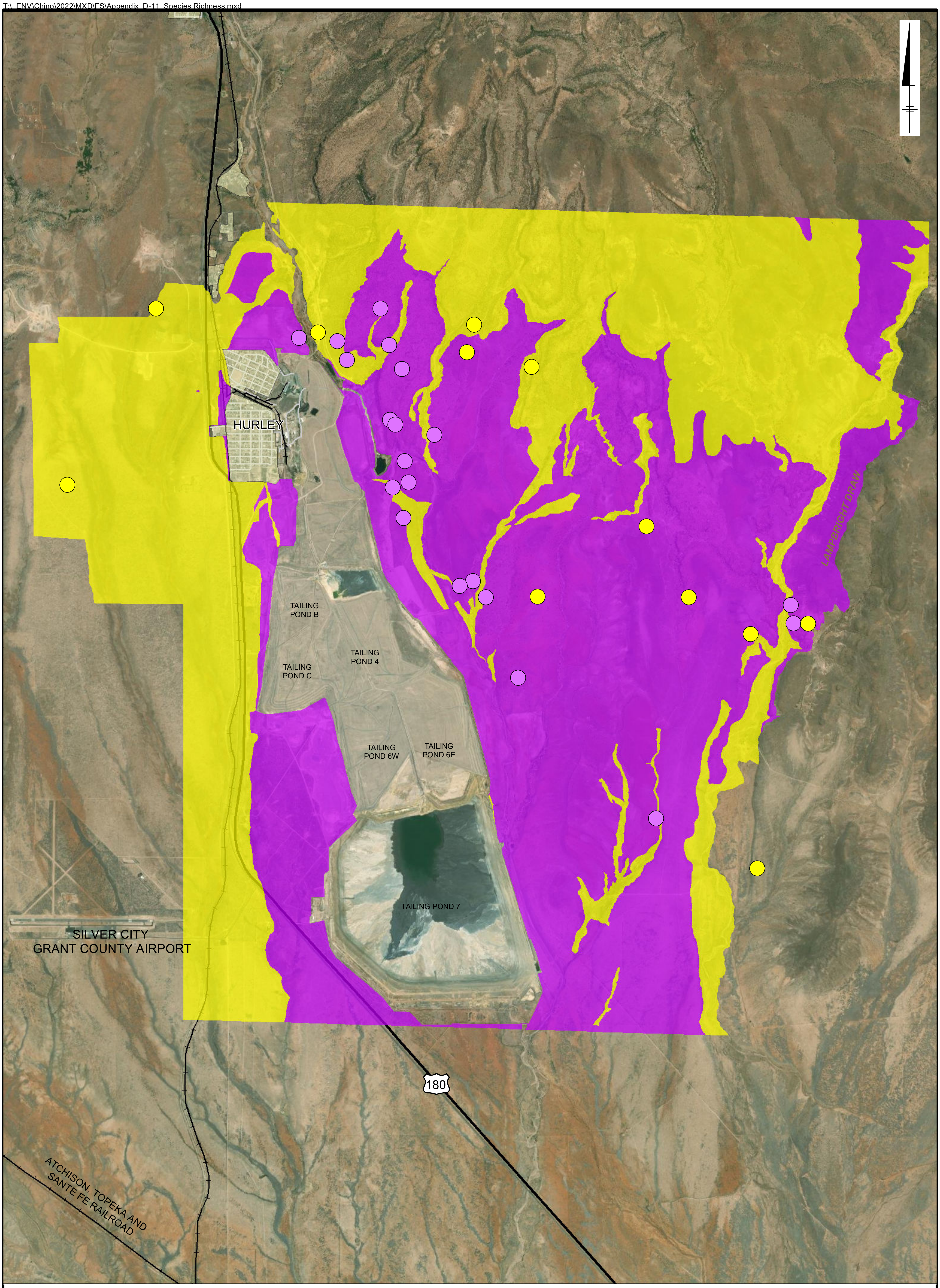
FREEPORT-MCMORAN CHINO MINES COMPANY
VANADIUM, NEW MEXICO

SMELTER/TAILINGS SOILS IU FS

FIELD SAMPLED COVER LOCATIONS vs. CLASS DERIVED FROM REMOTE SENSING

ARCADIS

APPENDIX
D-10



LEGEND:

Field Sampled Plant Richness Location

- ● Acceptable
- ● Unacceptable

Plant Richness Class Derived from Remote Sensing

- 🟨 Acceptable
- 🟪 Unacceptable

- ▭ City Limits
- ┼ Railroad
- — Town Roads
- ━ Major Roads

Service Layer Credits: Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community

0 4,000 8,000 Feet
GRAPHIC SCALE

FREEPORT-MCMORAN CHINO MINES COMPANY
VANADIUM, NEW MEXICO

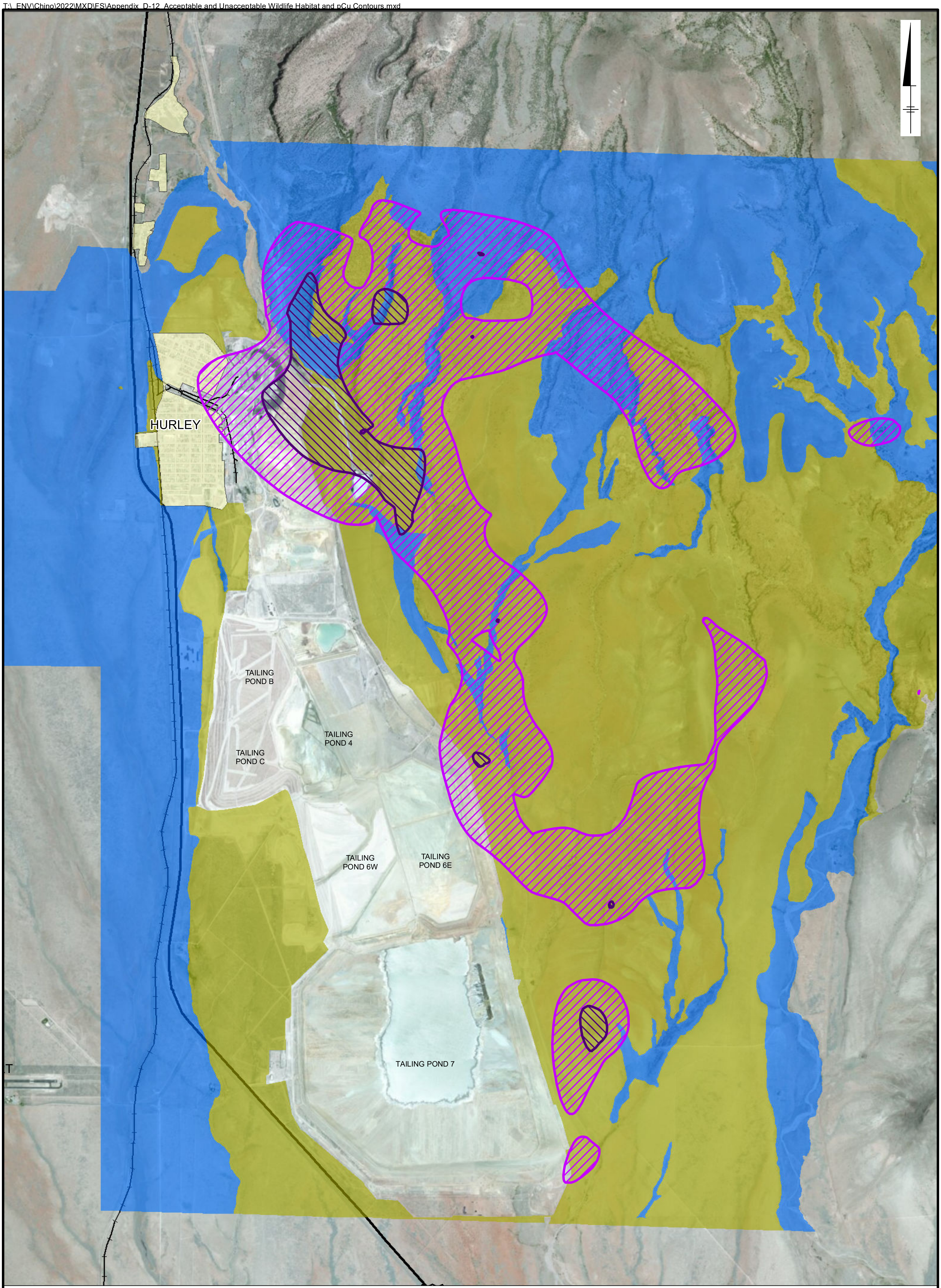
SMELTER/TAILINGS SOILS IU FS

FIELD SAMPLED PLANT RICHNESS LOCATIONS vs. CLASS DERIVED FROM REMOTE SENSING

ARCADIS

APPENDIX D-11

OFFICE: LAKEWOOD DB: MLM TM: MB PM: AT
PROJECT# B0063543.0000
T:\ ENV\Chino\2022\MXD\FS\Appendix D-12 Acceptable and Unacceptable Wildlife Habitat and pCu Contours.mxd



LEGEND:

pCu Range

▨ <4

▨ 4 - 5

🟨 Cover or Species Richness Unacceptable

🟦 Cover and Species Richness Acceptable

Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

0 3,000 6,000 Feet
GRAPHIC SCALE

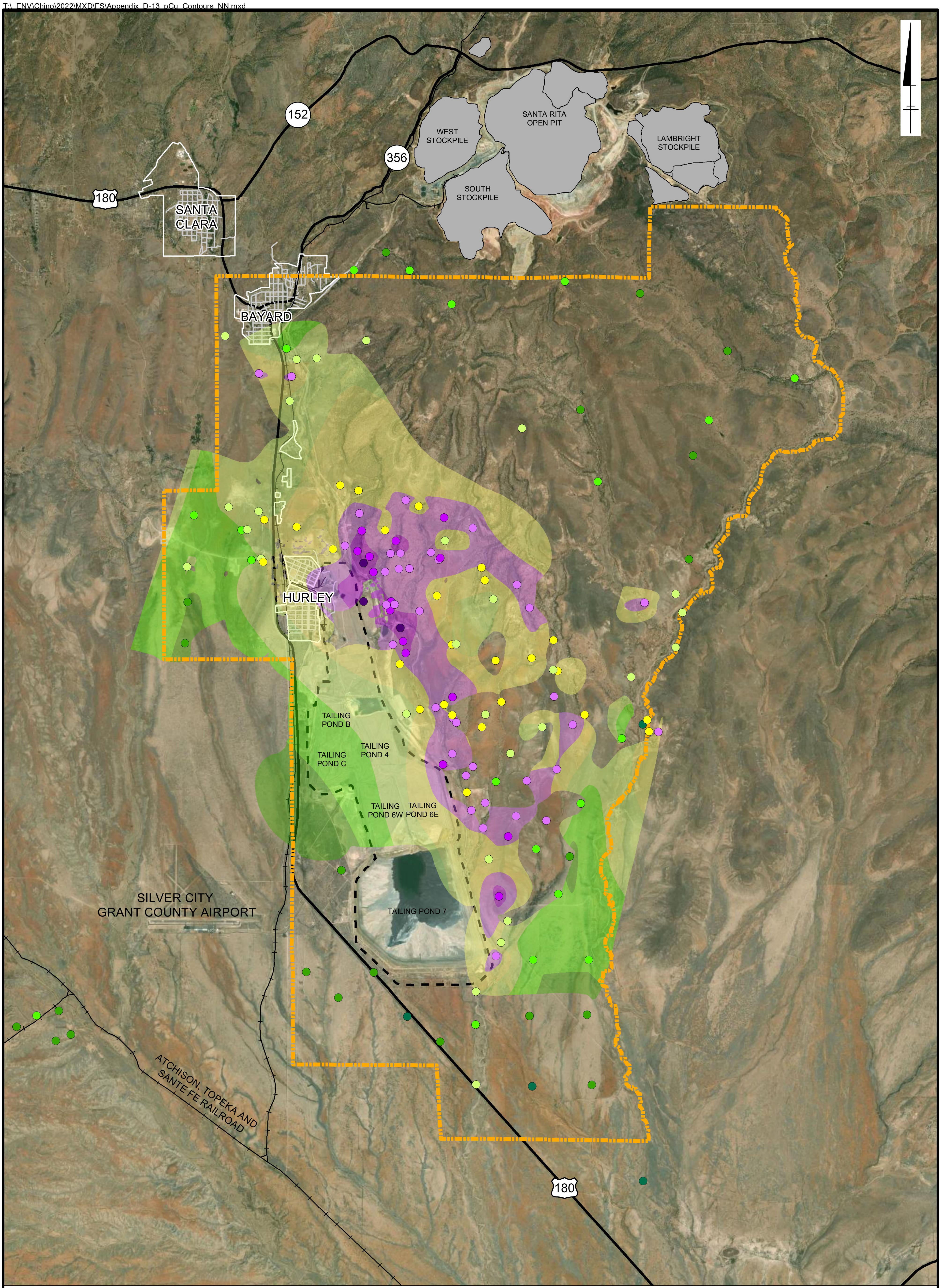
FREEPORT-MCMORAN CHINO MINES COMPANY
VANADIUM, NEW MEXICO

SMELTER/TAILINGS SOILS IU FS

ACCEPTABLE AND UNACCEPTABLE WILDLIFE HABITAT AND pCu CONTOURS

ARCADIS

APPENDIX
D-12



LEGEND:

pCu
- ● <3
- ● 3 - 4
- ● 4 - 5
- ● 5 -6
- ● 6 - 7
- ● 7 - 8
- ● 8 - 9
- ● 9 - 10
- ● >10
- ▭ STSIU Boundary

pCu Range
- ■ <3
- ■ 3 - 4
- ■ 4 - 5
- ■ 5 - 6
- ■ 6 - 7
- ■ 7 - 8
- ■ 8 - 9

Service Layer Credits: Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community

0 5,000 10,000 Feet
GRAPHIC SCALE

FREEPORT-MCMORAN CHINO MINES COMPANY
VANADIUM, NEW MEXICO

SMELTER/TAILINGS SOILS IU FS

STSIU AREAS WITH COPPER>327 mg/kg AND pCu<5

ARCADIS

APPENDIX
D-13

Attachment A: 2018 Reference Area Evaluation Technical Memorandum

MEMO

To:

Pam Pinson

Copies:

Anne Thatcher

Arcadis U.S., Inc.
630 Plaza Drive
Suite 100
Highlands Ranch
Colorado 80129
Tel 720 344 3500
Fax 720 344 3535

From:

Carolyn Meyer

Date:

November 10, 2022

Arcadis Project No.:

30006782

Subject:

Technical Memorandum on pCu Reference Area Visit and Analysis

1 INTRODUCTION

On October 2 and 3, 2018, personnel of Chino Mines (Chino), Arcadis, New Mexico Environment Department (NMED), and Formation visited areas off site to identify suitable reference areas for the Smelter Tailings Soils Investigation Unit (STSIU) Feasibility Study (FS). This technical memorandum discusses the methods used to select and sample these reference areas and the results from the sampling. It also summarizes how these reference areas can be used to evaluate adverse effect thresholds for pCu to assist in remedial decisions for the plant communities on the STSIU.

The purpose of the off-site reference area sampling and analysis is to help interpret background conditions of the plant community for the FS had there been no mining-related chemical impacts on the vegetation[1]. To reduce soil toxicity to plants from copper, NMED issued a pre-FS Remedial Action Criterion (RAC) for shallow soil within the STSIU of pCu ≥ 5, where the total copper concentration in soil is > 327 milligrams per kilogram (mg/kg). Not all areas of the STSIU that meet the pre-FS RAC should be remediated, however, especially if the plant community is in good condition, similar to reference areas.

As stated in the STSIU FS proposal (FS Work Plan; Arcadis 2011), “Chino proposes the decision to remediate areas with pCu < 5 be based upon consideration of the current range condition and habitat quality.” Reference areas help define the background range condition and wildlife habitat quality and assist in separating mine-related soil chemistry effects on the plant community from background soil chemistry effects. The STSIU Work Plan specifically states, “a grazed reference area east of Lampbright Draw with

---

[1] The reference areas were for evaluating the vegetation community endpoints, which are impacted by soil pCu, not wildlife toxicity, which is controlled by copper ingestion.

little impact from the smelter will be found to represent reference areas for cover and richness of grazed areas." This technical memorandum discusses the reference areas found in the grazed areas east of Lampbright Draw, areas that will be used to define acceptable wildlife habitat that does not require remediation for the FS.

The FS Work Plan also lists numeric criteria for determining acceptable wildlife habitat in ungrazed areas. The criteria are from the closure/closeout plan reclamation guidelines for Chino (DBS&A 1999) required by the New Mexico Mining and Minerals Division (MMD), and are at least 32 percent vegetation cover and at least eight species for richness. However, all areas with pCu < 5 are appear to be grazed; as such, these numeric criteria do not apply. Rather, as was done in DBS&A (1999), proportional success standards can be applied to the endpoints measured on the grazed reference areas. The grazed reference areas were selected to represent the topographic and soil conditions of impacted, grazed locations on the STSIU.

A phytotoxicity and community study (phytotoxicity study) on the STSIU (Arcadis 2022) demonstrated that four "soil/slope categories" (soil categories) have a strong influence on STSIU plant community richness and cover, and that the effect of these soil categories should be considered in the STSIU FS Report. The revised phytotoxicity study incorporated two reference locations for the community analysis to identify adverse effect thresholds[2], but these two reference areas represent one soil category and do not represent the full range of conditions across all four soil categories. As such, the purpose of the reference areas sampled in 2018 is to provide background values for community metric endpoints of cover, richness, and rangeland condition (via Observed Apparent Trend [OAT] score) across the following four soil categories identified in the phytotoxicity study (Arcadis 2018):

1. Flat granular
2. Flat rocky
3. Bedrock
4. Steeper slopes (>13%).

NMED agreed to accompany Chino to these locations and was present for sampling.

The new reference areas sampled in 2018 will be used in the FS to screen acres for their quality of wildlife habitat. Specifically, if a location meets the wildlife habitat criteria for richness and cover, it will not be carried forward into the FS for remedy evaluation. Rangeland condition (i.e., OAT) is a third criterion used to screen out areas; however, it is not determined by the reference area data because a numeric criterion was set in the FS Work Plan that stated good rangeland condition is present when a location's OAT score exceeds 22. The reference areas were reviewed to assess whether they represented fair-good or poor rangeland based on this criterion. If all or most of reference sites of a soil category are considered poor rangeland, however, the threshold of 22 was considered too high as a target, and a value consistent with reference was used instead, as explained further below.

The identified acres that remain after screening will be reviewed for pCu impacts and remedial alternatives in the FS. The results from the phytotoxicity study (Arcadis 2022), amendment study (Arcadis 2017a), and white rain study (with subsequent 5-year pH monitoring, Arcadis 2017b), combined with information from this memorandum, will be used for that evaluation. The new reference area data will **not** be used to revise

---

[2] One of these (Wildlife Reference North) was slightly west of Lampbright Draw, but its chemistry represented background conditions as discussed in the phytotoxicity study and was deemed acceptable as a reference.

the phytotoxicity study report, however, which has been through several review cycles with NMED. Instead, data from the new reference locations are evaluated as to how they affect de minimis effect levels (DELs) and probable effect levels (PELs) for pCu impacts on the vegetation community. Revised DELs and PELs provide context for net environmental benefit when evaluating remediation approaches.

2 SELECTION CRITERIA FOR REFERENCE LOCATIONS

As introduced above, this 2018 field study was designed to fill the data gaps on community endpoints for the other three soil categories (bedrock, slope, and flat rocky soils) not represented by the current set of reference locations. NMED requested that de minimis locations identified in the phytotoxicity study not be used[3]. Reference areas that have been identified as acceptable in the sitewide Ecological Risk Assessment (Newfields 2007) include an area near the airport, and in the phytotoxicity study areas west of the smelter (STS-PT-2013-24), and in the far southeast corner of the STSIU (STS-PT-2013-25, 26, 28 and “wildlife reference north” locations in the greenhouse experiments of the phytotoxicity study; Figure 1). Of the phytotoxicity study’s five locations, two locations (STS-PT-2013-26 and wildlife reference north) have plant community data available for screening, whereas all have laboratory phytotoxicity data. The two reference areas with plant community data are in the flat granular soil category and do not adequately represent the full range of conditions on the STSIU.

The criteria specified for selecting the new reference locations included:

1. Two locations per soil category, totaling eight new reference locations. For the FS, each STSIU location will be matched to the reference locations within the same soil category. However, only one flat rocky reference location was identified in the field and sampled, and an extra bedrock location was sampled.
2. Elevation, geology, and grazing management history similar to those of the STSIU locations
3. No locations on the eastern side of the Black Range; preference for areas close to Faywood, which is on the western side of the Range.
4. Soils developed from rhyolitic pyroclastic flows, the same geology as areas found to have low pCu and higher sulfate on the STSIU. Rhyolitic soils have lower buffering capacity than basaltic soils or other soils derived from other non-rhyolite rock types and are most sensitive to pH changes.
5. Distant from the former Hurley smelter. The locations should not be in the path of wind deposition from the smelter or else be far enough away to have low copper, neutral pH, and low sulfate concentrations.
6. Permission to access the property. This criterion limited selection of locations to public lands.
7. Season of collection in September-October timeframe. This timeframe matches that of vegetation data collection at the STSIU locations.

---

[3] Other potential reference areas that Chino and NMED jointly selected in the field in 2011 and 2012 for a community analysis include bedrock areas (STS-PT-2013-21, 22, 23) and a flat granular area (STS-PT-2013-27, also known as wildlife reference area south). These are considered “de minimis” locations that represent areas with copper concentrations below background levels. Those locations could not be considered reference areas, however, because their low pH and high sulfate concentrations do not appear to be representative of background, as shown on Figure 3 of that report. Further, though distant from the smelter by about 2.5 to 3 miles, they are in the path of the former smelter’s wind direction.

When including the two flat granular reference locations with community data collected previously (STS-PT-2013-26, Wildlife Reference Plot North), the number of reference locations available for the FS sums to 10 (Figure 1).

3 DESCRIPTION OF THE REFERENCE LOCATIONS

Based on the seven criteria in Section 2, eight locations, two of each soil category, initially were identified to sample in early October 2018.. It was not possible to always sample two of each soil category because of the difficulty of finding flat rocky soils that met the criteria. Only one flat rocky location was identified as a reference site. An additional bedrock location similar to site bedrock locations was sampled to bring the total number of reference locations sampled in 2018 to eight (Figure 1).

The eight locations met the other criteria. They had elevations similar to the compared site locations on the STSIU, ranging from 5,000 feet to just over 5,700 feet above sea level. The STSIU sites ranged from 5,000 feet to 6,500 feet in elevation. The locations also met the geologic criteria of having soils developed on rhyolite, as they were situated on Kneeling Nun rhyolite or Sugar Lump rhyolite (only STS-2018-REF-FG1 was on Sugar Lump rhyolite). All locations were grazed, which matches the STSIU grazing history. The locations were close to the town of Faywood. All were on public land (Bureau of Land Management) to facilitate access. All eight locations were more than 13 miles from the smelter. Aspect can also impact plant communities; obtaining a north- and south-facing wildlife reference area was the focus initially in 2011. However, it was not included in the final criteria list in Section 2 because aspect turned out not to be predictive of plant cover, richness, or of the OAT score. Soil category was much more predictive (Arcadis 2018) and became the focus for the sampling design. Table 1 summarizes the physical characteristics of the selected locations by soil category.

Additionally, two locations were selected for re-sampling to characterize effects of climatic differences among years. One of those was a site location with impacts (wildlife reference south) and the other a reference location (wildlife reference north). Two other site locations farther from the smelter but with smelter impacts were selected to fill in data gaps on pCu effects on locations more distant from the smelter that are heavily affected by grazing. They are referred to as overgrazed reference area[4] and overgrazed rocky area 2; the latter is an area just uphill of the overgrazed reference area, shown on Figure 1.

For comparison; the reference, de minimis, and STSIU locations are mapped onto the soil category map on Figure 2[5] and the geology map on Figure 3.[6]

---

[4] Although referred to as overgrazed reference area, this location is not a reference area, as it has been impacted by the smelter.

[5] The soil category map was created by identifying all obvious bedrock areas (> 65% rock at surface) from aerial imagery and labeling it bedrock. For the remaining rangeland polygons, slopes greater than 13 percent were identified as slope soils, and the rest were divided into flat granular soils if considered good rangeland condition (OAT score ≥ 22) and flat rocky soils if not. The last rule is an approximation because, as the reference data results show, some flat granular areas are in poor rangeland condition and some flat rocky areas are in good rangeland condition. Overall accuracy of ground locations is 74 percent, and user accuracy is above 70 percent for all soil categories, except flat granular (33 percent). Flat granular was most frequently mapped as flat rocky, which will be conservative for the FS.

[6] The geological classifications beginning with Q have deeper soils because they are derived from alluvium. This geology map considers shallow soils of less than 6 inches on average with bedrock underneath as representing areas

4 SAMPLING, SURVEY, AND ANALYTICAL METHODS

Appendix A of this memorandum contains the detailed standard operating procedures (SOPs) used for sampling soils and surveying the vegetation. The methods match those used in the field community study described in the phytotoxicity study report (Arcadis 2022), which are based on the methods more generally outlined in Appendix A of the approved FS Work Plan (Arcadis 2011). Soil was collected from 0 to 6 inches below ground surface at five locations (corners and center) of a 100 x 100 foot square area and composited. The soil was sampled for pH, total copper, and sulfate, analyzed at ACZ laboratories using Energy Laboratories' analytical methods described in the phytotoxicity study work plan (Arcadis 2014) and report (Arcadis 2022). The exception was sulfate, which was sampled using a turbidimetric method rather than the inductively coupled plasma (ICP) method. The ICP method sampled all forms of sulfur including sulfate, whereas the turbidimetric method sampled only sulfate. Because sulfide in the soil would convert to sulfate quickly (Keller-Lehmann et al. 2006, USEPA 1983, APHA 2017), the two methods should give the same results. ACZ reported the sulfate results in mg/kg. The units were converted to milliequivalents per liter (mEq/L) for this report to compare to STSIU sulfate results that were reported in mEq/L in the phytotoxicity study report.

Vegetation endpoints surveyed included vegetation cover, species richness, and the OAT score.

The data analysis was composed of three components as follows:

1. Evaluate if the soil chemistry reference locations selected fall within the background range for pH, copper, and sulfate concentrations to confirm they represent background chemistry.
2. Identify target vegetation endpoint values for screening based on reference data. This entails three steps.
    I. Adjust the vegetation cover measured in 2018 at the reference locations to vegetation cover expected at those locations in 2011, the year of vegetation cover estimates for the STSIU locations in the phytotoxicity and community study (Arcadis 2022). To accomplish this, a normalized vegetation difference index (NDVI) was calculated from Landsat 7 and 8 Images for 2011 and 2018, respectively, at all locations and scaled from 0 to 1 (removes artifacts of differences between the two Landsat sensors). The ratio between years was applied to 2018 data to convert to 2011 estimates using the same method applied in the phytotoxicity study to adjust 2014 vegetation data to 2011 conditions.[7]
    II. Identify the mean value of the reference envelope (envelope ranges from minimum to maximum) for each community endpoint for each soil category.
    III. Using the proportional success guidelines, identify the percentage of the mean value that will be the target used to classify a rangeland polygon[8] on the STSIU as acceptable (if above target) or unacceptable (below target) for the screening step.

---

where tilling, ripping, and soil removal remedial technologies to improve the plant community may not be an option. The map is an approximation, however, and not used to eliminate areas.

[7] As was done in the phytotoxicity study, richness was not adjusted because it requires high-resolution IKONOS imagery in both years, and such imagery was not readily available in fall 2018. OAT score did not require adjustment because investigators adjusted their scale in the field each year based on climatic conditions that year.

[8] Rangeland polygons are defined and shown in the STSIU FS proposal.

3. Identify pCu effect thresholds for rangeland polygons not screened out using the following two steps:
    I. Create dose-response regression curves (using general linear models) between pCu and the three community endpoints. These will look similar to the community dose-response curves in the phytotoxicity study. However, these curves will be fit to a dataset that includes the new reference and site data collected in October 2018 in addition to the data collected in 2011, 2012, and 2014.
    II. Calculate a DEL and PEL from each regression curve. The DEL and PEL are the respective pCu effect thresholds corresponding to 100 percent and 50 percent of the reference community endpoint value for each community endpoint and soil category.[9]

5 RESULTS

Section 5.2 reports the results for the soil chemistry data, and Section 5.3 reports the results for the plant community endpoints and threshold targets for screening out areas from remediation. Section 5.4 presents the calculated DEL and PEL values.

5.1 Soil Chemistry

Table 2 presents the soil chemistry results for the locations sampled in 2018. Of the reference locations, soil pH ranged from 5 to 6.4 in the bedrock locations, from 6 to 6.4 in the slope locations, and from 6.2 to 7.7 in the flat rocky and flat granular locations. One of the flat granular locations (STS-2018-REF-FG1) had the highest pH (7.7), probably because it did not occur in the same vicinity as the other sites and was on a different rock formation, the Sugar Lump Formation. Copper concentrations never exceeded 180 mg/kg, which is well below the pre-FS background threshold for copper of 327 mg/kg. Soluble sulfate was low, ranging from 0.21 to 0.25 mEq/L for the reference locations, except at STS-2018-REF-BR2, which had 0.38 mEq/L, a value still considered low.

To determine if these locations fit the profile of background soil conditions, their pH and sulfate data were plotted on Figure 4, a figure that was also presented in the phytotoxicity report using the greenhouse experiment data[10] and is now modified for the new data in this memorandum. All fell within the expected pH range and low range for sulfate (meaning no smelter influence) for the pertinent soil category and were similar to other reference locations deemed adequate as background soils in the NMED-reviewed phytotoxicity report. The background ranges were updated with the new reference data on Figure 4. Notably, the background for pH of rhyolitic bedrock now ranges from 5 to 6.4, indicating that this bedrock type can have low pH naturally.

In contrast, the two STSIU site soils with soil chemistry sampled (overgrazed reference, overgrazed rocky 2 in Table 2) contained copper concentrations greater than the background threshold of 327 mg/kg and pH

---

[9] The DEL is a “de minimis effect level”, preferably at 90 or 80 percent of reference (e.g., a 10 or 20 percent effect level), as discussed in the phytotoxicity work plan, but to be conservative, it was set at 100 percent of reference in the phytotoxicity report and in this memo.

[10] The phytotoxicity study included two components: a field community study (data shown in Table E-1) and a greenhouse experiment (data shown in Table E-2, Figure F-1 and F-2). Most of this memo focuses on the field community study locations, but not all of these locations had extensive chemistry sampled. Because all the greenhouse experiment locations for soil collection had extensive chemistry sampled including sulfate, bicarbonates, and calcium, these locations were used to evaluate and discuss chemical factors differentiating the four soil categories.

lower than 5. When plotted on Figure 4 (labelled O and O2), they fell within the range of other STSIU site soils.

The soil chemistry and Figure 4 support that the 2018 reference soils represent background and the 2018 site soils represent site impacts. The laboratory reports with these data are included in Appendix B.

5.2 Plant Community Endpoints

Table 3 presents the OAT scores, mean cover, and mean richness values recorded for the new sample locations in 2018. Appendix C contains the raw vegetation data used to calculate the means.

As mentioned previously, the percentage of reference area cover and richness used as the target for screening out rangeland polygons will be based on proportional success guidelines. The guideline for establishing targets for richness and cover will be based on a proportion of the mean reference value for each soil category, determined by the spatial variability observed in the reference locations. Specifically, the spatial variability is measured using the relative percent difference (RPD[11]) between the maximum and minimum value of reference locations in each soil category; it will determine the proportion of the reference mean that will be the target. The flat rocky soil category only had one reference site; therefore, the average RPD for the three other soil categories was used as its RPD. This RPD approach works for small reference datasets (n = 2 or 3) because it helps account for expected variability in a reference dataset if a larger sample had been taken. This methodhas been used on other mine sites (Arcadis 2019).

The OAT score indicates that all the bedrock reference areas were in poor rangeland condition (less than 22) and all the slope reference areas were in fair-good rangeland condition. The flat granular reference areas surveyed in 2018 were variable, with two thirds in fair-good rangeland condition and one third in poor rangeland condition. When all flat granular reference locations are included by adding the STS-PT-2013-26 location sampled in 2014 (shown in footnote of Table 3), half are in fair-good rangeland condition and half are in poor rangeland condition. The flat rocky reference location was in borderline poor/fair-good rangeland condition with an OAT score of 22 (Table 3). Because all bedrock locations were poor rangeland, the target criterion of 22 was changed for bedrock to the proportional success approach used for richness and cover. Table 4 identifies the mean, RPD of the four soil categories, and target values for screening.[12]

Table 3 shows the ratio of scaled NDVI values in 2011 and 2018, and the estimated 2011 values when that ratio is applied to the 2018 mean cover values for each location to convert them to 2011 values. These estimated 2011 cover values are considered comparable to the STSIU site values used for analysis in the phytotoxicity study, which were also 2011 values. The mean value of the average 2011 cover for the reference areas is used to calculate a cover target for screening, and ranged from 17 percent cover in bedrock areas to 53 percent cover on the slope areas (Table 4). In contrast, the location with flat rocky soils on the STSIU sampled in 2018 (overgrazed reference in Table 3) had a low estimated mean cover in

---

[11] Calculated as maximum minus minimum value divided by average value times 100 to convert to a percentage.

[12] For flat granular soils, the creosote bush location had different cover than the other locations, creating an RPD for cover of more than 100 percent and therefore was eliminated when calculating the RPD for cover. Similarly, one bedrock reference location had a large patch of non-bedrock, creating a very high RPD for cover and richness for bedrock of more than 80 percent and was eliminated for cover and richness before calculating the RPD.

2011 of 6 percent and low mean richness of six species. This location was not randomly selected but rather sampled to evaluate a highly overgrazed location on the site.[13] It may not fully represent the rangeland polygon in which it is located. For example, immediately uphill of that location (in the same rangeland polygon), the vegetation, which was not formally surveyed, visually looked more diverse, and had higher cover than the downhill location (see photograph comparisons in Appendix D), even though soil pCu was somewhat similar (compare pCu of 4.4 on uphill location called “overgrazed rocky 2” to pCu of 4.6 on the downhill “overgrazed reference” location in Table 2). These differences may be due to less intense grazing on the uphill location because the uphill site is farther from a drainage where livestock often prefer to graze. Grazing impacts (reduced vegetation, topsoil erosion, compaction) vary even within a soil category and complicate the interpretation of pCu effects on the plant community.

The mean richness of reference areas, which could not be adjusted to 2011 values is used to calculate a target for richness screening. Mean richness ranges from seven species in bedrock areas to 15 species in slope areas (Table 4).

Using the “acceptable” criteria discussed above to calculate targets, Table 4 presents the target community endpoints for each soil category that will be used in the STSIU FS to determine which rangeland polygons with pCu < 5 appear to have acceptable wildlife habitat (cover and richness) or fair-good rangeland condition. Depending on the soil category, the target thresholds for percent cover range from 7 (bedrock) to 45 (slope) percent and from 4 (bedrock) to 10 (slope) for richness (number of species; Table 4). The target for fair-good rangeland condition is an OAT score of 22 for all but the bedrock category, which has a target of 13 for the OAT score. The criteria are used to evaluate habitat quality for livestock and wildlife. Specifically, OAT scores are used for the livestock assessment and cover and richness for the wildlife habitat assessment. Therefore, to evaluate wildlife, both richness and cover targets must be met. To evaluate livestock rangeland quality, only the OAT score target must be met. If one of the two goals (meeting livestock or wildlife targets) is met, the rangeland polygon can be screened out from consideration for remediation because remediation in this arid, slow-recovery environment likely would do more harm than good to the goal of the remediation because the goal (an intact plant community) is already met.

Maps to be used for this screening were developed using remote sensing and include:

1. OAT score fair-good (acceptable) versus poor (unacceptable) rangeland map (88 percent accuracy with 17 percent error of commission on the acceptable class based on independent data points[14])
2. Vegetation cover acceptable versus unacceptable rangeland map (74 percent accuracy based on all datapoints with 18 percent error of commission on the acceptable class)
3. Vegetation species richness acceptable versys unacceptable rangeland map (71 percent accuracy based on all datapoints with 40 percent error of commission on the acceptable class).

The accuracy for usability of these maps was set at 70 percent or greater total accuracy in the FS Work Plan, with no more than 15 percent error of commission (such commission error is where unacceptable

---

[13] Although visually in photographs, it appears to have improved by 2018.

[14] 23 locations were used to train data for OAT scores, and a randomly selected 8 were used for accuracy assessment. For cover and richness, locations were not used to train data; instead, NDVI and variance in NDVI were scaled to the endpoint. Therefore, all 31 locations were used to assess accuracy. This differs slightly from FS work plan, which says jack-knife cross-validation method should be used, but that method had too much uncertainty.

areas are mapped as acceptable). All three metrics met the total accuracy criteria The error of commission was close to the criteria for OAT and vegetation cover (generally met the criteria considering the sample size), but the richness map did not meet the 15 percent error of commission (see main Appendix D accuracy section). Part of the challenge is that the FS Work Plan criteria were based on the assumption that the community endpoints mostly will vary based on aspect, not on the soil categories. The change to modeling four soil categories, each with different target thresholds, versus two aspect categories (north- and south-facing) makes it more difficult to attain a low error of commission with the low sample size in the mapped “acceptable” category (n = 5 for OAT and n=10 for richness, whereas n = 14 for cover, the only endpoint that had error lower than the target). For example, a sample size of six that has one error can have no lower than 17 percent error of commission due to that small sample size. Thus, the 17 percent error for OAT score that represents only one error should be acceptable. The richness map had a larger error of commission but the map was deemed acceptable to use to be conservative in retaining more areas for remedial evaluation, as discussed in the main text of Appendix D.

A minor issue with this screening approach is that the soil category map was used to develop the remote sensing maps when the above thresholds were applied to each soil category to create the binary classifications of the maps (see main Appendix D for more details). The soil category map required some assumptions that increase errors in classifications. Specifically, flat granular soil areas were defined as non-bedrock fair-good (acceptable) rangeland that is not in steep areas. As such, flat granular mapped rangeland polygons cannot fail to meet the fair-good rangeland condition because of this definition, and all acres of this soil category will be screened out. Yet, some of the flat granular areas have poor rangeland condition, as seen by viewing the ground data in Table E-1, which shows 5 of 12 flat granular locations, defined as that class on the ground, had poor rangeland; however, three of these were classified as flat rocky on the map (the other two were not classified because outside the STSIU), and were still classified as poor rangeland on the final rangeland condition map because their flat rocky soil polygon was defined as poor rangeland condition. This means flat granular locations on the ground can fail to meet the criteria but likely still will be found and placed in the flat rocky acres that would be carried forward to the FS (e.g., they are included because they were mistakenly classified as flat rocky instead of flat granular).

A final issue is that the flat rocky reference location had shallow soil over bedrock. Although at least one STSIU flat rocky location also had shallow soil over bedrock, most flat rocky locations on the STSIU had compacted soils with rock armoring. They are not as well represented by the single flat rocky reference location. The Natural Resources Conservation Service (NRCS) web soil data indicate that flat rocky soils are in a Hills ecotype commonly found in the STSIU. Heavy grazing in this ecotype can convert areas with abundant grasses to mostly shrubs (e.g., mesquite) and bare ground with overgrazing (Bestelmeyer et al. 2004, also see the succession section of Appendix B-3 of the Amendment study, Arcadis 2017a). At the time of sampling, other possible flat rocky areas representative of this type could not be accessed. If such areas can be found or accessed, additional flat rocky sampling could be recommended to improve the screening process but none have been found to date.

5.3 Effect Levels for Plant Community Dose-Response Curves

Dose-response curves in the phytotoxicity report were updated with the 2018 reference data[15], and the resulting curves are shown on Figure 5. The methods used to develop the curves and the pCu DELs and PELs for each soil category are described in the phytotoxicity study report. The same outliers were removed from richness regression calculations (e.g., represented very different juniper habitat than other sites or unusually heavy trampling) except that the new flat granular reference site STS-REF-2018-FG1 was removed as an outlier from the richness and cover regressions (but retained as a point in the plot). This flat granular reference site was an outlier because it had unusually low richness and was predicted to have unusually low cover in 2011 even though it had at very high pCu (Figure 5).[16]

The regression analyses indicated no significant relationship ($p<0.05$) between pCu and richness or pCu and OAT score in flat granular soils, and no relationship between pCu and cover in slope and flat rocky soils (Table 5). The results are similar to those reported in the phytotoxicity study report, except that: (1) flat granular soils no longer correlate with pCu for richness, and (2) the OAT score has significant correlations with three of the four categories. No relationship indicates either that other factors strongly override pCu effects or the plant community has high tolerance or low copper uptake in low pCu soils because of a soil category's properties.

The PELs and DELs for significant relationships for the four soil categories and endpoints are plotted on Figure 5 and shown in Table 6. Most importantly, when all three endpoints are considered, all but bedrock have some insignificant relationships with pCu ($p>0.05$), which suggests that pCu is not always a strong indicator of the plant community condition.

The average DEL and PEL across all three endpoints is informative for evaluating tolerance of plant communities in each soil category to pCu. However, the insignificant DELs and PELs do not have a numeric value, making the average not correlated to pCu tolerance of a soil category. To correct this omission, buffering capacity classes were employed to assign a value for insignificant values.[17] When a non-significant PEL or DEL was identified for a soil category for an endpoint, it was replaced with the significant DEL or PEL value of a soil category in its buffering class, as shown in Table 7. With this adjustment, average DELs across the soil categories range from 5.83 to 8.08 and average PELs range from 2.97 to 4.60, with the highest values in the flat rocky soil category. As expected, PELs were highest in the low buffering capacity soils (bedrock and flat rocky) and lowest in the high buffering capacity (flat granular and slope) soils.

---

[15] Cover data were adjusted to 2011 values. Data used for the models are shown in Appendix E, Table E-1.

[16] This unusual condition is likely a result of STS-REF-2018-FG1 representing a creosote bush community rather than the mesquite-grama or mixed grama community of most of the other flat granular locations.

[17] Because the data show that buffering capacity (and vegetation community response) usually is highest in the flat granular soils, followed by the slope soils (Figure F-1, also see Figure 5), these two soil categories were grouped together as the "high buffering capacity soils class" relative to their sulfate concentration/potential acidity. The lowest buffering capacity is in bedrock and flat rocky soils (Figure F-1), so these two were grouped together in the "low buffering capacity soils class." The other option is to include the insignificant regression coefficients to calculate a PEL and DEL, but this method does not work when the trend line is positive, as it was for some relationships such as cover in slope soils vs. pCu.

6 DISCUSSION

The pre-FS RAC for pCu and performance criteria discussed in this memorandum can be used to screen out rangeland polygons from requiring remediation. For refining remedial decisions for areas not screened out and carried forward to the FS, pCu may not be a good metric because three of the four soil categories had some insignificant relationships with pCu for at least one plant community endpoint. The fourth soil category (bedrock) had all three endpoints correlated to pCu but has very little buffering capacity (low lime, Figure 6a) compared to the other three soil categories. It is sensitive to the pH and pCu changes from the former smelter and windblown tailings (has low alkalinity in acidic soils to offset any added acidity, Figure 6b). However, bedrock always was in poor rangeland condition, even in reference areas (reference OAT score was as low as 14, Table 3), indicating that bedrock areas may be unimportant to livestock. Also, they have limited value to wildlife because bedrock locations have hard rock at the surface and contain only small, shallow pockets of soil with limited cover by the herbaceous, non-woody plants that are typically most affected by pCu (Arcadis 2017a). These pockets are subject to erosion from monsoon rains and do not provide much wildlife habitat or livestock rangeland. Remediation for small pockets of vegetation on naturally poor-quality rangeland and habitat is questionable because the pCu Remedial Action Objective (RAO) is intended to protect naturally good rangeland that may have been degraded due to historical mineral processing.

Like bedrock, flat rocky soils also appear to experience greater impacts from pCu to the plant community than slope or flat granular soils (Figure 5). This soil category is not limited by large areas of hard bedrock on the surface, and its low pCu areas may require remediation measures that increase the pCu when the plant community endpoints are below the screening thresholds. However, in contrast to the other three soil categories, Figure 4 indicates that pH is not negatively correlated to sulfate as expected[18] in the flat rocky areas. The lack of correlation appears to be from three flat rocky soils that had unusually high lime and alkalinity (STS-PT-2013-2, 17, and 36), likely from their topography and location capturing greater deposition of nearby alkaline windblown tailings or white rain (Figures 6a and 6b). If these three soils are removed from Figure 4 as outliers, the flat rocky soil negative relationship between pH and sulfate becomes similar and parallel to the other three soil categories as expected (see Appendix F, Figure F-1), falling below slope and flat granular soils, and appearing to be more similar to bedrock soils. This trend line indicates that this soil category's buffering capacity, specifically its ability to resist pH reductions with the former smelter deposition of sulfuric acid (which converted to sulfate), is typically poor and more similar to bedrock. In support, Figure 6a shows that lime is relatively low in this flat rocky soil category if one ignores the three outliers (outlier locations 2, 17, and 36)[19].

It might be expected that the three impacted outlier flat rocky locations with high pH soils would have high soil pCu and consequently greater cover, richness, and OAT scores than lower pCu soils, and would be more similar to the high pCu reference flat rocky soil. Of the three soils, only two have community data to evaluate that hypothesis. The two locations both had high pCu (>5, up to 6.3) and had similar or greater cover (though lower richness and OAT scores) than the flat rocky reference location (STS-2018-REF-FR1,

---

[18] Sulfate was likely derived from sulfuric acid deposition from the smelter; thus, low pH is correlated with high sulfate in impacted areas.

[19] Also see Appendix F, Figure F-2 piper diagrams for cations such as calcium from lime and buffering anions such as bicarbonate in the various soils.

Table E-1). Although they had greater or similar cover, it was mostly woody cover. Non-woody cover is often more impacted by pCu (Arcadis 2017a), and in the two locations, non-woody cover was lower than in the reference soil (2.5 to 4.8 percent vs. 8 percent), and non-woody cover fell within the range of non-woody cover of impacted flat rocky locations that had pCu < 5 (three locations with available non-woody data ranged from 1.1 to 5.3 percent). This result suggests that even currently high pCu flat rocky locations have poor amounts of non-woody cover because of compaction and erosion in that soil category.

The third flat rocky location (STS-PT-2013-36) was at the top of a hillslope near former tailing operations and did not have community data, but did have a high copper concentration, at 3,770 mg/kg, and a correspondingly low pCu of 3.36. As such, it may not be expected to have as healthy a plant community. Yet, it had some large bunchgrass growing on the site that was visible in the location's photo (see photos in Appendix I of phytotoxicity study and grass data in Table E-1). The unexpected large bunchgrass is likely a result of the amount of grazing and associated compaction in the soil because areas up on slopes are often less grazed. Though categorized as a flat rocky location, this third location is on the border of a slope and represents more of an intermediate condition between flat rocky and slope categories. These observations further support conclusions in the amendment study (Arcadis 2017a) that a strong non-woody vegetation cover response to lime application alone is not guaranteed in flat rocky soils because of past grazing pressure effects on the soil. This information will be useful for remedial decisions in the FS.

7 SUMMARY AND CONCLUSIONS

To support the STSIU FS, this technical memorandum summarizes the results from the 2018 field sampling and surveying of reference areas to fill data gaps. Eight reference areas were sampled for soil and surveyed for plant endpoints in October 2018, bringing the total reference area dataset to be used for comparing plant communities on site to reference areas off site to ten, given that two reference sites (wildlife reference north and STS-PT-2013-26) had been sampled previously. Three additional STSIU site locations were sampled or surveyed. Two of these were sampled for soil to evaluate pCu at highly overgrazed areas on the site, and one was sampled and surveyed along with the wildlife reference north location to calibrate changes[20] in plant cover due to the climatic differences over 3 different years of sampling; this repeat survey ensured that on-site and off-site area data are comparable.

Like the two previously sampled reference locations, all new reference locations had sulfate concentrations and pH in the soil within the expected range for the geology and soils of the location, indicating that they do not have any smelter or windblown tailing impacts. These results support that the new reference locations adequately represent background conditions without mining impacts.

The purpose of the new data is to identify target thresholds for classifying a "rangeland polygon" on the STSIU site that has pCu less than 5 (below the pre-FS RAC threshold) as acceptable or unacceptable wildlife habitat. Thresholds were developed for each of the four soil/slope categories that strongly affect plant communities, which are:

- Flat granular
- Flat rocky

---

[20] Wildlife Reference North and South locations were sampled each year of community sampling to calibrate cover.

- Slope
- Bedrock soils.

In conjunction with the OAT score, which identifies areas with fair-good or poor rangeland condition using a threshold of 22 (13 for bedrock), these criteria will help identify if some areas have acceptable wildlife habitat or rangeland condition, and if so, then remediation of such areas would likely do more harm than good. Target thresholds were identified based on a proportional success guideline developed from the reference locations. Depending on the soil category, target thresholds ranged from 7 to 45 percent for cover and from 4 to ten species for richness. An issue that arose with the OAT score threshold of 22 for "fair-good" rangeland identified in the Work Plan is that one soil category (bedrock) always is in poor rangeland condition, even in reference areas. Therefore, the OAT score threshold for bedrock was changed from 22 to a proportional success target developed using the same approach as for richness and cover, which was an OAT score of 13. If an area's livestock rangeland or wildlife habitat is found to be "fair-good" or "acceptable," the area will be screened out from consideration for remediation in the STSIU FS because it may already be in a condition adequate for livestock or for wildlife.

To understand plant community effect thresholds in areas retained for remediation consideration, DELs and PELs presented in the phytotoxicity study were recalculated with the new data. The recalculation is important because the phytotoxicity study did not have any reference areas representative of flat rocky, bedrock, or flat granular soils. That study only had two reference areas, both falling in the flat granular soil category, to develop DELs and PELs from the plant community analysis. The new DELs and PELs will be incorporated into the decision analyses for the FS. DELs and PELs for some soil categories and endpoints were not significantly correlated to pCu and were replaced with DELs and PELs of a soil category having a similar buffering capacity. When averaged across all three endpoints after replacing insignificant DELs and PELs with these significant DELs and PELs, the average DELs across the soil categories ranged from 5.83 to 8.08, and average PELs ranged from 2.97 to 4.60, with the highest values in the flat rocky soil category. These DELs and PELs will assist with identifying remediation approaches for areas not screened out that will require some form of remediation of the pCu impacts in the STSIU.

8 REFERENCES

American Public Health Association (APHA). 2017. Standard Methods for the Examination of Water and Wastewater. 1504 pp.

Arcadis. 2011. Feasibility Proposal for Smelter/Tailings Soils Investigation Unit. Prepared for Chino Mines Company, Hurley, New Mexico.

Arcadis. 2014. Work Plan: Smelter Tailing Soils Investigation Unit (STSIU): Phytotoxicity and Vegetation Community Study. Prepared for Freeport-McMoRan Chino Mines Company, Vanadium, New Mexico.

Arcadis. 2017a. Year 5 Monitoring Report for Smelter/Tailing Soils Investigation Unit Amendment Study Plots. Prepared for Freeport-McMoRan Chino Mines Company, Vanadium, New Mexico.

Arcadis. 2017b. Administrative Order on Consent Year 5 Report on pH Monitoring to Evaluate the Effect of the White Rain on the Smelter/Tailing Soils Investigation Unit. Prepared for Freeport-McMoRan Chino Mines Company, Vanadium, New Mexico.

Arcadis. 2018. Phytotoxicity and vegetation community study. Smelter/Tailing Soils Investigation Unit. Prepared for Freeport-McMoRan Chino Mines Company, Vanadium, New Mexico.

Arcadis. 2019. Biomonitoring report 2018. Prepared for Rio Tinto AuM Company on behalf of Intalco. Holden Mine, Chelan County, Washington. September.

Bestelmeyer, B.T., J.E. Herrick, D.A. Trujillo, and K.M. Havstad. 2004. Land management in the American southwest: a state-and-transition approach to ecosystem complexity. Environmental Management 34:38-51.Daniel B. Stephens & Associates (DBS&A). 1999. Interim Technical Standards for Revegetation Success. Chino Mines Company. Prepared for Chino Mines Company, Hurley, New Mexico. November 30.

Keller-Lehmann, B., S. Corrie, R. Ravn, Z. Yuan, and J. Keller. 2006. Preservation and Simultaneous Analysis of Relevant Soluble Sulfur Species in Sewage Samples. In Proceedings of the 2nd International IWA Conference on Sewer Operation and Maintenance. Vienna, Austria.

NewFields. 2005. Chino Mines Administrative Order on Consent Site-wide Ecological Risk Assessment. Prepared for Chino Mines Company in November 2005.

USEPA. 1983. Methods for Chemical Analysis of Water and Wastes. EPA-600/4-79-020.

Enclosures

Tables

Table 1. Characteristics of locations sampled in October 2018

Table 2. Soil chemistry of locations sampled in October 2018

Table 3. Summary of cover and richness of locations surveyed in October 2018

Table 4. Minimum and target reference values for each soil category

Table 5. General linear model results for richness, cover, and OAT scores

Table 6. DELs and PELs calculated with new reference data included

Table 7. DELs and PELs calculated with new reference data included and substitutions for categories that were not significant

Figures

Figure 1. Site Map with 2018 Reference and Site Locations

Figure 2. Soil/Slope Category map with 2018 Sample Locations

Figure 3. Geology map with 2018 Sample Locations

Figure 4. Relationship between Soluble Sulfate and pH used to Identify Reference vs. Impacted Locations

Figure 5. Relationship between pCu and Community Endpoints by Soil Category

Figure 6. Relationship of pH with Lime and Alkalinity

Appendices

Appendix A. Standard Operating Procedures for 2018

Appendix B. Laboratory Reports from ACZ for soil

Appendix C. 2018 Wildlife Habitat Data

Appendix D. Photolog of 2018 Sampled Locations

Appendix E. STSIU and Reference Community and Soil Data

Appendix F. Soil Chemistry Plots

TABLES

Table 1. Characteristics of locations sampled in October 2018.

Freeport-McMoran Chino Mines Company
Vanadium, New Mexico
Technical Memorandum on Reference Areas

Sample ID	Soil Category	Latitude and Longitude	Elevation (ft)	Slope (%)	Aspect	Distance to Smelter (ft)	Percent bedrock	Soil Complex	Ecological Site	Vegetation Alliance	Average Productivity (lbs/acre dw)	Media sampled/ surveyed
Reference Locations												
STS-2018-REF-FG1	flat granular	N32° 33.308' W107° 56.161'	5103 ft	0	Flat	71889	0	37, Muzzler-Rock outcrop association, 25-45%	Hills	lemonweed (woody)	600	soil, vegetation
STS-2018-REF-FG2	flat granular	N32° 35.498' W107° 55.554'	5138 ft	12.84	Southeast	77523	0	37, Muzzler-Rock outcrop association, 25-45%	Hills	mesq/mix grama	600	soil, vegetation
STS-2018-REF-BR1	bedrock	N32° 35.552' W107° 55.520'	5156 ft	21.87	Southeast	71925	80	37, Muzzler-Rock outcrop association, 25-45%	Hills	mtn mahogany/shrub	600	soil, vegetation
STS-2018-REF-BR2	bedrock	N32° 35.444' W107° 55.204'	5047 ft	30.18	Southeast	71256	63	RU, Rough, broken and rockland (likely Muzzler)	Hills	mesq/mix grama	600	soil, vegetation
STS-2018-REF-BR3	bedrock	N32° 35.610' W107° 55.568'	5171 ft	16.24	Southwest	71775	95	37, Muzzler-Rock outcrop association, 25-45%	Hills	mtn mahogany/shrub	600	soil, vegetation
STS-2018-REF-FR1	flat rocky	N32° 35.442' W107° 55.243'	5076 ft	5.74	East	73418	20	LD, Lehmans extremly rocky loam, 10 to 25%	Hills	mesq/mix grama	325	soil, vegetation
STS-2018-REF-SL1	slope	N32° 35.722' W107° 55.414'	5177 ft	25.44	South	71090	7	37, Muzzler-Rock outcrop association, 25-45%	Hills	mtn mahogany/shrub	600	soil, vegetation
STS-2018-REF-SL2	slope	N32° 35.676' W107° 55.605'	5270 ft	39.89	Northeast	71464	17	37, Muzzler-Rock outcrop association, 25-45%	Hills	mtn mahogany/shrub	600	soil, vegetation
Wildlife Reference North	flat granular	N32° 41.040' W108° 04.062'	5714 ft	5.35	North	8101	0	37, Muzzler-Rock outcrop association, 25-45%	Hills	mesq/mix grama	600	vegetation
Site Locations												
Overgrazed Reference	flat rocky	N32° 38.754' W108° 03.938'	5408 ft	6.38	East	25884	0	13, Encierro-Rock outcrop complex, 15-35%	Hills	mesq/mix grama	579	soil, vegetation
Overgrazed Rocky 2	flat rocky	N32° 38.804' W108° 04.031'	5417 ft	2.87	East	25339	0	13, Encierro-Rock outcrop complex, 15-35%	Hills	mesq/mix grama	579	soil
Wildlife Reference South	flat granular	N32° 40.488' W108° 03.606'	5663 ft	3.02	Southwest	12723	0	37, Muzzler-Rock outcrop association, 25-45%	Hills	mesq/mix grama	600	vegetation

Notes

"--" means soil was not sampled because the location was sampled in previous years

Overgrazed Reference and Wildlife Reference South, despite their names, had low pH and high sulfate and were in the path of the smelter deposition and were not actually reference sites.

mesq = mesquite, mix grama = mixed grama, dw = dry weight

Table 2. Soil chemistry of locations sampled in October 2018.

Freeport-McMoran Chino Mines Company
Vanadium, New Mexico
Technical Memorandum on Reference Areas

Sample ID	Soil Category	Collection Date	Copper, total (mg/kg) dw	pH, Saturated Paste (s.u.)	pCu, Calculated (s.u.)	Soluble Sulfate (meq/L)
Reference Locations						
STS-2018-REF-FG1	flat granular	10/2/2018	22	7.7	10.95	0.25
STS-2018-REF-FG2	flat granular	10/3/2018	82	6.5	8.32	0.25
STS-2018-REF-BR1	bedrock	10/2/2018	96	5.7	7.39	0.38
STS-2018-REF-BR2	bedrock	10/2/2018	49	6.4	8.82	0.21
STS-2018-REF-BR3	bedrock	10/3/2018	180	5	6.02	0.21
STS-2018-REF-FR1	flat rocky	10/2/2018	82	6.2	8.04	0.21
STS-2018-REF-SL1	slope	10/2/2018	72	6.4	8.37	0.25
STS-2018-REF-SL2	slope	10/3/2018	100	6	7.62	0.21
Wildlife Reference North[a]	flat granular	10/2/2018	--	--	--	--
Site Locations						
Overgrazed Reference	flat rocky	10/3/2018	361	4.3	4.57	1.96
Overgrazed Rocky 2	flat rocky	10/3/2018	348	4.1	4.42	0.67
Wildlife Reference South[a]	flat granular	10/2/2018	--	--	--	--

Notes

[a] Though not measured in 2018, soil at these locations was measured in 2013, with copper, pH, pCu, and sulfate of 164-288 mg/kg, 4.6, 5.1-5.8, and 1.4 meq/L, respectively for wildlife reference south location and for copper, pH, and pCu of 213 mg/kg, 5.9, and 6.66, respectively for wildlife reference north location (Arcadis 2018)

"--" means soil was not sampled because the location was sampled in previous years

Overgrazed Reference and Wildlife Reference South, despite their names and low copper concentrations, had low pH and high sulfate and were in the path of the smelter deposition and were not retained as reference sites.

Table 3. Summary of cover and richness of locations surveyed in October 2018

Freeport-McMoran Chino Mines Company
Vanadium, New Mexico
Technical Memorandum on Reference Areas

Site ID	Soil Category	2018 OAT Score	Rangeland Condition	2018 Mean richness (no. species)[b]					2018 Mean cover (%)[a]					Scaled NDVI 2011/2018 ratio	Mean cover adjusted to 2011 (%)
				shrub/tree	grass	forb	succulent	total	shrub/tree	grass	forb	succulent	total		total
2018 Reference Locations															
STS-2018-REF-FG1	flat granular	28	Good	3.4	1.2	6.4	0	**11**	30.03	6.25	3.13	0.00	32.40	0.026/0.088	**9.58**
STS-2018-REF-FG2	flat granular	20	Poor	2.0	4.0	5.8	0.8	**12.6**	16.15	22.00	4.88	1.63	35.35	0.250/0.242	**36.48**
STS-2018-REF-BR1	bedrock	**17**	Poor	0.6	2.4	2.8	0.8	**6.6**	5.88	3.50	1.13	0.00	8.50	0.173/0.125	**11.76**
STS-2018-REF-BR2	bedrock	**14**	Poor	1.6	4.0	3.8	1.2	**10.6**	8.93	11.68	2.88	0.00	24.35	0.386/0.286	**32.84**
STS-2018-REF-BR3	bedrock	**16**	Poor	0.4	2.4	1.2	0.4	**4.4**	0.75	3.40	0.13	0.00	2.38	0.080/0.026	**7.25**
STS-2018-REF-FR1	flat rocky	22	Good	2.6	3.8	6.8	0.0	**13.2**	6.55	16.23	5.63	0.00	22.70	0.122/0.137	**20.15**
STS-2018-REF-SL1	slope	29	Good	2.4	4.2	5.4	2.0	**12.8**	3.25	37.10	4.25	11.53	50.40	0.245/0.252	**49.05**
STS-2018-REF-SL2	slope	36	Good	1.8	5.4	10.2	0.4	**17.8**	11.93	52.10	9.03	1.90	68.60	0.209/0.248	**57.85**
Wildlife Reference North	flat granular	27	Good	1.2	2.6	3.6	0.2	**8.2**[c]	23.58	27.95	5.63	1.90	50.85	0.194/0.270	**30.00**[e]
2018 Site Locations															
Overgrazed reference	flat rocky	16	Poor	1.0	1.4	3.4	0.0	5.8	16.45	2.75	8.28	0.00	25.78	0.001/0.004	6.37
Wildlife Reference South	flat granular	24	Good	2.8	3.2	5.8	0.6	12.4[d]	10.90	15.43	2.38	4.90	27.25	0.119/0.180	19.90[e]
Notes															
2014 reference location data for same columns above are shown below (except replace 2018 with 2014 in headings). This location combined with the above reference locations was used to define target thresholds in Table 4															
STS-PT-2013-26	flat granular	20	Poor	1	7	7.8	0	**15.8**	13.9	16.15	16.15	0	37	0.22/0.16	**51**

[a] Cover was calculated as midpoints of Daubenmire class ranges and averaged to obtain the mean.

[b] Richness was calculated as average number of species across five 20x20' sample blocks.

[c] This mean richness value was 10 in 2011 and 13 In 2014.

[d] This mean richness value was 11 in 2011 and 14 in 2014.

[e] This value was measured in 2011, whereas other 2011 cover values in the column were estimated by applying a scaled (0-1) NDVI ratio to 2018 NDVI corrected data. The estimated 2011 value based on NDVI ratio is similar to observed (estimated at 18 vs. 20% in 2011) for wildlife reference south and somewhat higher for wildlife reference north, which appeared to have more of a community shift over time (estimated at 41 vs. 30% in 2011) with more bristlegrass dominance reducing other species (possibly from some disturbance).

OAT score and richness were not adjusted to 2011 because OAT was re-calibrated every year by observers to weather conditions and richness could not be adjusted without IKONOS imagery (resulting in richness error of about 20-35%).

Mean of bolded values will define the mean of the reference envelope, shown in Table 4. Only bedrock is bolded for calculating OAT targets because only bedrock did not use OAT of 22 as the threshold.

Table 4. Mean, RPD, and final target community endpoint values for each soil category.

Freeport-McMoran Chino Mines Company
Vanadium, New Mexico
Technical Memorandum on Reference Areas

Soil Category	Cover 2011	Richness	OAT
Mean of Reference Areas[a]			
Bedrock	17	7	16
Flat Rocky	20	13	22
Flat Granular	32	12	24
Slope	53	15	33
Relative Percent Difference (maximum - mininum/mean)[b]			
Bedrock	47%	40%	19%
Flat Rocky	39%	38%	25%
Flat Granular[a]	52%	41%	33%
Slope	16%	33%	22%
Target Threshold for Acceptability Criteria[c]			
Bedrock	7	4	13
Flat Rocky	12	8	22
Flat Granular	10	7	22
Slope	45	10	22

Notes

[a] Wildlife Reference North had 8 species in 2018, 11 in 2011, and 14 in 2018, averaging to 11 over the three years; the average was used I this table. This location was the only reference sampled in more than one year.

[b] RPD omits extremes that cause percent difference to be over 80-100%. Also, flat rocky category had only one reference area and its RPD was the average of the other three soil category RPDs (RPD = relative percent difference).

[c] Except for OAT, calculated as 1-RPD x mean, unless result is higher than minimum reference and then minimum used. For OAT, the threshold is 22 except for bedrock, which was based on the RPD.

Table 5. General Linear Model Results for Richness, Cover, and OAT Scores

Freeport-McMoran Chino Mines Company
Vanadium, New Mexico
Technical Memorandum on Reference Areas

Effect	Coefficient	Standard Error	Standardized Coefficient	t-value	p-value
Richness (n = 27[a], R^2=0.74) for all categories except flat granular[a]					
Constant	-1.46	2.05	0	-0.71	0.4849
Calculated pCu	1.85	0.29	0.66	6.31	**<0.0001**
Bedrock	-5.08	1.10	-0.61	-4.64	**<0.0001**
Flat Rocky	-2.85	1.18	-0.33	-2.41	**0.0244**
Cover (n = 24, R^2 = 0.83) for flat granular and bedrock locations only[b]					
Constant	0.03	0.28	0	0.11	0.9125
Calculated pCu	0.39	0.04	0.76	8.83	**<0.0001**
Flat Granular	1.15	0.20	0.50	5.84	**<0.0001**
OAT score (n = 28, R^2 = 0.72) for all categories except flat granular					
Constant	15.63	4.11	0.00	3.80	0.0009
Calculated pCu	1.95	0.60	0.35	3.25	0.0034
Bedrock	-13.91	2.13	-0.85	-6.52	**<0.0001**
Flat Rocky	-12.09	2.32	-0.70	-5.21	**<0.0001**

Notes:

a. Excludes three outliers

b. Excludes one outlier

OAT = Observed apparent trend

Slope is the reference group for the "indicator" variable of soil category (bedrock, flat granular, flat rocky, slope) in the multiple regression. Excluded categories were not significantly related to pCu in the model. R^2 is adjusted for number of variables in model.

Bolded P values have $p < 0.05$.

pCu = cupric ion activity

Table 6. DELs and PELs calculated with new reference data included.

Freeport-McMoran Chino Mines Company
Vanadium, New Mexico
Technical Memorandum on Reference Areas

Soil category	Richness		Cover		OAT Score	
	DEL	PEL	DEL	PEL	DEL	PEL
flat granular	not sig.	not sig.	6.03	3.98	not sig.	not sig.
slope[a]	7.71	4.25	not sig.	not sig.	6.87	0.69
flat rocky	9.47	5.90	not sig.	not sig.	9.48	3.83
bedrock	5.91	4.72	5.28	4.07	6.31	2.71

Notes

not sig. = not significant in regression at $P<0.05$

[a] OAT PEL is the estimated measured pCu because calculated pCu dipped slightly below 0 but measured more realistically does not (using measured pCu = 0.7388*calculated pCu+1.0974 in Figure J-1 in Phytotoxicity and Community Report).

Table 7. DELs and PELs calculated with new reference data included and substitutions for categories that were not significant.[a]

Freeport-McMoran Chino Mines Company
Vanadium, New Mexico
Technical Memorandum on Reference Areas

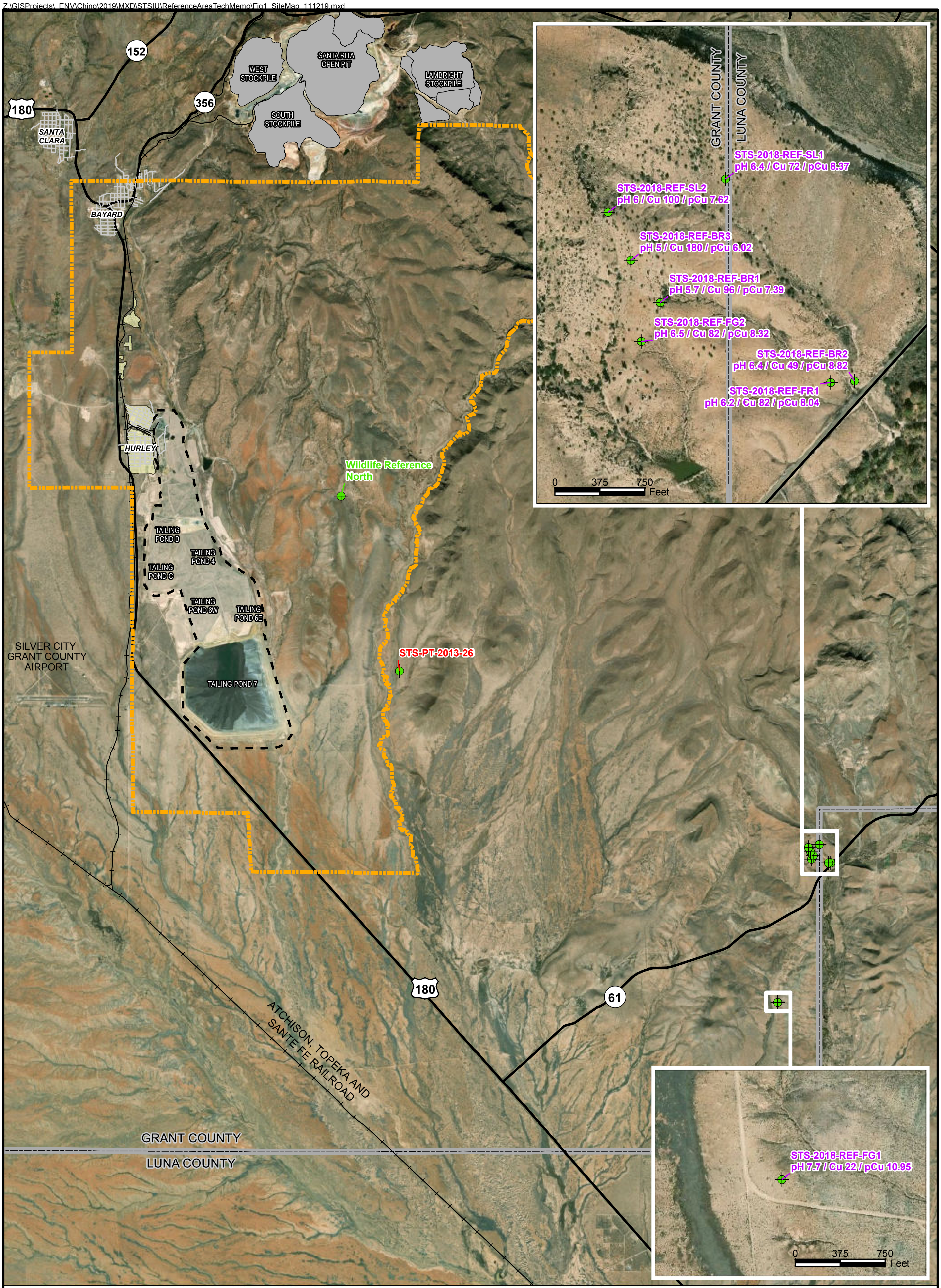
Soil category	Richness		Cover		OAT Score		Average DEL	Average PEL
	DEL	PEL	DEL	PEL	DEL	PEL		
flat granular	7.71	4.25	6.03	3.98	6.87	0.69	6.87	2.97
slope	7.71	4.25	6.03	3.98	6.87	0.69	6.87	2.97
flat rocky	9.47	5.90	5.28	4.07	9.48	3.83	8.08	4.60
bedrock	5.91	4.72	5.28	4.07	6.31	2.71	5.83	3.83

Notes

[a] Red numbers are substitutions for a non-significant regression at $P<0.05$, where substitutions are from another soil category in the same buffering capacity group.

FIGURES

OFFICE: LAKEWOOD DB:MEB TM: MB PM: AT
PROJECT# B0063543.0000 11/21/2019 2:54:22 PM
Z:\GISProjects_ENV\Chino\2019\MXD\STSIU\ReferenceAreaTechMemo\Fig1_SiteMap_111219.mxd



Legend

- ⊕ Reference vegetation survey and soil sampling location
- ▭ STSIU Boundary
- ▭ Smelter Tailings Boundary
- ▭ County Boundary

Aerial Source: DigitalGlobe, photo dated 11/15/2018; accessed via ESRI World Imagery Service on 11/21/2019.

Notes:

Red labels denote sites sampled for vegetation only in 2014
Green labels denote sites sampled for vegetation in 2011, 2014 and 2018
Purple labels denote sites sampled for vegetation only in 2018

Soil samples taken at all purple-labeled locations in 2018

Copper (Cu) units are mg/kg
pH and pCu units are s.u.

0 0.75 1.5 3 Miles
GRAPHIC SCALE

FREEPORT-MCMORAN CHINO MINES COMPANY
VANADIUM, NEW MEXICO

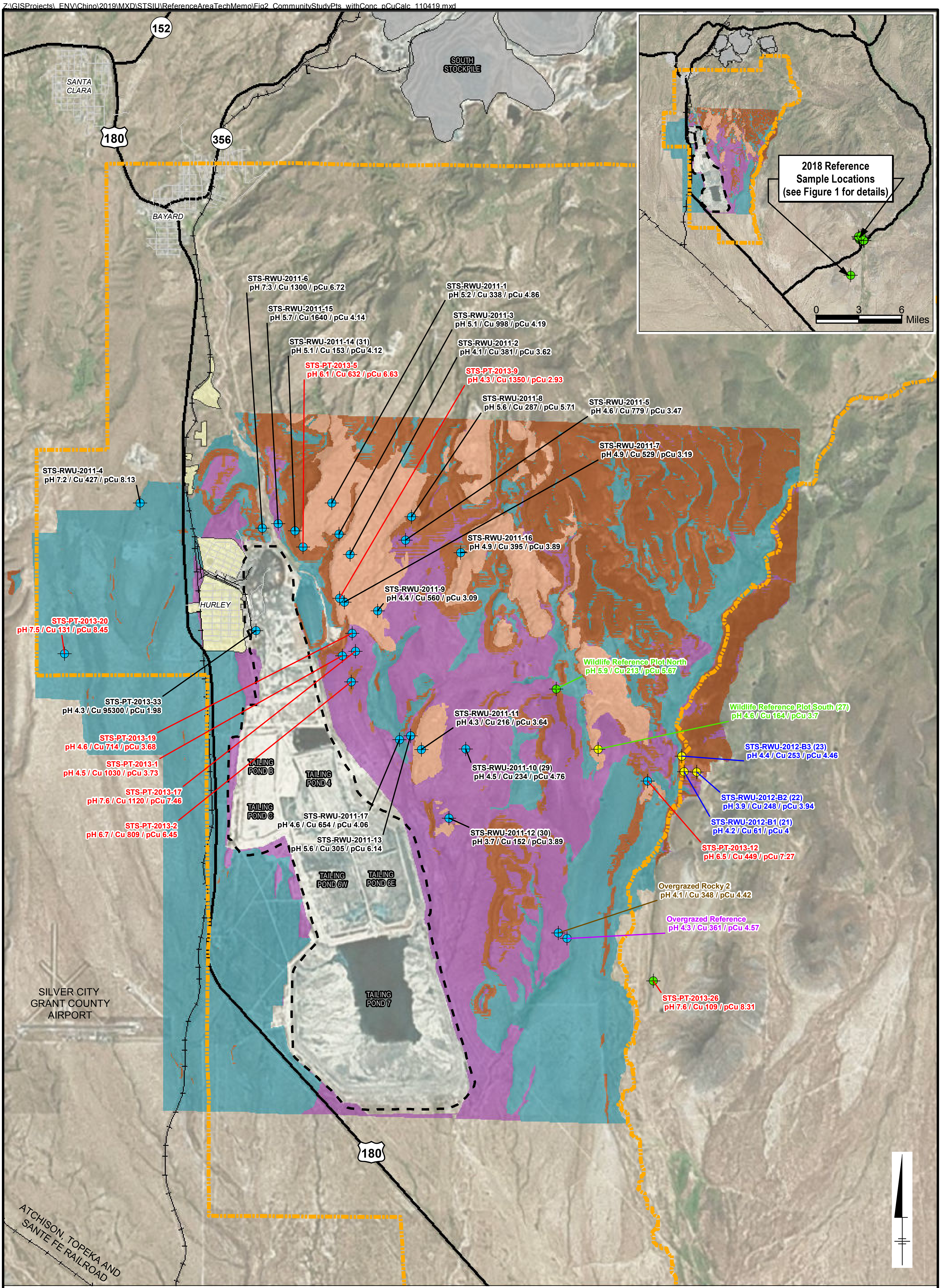
TECHNICAL MEMORANDUM ON REFERENCE AREAS

SITE MAP WITH 2018 REFERENCE LOCATIONS

ARCADIS

FIGURE
1

OFFICE: LAKEWOOD DB:MEB TM: MB PM: AT
PROJECT# B0063543.0000 11/21/2019 3:13:44 PM
Z:\GISProjects_ENV\Chino\2019\MXD\STSIU\ReferenceAreaTechMemo\Fig2_CommunityStudyPts_withConc_pCuCalc_110419.mxd



Legend

- Site vegetation survey and soil sampling location
- De minimus vegetation survey and soil sampling location
- Reference vegetation survey and soil sampling location
- STSIU Boundary
- Smelter Tailings Boundary

Soil Category

🟦	Flat Granular Soil
🟪	Flat Rocky Soil
🟫	Slope > 13%
🟧	Bedrock

Aerial Source: DigitalGlobe, photo dated 11/15/2018; accessed via ESRI World Imagery Service on 11/21/2019.

Notes:

Black labels denote sites surveyed for vegetation only in 2011
Brown labels denote sites never sampled for vegetation
Blue labels denote sites sampled for vegetation only in 2012
Red labels denote sites sampled for vegetation only in 2014
Green labels denote sites sampled for vegetation in 2011, 2014 and 2018
Purple labels denote sites sampled for vegetation only in 2018

Soil samples taken at all locations in 2013 or 2018

Location labels with a number in parenthesis are for locations also sampled in the laboratory phytotoxicity study and indicate the X in that study's STS-PT-2013-X label.

Copper (Cu) units are mg/kg; pH and pCu units are s.u.

0 0.5 1 2 Miles
GRAPHIC SCALE

FREEPORT-MCMORAN CHINO MINES COMPANY
VANADIUM, NEW MEXICO

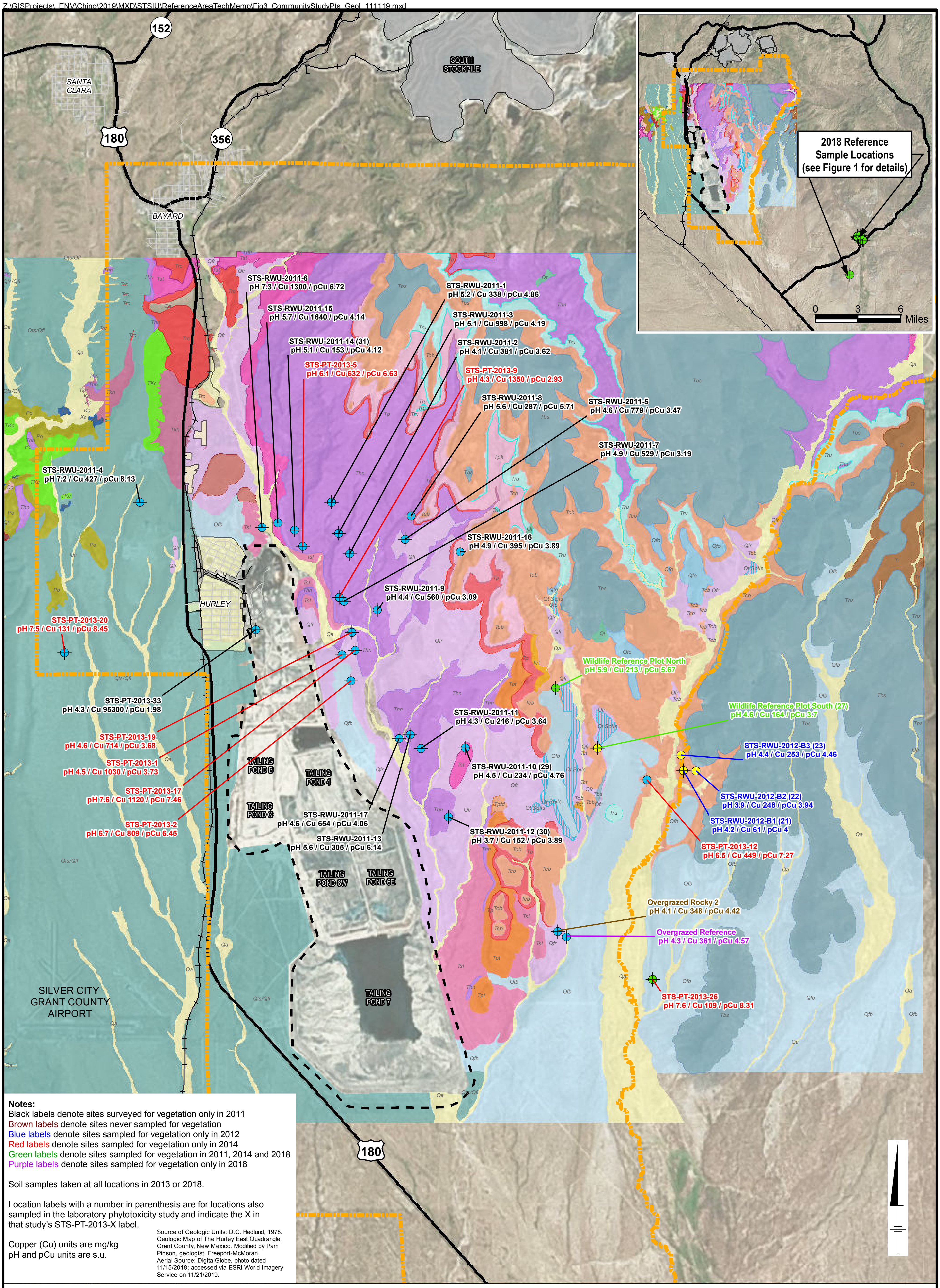
TECHNICAL MEMORANDUM ON REFERENCE AREAS

SOIL/SLOPE CATEGORY MAP WITH SITE AND 2018 SAMPLE LOCATIONS

ARCADIS

FIGURE
2

OFFICE: LAKEWOOD DB:MEB TM: MB PM: AT
PROJECT# B0063543.0000 11/21/2019 3:18:45 PM
Z:\GISProjects_ENV\Chino\2019\MXD\STSIU\ReferenceAreaTechMemo\Fig3_CommunityStudyPts_Geol_111119.mxd



Notes:
Black labels denote sites surveyed for vegetation only in 2011
Brown labels denote sites never sampled for vegetation
Blue labels denote sites sampled for vegetation only in 2012
Red labels denote sites sampled for vegetation only in 2014
Green labels denote sites sampled for vegetation in 2011, 2014 and 2018
Purple labels denote sites sampled for vegetation only in 2018

Soil samples taken at all locations in 2013 or 2018.

Location labels with a number in parenthesis are for locations also sampled in the laboratory phytotoxicity study and indicate the X in that study's STS-PT-2013-X label.

Copper (Cu) units are mg/kg
pH and pCu units are s.u.

Source of Geologic Units: D.C. Hedlund, 1978. Geologic Map of The Hurley East Quadrangle, Grant County, New Mexico. Modified by Pam Pinson, geologist, Freeport-McMoran.
Aerial Source: DigitalGlobe, photo dated 11/15/2018; accessed via ESRI World Imagery Service on 11/21/2019.

Legend

⊕ Site vegetation survey and soil sampling location
⊕ De minimus vegetation survey and soil sampling location
⊕ Reference vegetation survey and soil sampling location

Geologic Unit

Qa
Qts/Qfl
Qt Soils
Qfr
Qfb
Qfo
Qt
Kb
Kc
Mlt
Oc
Po
Tbs
Tr
Tcb
Tct
Tru
Tpk
Tp
Tpt
Tptd
Thn
Tst
Tsl
Trt
Trc
Tkh
TKa
TKc
STSIU Boundary
Smelter Tailings Boundary

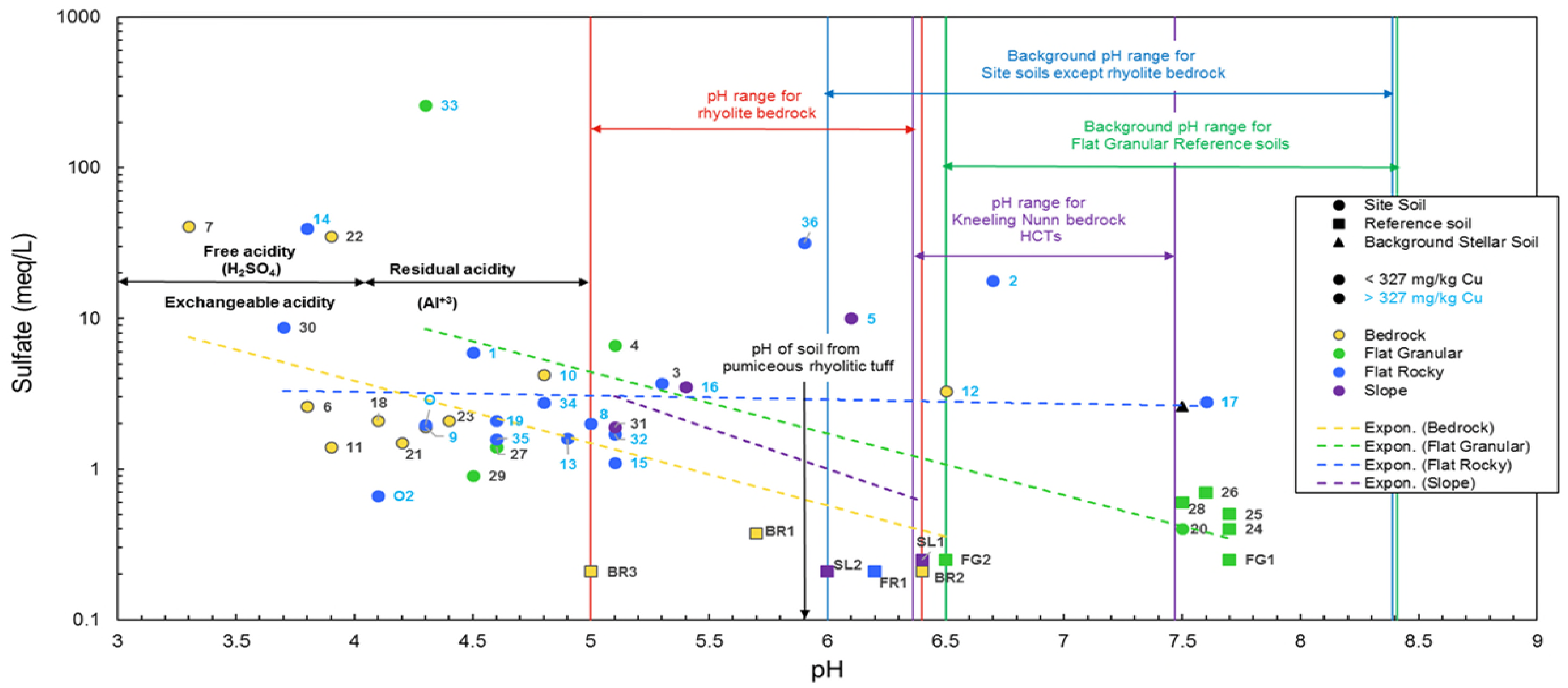
0 0.5 1 2 Miles
GRAPHIC SCALE

FREEPORT-MCMORAN CHINO MINES COMPANY
VANADIUM, NEW MEXICO
TECHNICAL MEMORANDUM ON REFERENCE AREAS

GEOLOGY MAP WITH SITE AND 2018 SAMPLE LOCATIONS

ARCADIS

FIGURE
3



Notes:

Numbers represent the last number of the location IDs on Figure 2.

HCTs = Humidity Cell Tests for kinetic testing of rock

Location 27 is wildlife reference south.

Location 2,17,and 36 had flat, rocky soils with high alkalinity, if removed blue dashed line would be parallel to flat granular green dashed line but position between bedrock and slope lines, showing same order of the four categories as seen in Figure 5 (i.e., flat granular has highest quality and bedrock has lowest quality in terms of plant endpoints or sulfate impacts relative to pH or pCu).

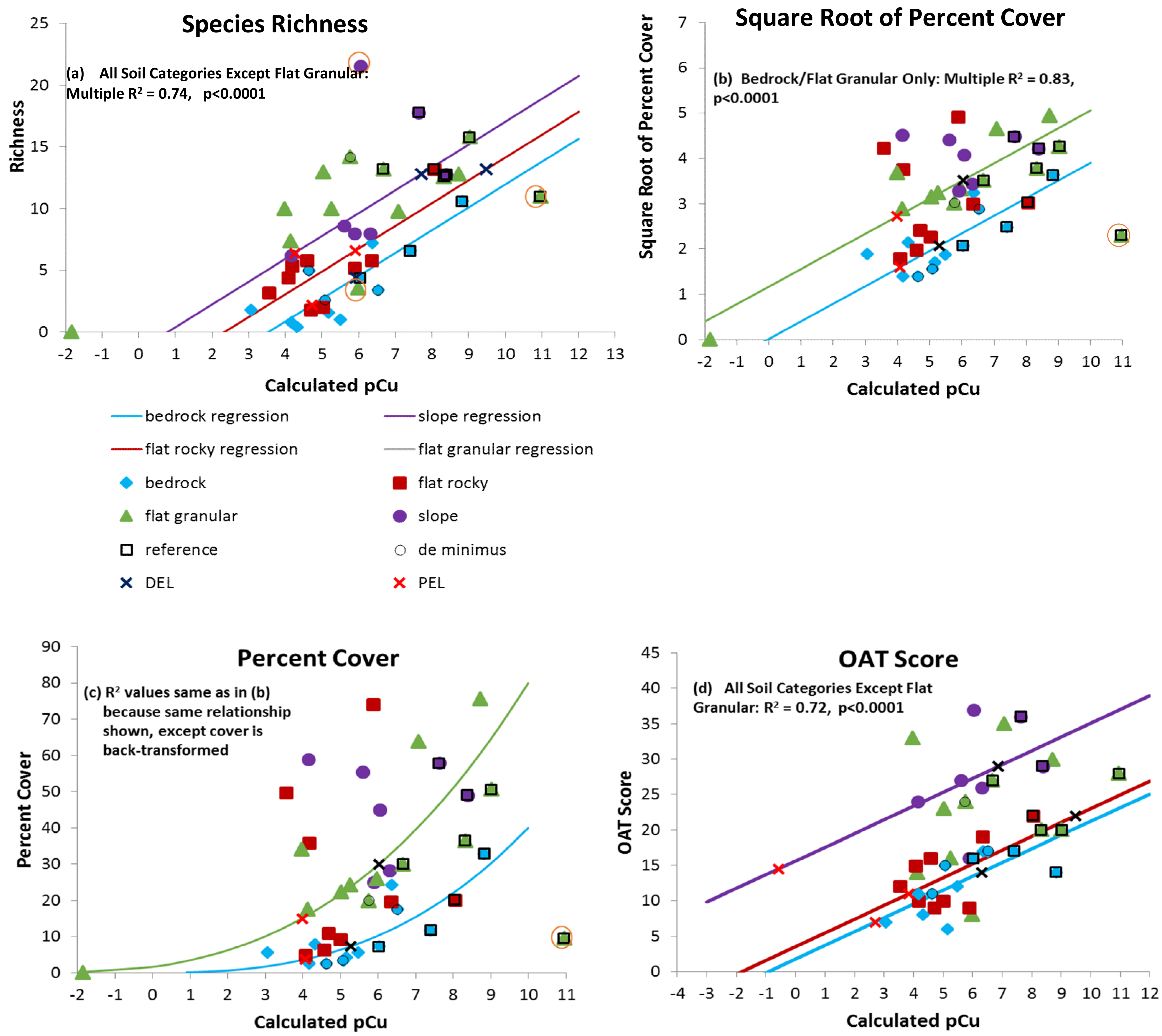
FREEPORT-MCMORAN CHINO MINES COMPANY
VANADIUM, NEW MEXICO

TECHNICAL MEMORANDUM ON REFERENCE AREAS

Relationship between Soluble Sulfate and pH used to Identify Impacted Locations

ARCADIS

FIGURE
4



Notes:

(a) Regression lines for richness exclude the high "slope" (purple) juniper outlier (STS-RWU-201108) and low "flat granular" (green) "trampled" outlier (STS-RWU-2011-13) and creosote bush flat granular reference site with very high pCu (STS-2018-REF-FG1) [outliers are circled in orange]. (b) The percent cover was modeled with box-cox transformation (y^0.37) to meet assumptions of regression (backcalculated curve also shown in (c)). The creosote bush reference outlier was removed from b and c. (d) Relationship between calculated pCu and OAT score is significant for each soil category except flat granular. R^2 represents R^2 adjusted for number of variables in model. Only significant relationships (p<0.05) shown as regression lines.

FREEPORT-MCMORAN CHINO MINES COMPANY
VANADIUM, NEW MEXICO

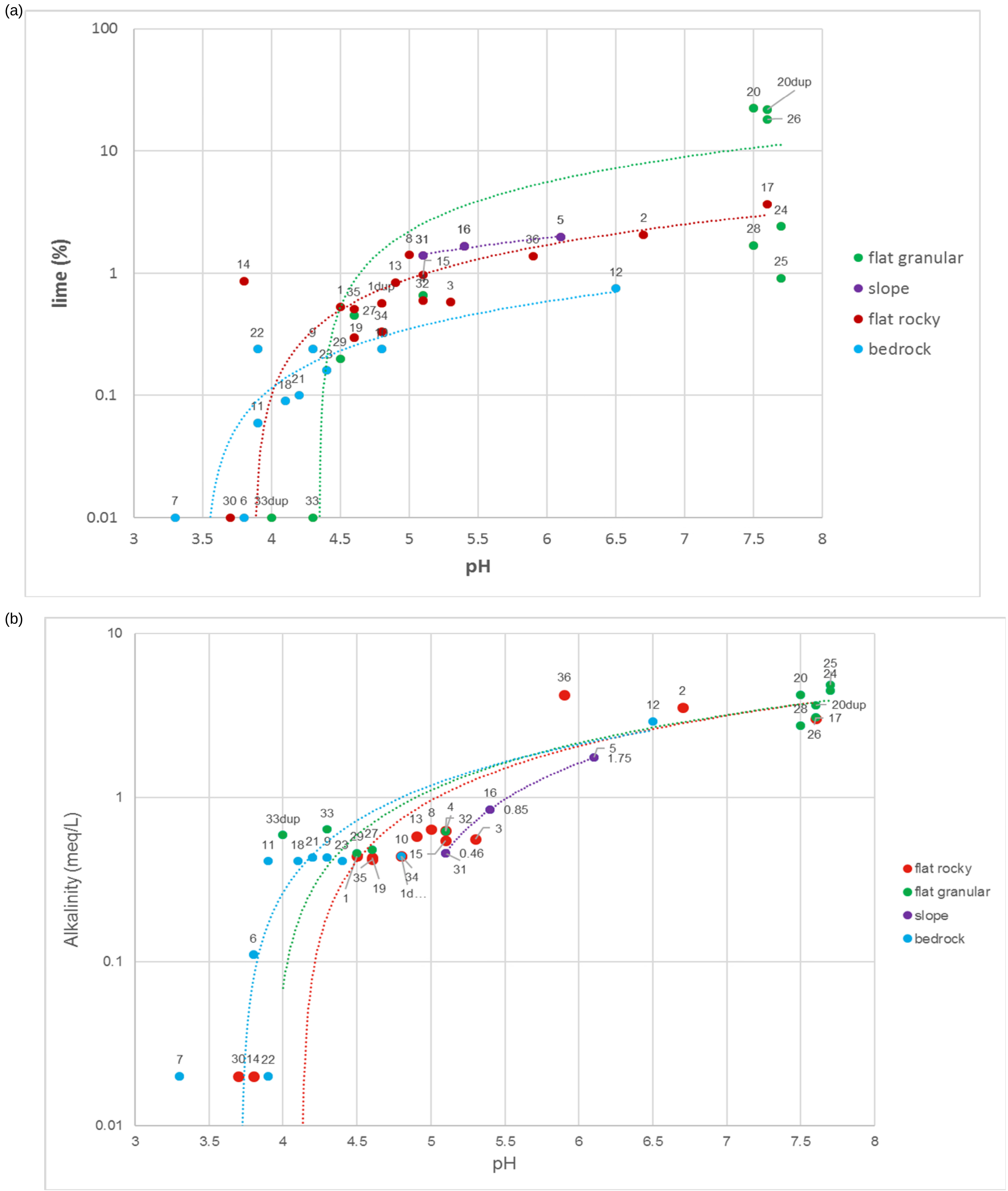
TECHNICAL MEMORANDUM ON REFERENCE AREAS

Relationship between pCu and Community Endpoints with Soil Category Covariate

ARCADIS

FIGURE

5



Notes:
Lime is Calcium carbonate ($CaCO_3$).

FREEPORT-MCMORAN CHINO MINES COMPANY
VANADIUM, NEW MEXICO

TECHNICAL MEMORANDUM ON REFERENCE AREAS

Relationship of pH with lime and alkalinity

ARCADIS

FIGURE

6

APPENDIX A

Standard Operating Procedures for 2018

Soil SOPs (from STSIU Feasibility Study Proposal)

SOP-22 “Surface Soil Sampling” will be followed for field sampling procedures. Each soil sample will be a composite of five sub-samples taken over a sample interval of six inches in sample depth as measured from the ground surface. The five sub-samples will be sampled over a 50 x 50 m area (rather than 20 feet in the SOP) to reduce microscale variability and the locations will be representative of the area.

A description of the composition of each soil sample and other relevant information will be noted in the field logbook and/or field sample data sheets. In accordance with SOP-3 “Field Quality Control”, field QC samples (one per 10 samples) and rinsate blanks (one per 20 samples) will be collected as part of the sampling program. These blind field duplicate samples and rinsate blanks will be submitted for laboratory analyses.

Sample Handling and Analysis

Sample bottle requirements for rinsate, holding times, and preservation techniques are listed in SOP-14 “Sampling, Containerization and Preservation”, and are consistent with the laboratory requirements. Rinsate samples for chemical analysis will be placed into media-appropriate bottles and stored in ice filled coolers until delivery to the laboratory. Soil samples will be sealed in plastic bags and shipped in coolers. Samples will be handled and shipped in accordance with SOP-4 “Sample Custody Procedures” and SOP-5 “Packaging and Shipping of Environmental Sample Containers.”

Soil will be sieved to 2 mm in the laboratory (specify in COC)

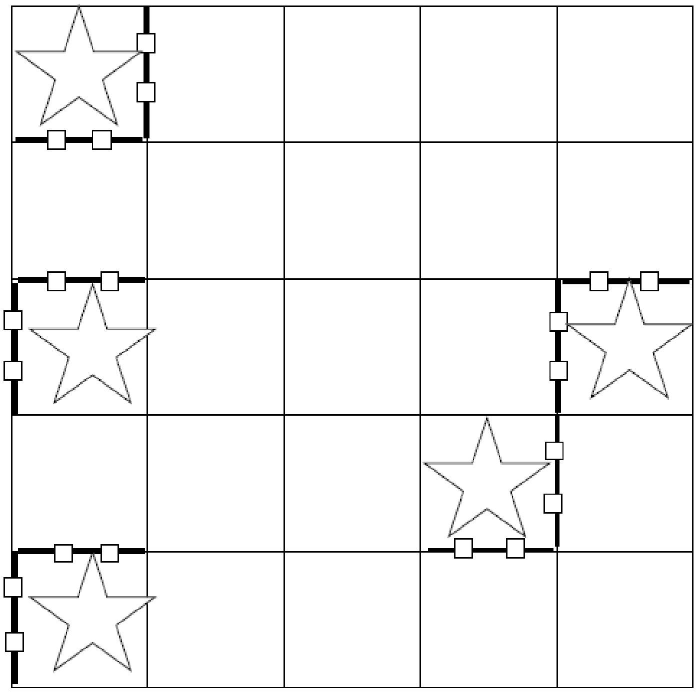
<u>Equipment list:</u>

Quart bags for soil samples
Bucket for mixing composite
Trowel and shovel to dig 6”
Ruler
Alconox
Bottles for rinsate blanks
Two 50-m tape measures
COC forms
Coolers for soil
Permanent marker
Tailgate safety forms
Field notebook

Standard Operating Procedure for Reference Site Plant Community Survey

Locate the site using GPS. This procedure ideally will be performed on 9 reference sites indicated on the map and at wildlife reference north (to calibrate to the year's dryness). If short on time, at minimum, complete it on one of each of the following types (flat rocky, bedrock, and slope) as well as wildlife reference north (which is flat granular—stay out of the bedrock). Randomly select which site of each type to conduct (or which looks most representative of STSIU). For the wildlife reference north and south, go to the coordinates, which is the plot corner (stay away from bedrock area).

1. Move to a location in that area that is the size of a 100'x 100' plot and representative of the soil category type. If it is for a bedrock category location, make sure the area has at least 60 percent bedrock on the surface. If it is a slope location, make sure that the area is relatively steep and has boulders. If it is for a flat rocky location, make sure the area shows signs of erosion, which means the rocks are armoring the surface and mostly are sitting on top of the soil, not embedded part way into it. If it is for a flat granular location, the soil may be more granular or sandy. Rocks can be abundant but embedded more into the soil (at least half way).
2. Move to the corner of the plot and measure out 100' of tape toward the other two corners (tape at right angles), placing pin flags every 20 feet along the tapes.
3. Walk to the opposite corner of the starting corner and stretch out 100' tapes toward the other corners (at right angles) and place pin flags every 20 feet along the tapes.
4. Place pin flags at every intersection of 20' x 20' grid cell of plot to mark off their locations (intersection of lines to create the 25 grid cells in the diagram shown below). If needed, you can number the pin flags to help keep track of which grid cell you are in and to find the cell selected for sampling. (e.g, 0, 0 for first flag, 1, 0 for next flag over on first row, etc.). However, if flags are easy to see, a person can count the grid cells to find the selected locations.



5. Using the first set of paired, random numbers shown below, find the grid cell that will be starred, which means it will be sampled (diagram below is only an example). So if paired numbers are 3,4, then count across 3 at the top of the grid and then down 4 and place a star in that grid cell. Do this using next set of random numbers until five grid cells are selected for sampling. The flags outline the corners of each grid cell.

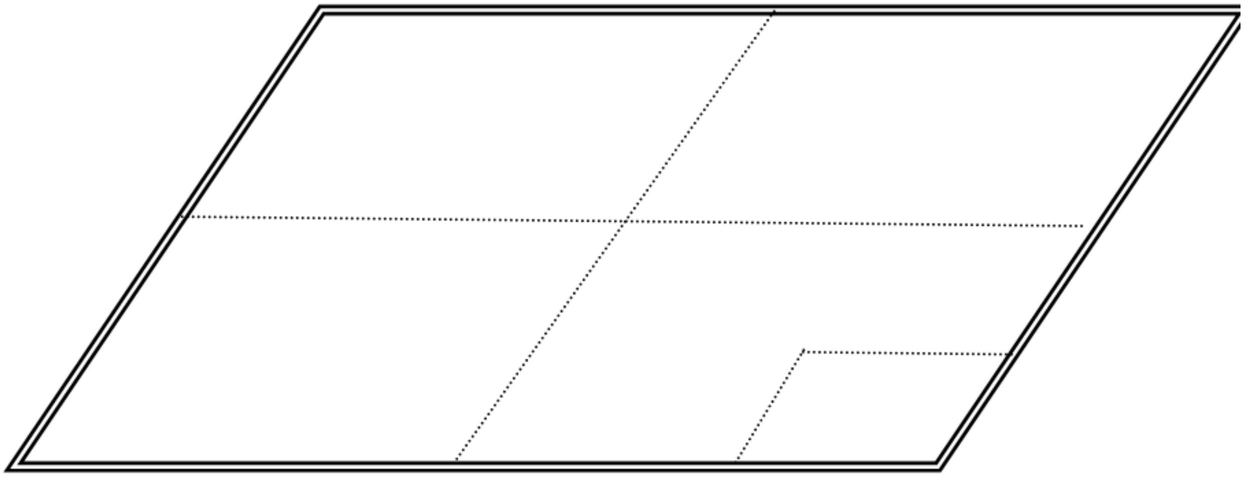
   Paired random numbers:
   RS1: 1,4; 4,4; 1,3; 3,1; 3,3
   BR1: 1,3; 3,2; 4,3; 5,5; 4,3
   S1: 5,5; 3,5; 5,3; 5,4; 4,3
   RS2: 1,1; 5,5; 4,2; 2,5; 3,1
   BR2: 5,2; 4,1; 3,2; 2,1; 3,3
   RS3: 2,4; 5,5; 3,1; 4,4: 4,5
   RS4: 2,3; 3,1; 3,3; 5,1; 1,3
   S2: 1,1; 1,5; 5,5; 3,5; 5,3
   S3: 4,2; 5,2; 4,1; 3,2; 1,5
   Wildlife Reference North: 5,2: 2,2; 2,1; 1,4; 5;3
   Wildlife Reference South: 4,5; 1,2; 5,5; 3,5; 3,1

6. Place the Daubenmire frame (1 meter by 1 meter PVC square as shown below) along two of the adjacent sides of each selected grid cell as shown in diagram—spaced evenly. Do one frame at a time until four are completed for each selected grid cell. Record the percent cover category for all plants combined and then every life form (woody, grass or grass-like, forb, cactus) in that frame using the Daubenmire percent cover range below in the table and field form. See first column of table for ranges to record (ignore midpoints when in field).

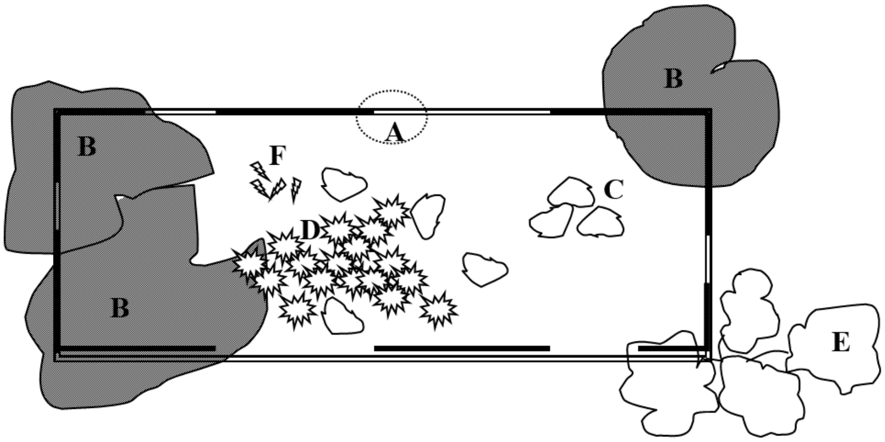
Table 1. Vegetation Cover Class Midpoints

Percent Cover Range	Cover Class Midpoint
< 1	0.5
1 – 5	3
6 – 15	10.5
16 – 25	20.5
26 – 50	38
51 – 75	63
76 – 90	85.5
> 95	98

The Daubenmire frame shown below has dotted imaginary lines that divide the frame area into quarters or 95% or 5% (corner square is 5%). Imagine these lines when looking straight down on the frame.



Imagine a line drawn about the leaf tips of the undisturbed canopies (ignoring inflorescences) and project these polygonal images onto the ground. This projection is considered the canopy-coverage. See Figure below for the method using a rectangle, but same principle applies to a square meter. Mentally "cram" the projected area for the life form into the five percent area, then if too big, the 25 percent area, if too big the 50 percent area (2 quarters), if too big into the 75 percent area (75 percent), etc. Decide which of the following classes the canopy coverage finally falls into, recording the coverage class value on the data form. The imaginary lines of the frame provide visual reference areas equal to 5, 25, 50, 75, and 95 percent of the quadrat area. Repeat the above for each species in the plot or over it.



COVER ESTIMATES
A - 0-5
B - 25-50
C - 5-25
D - 5-25
E - 0-5
F - 0-5

7. To record species richness, a second person will walk throughout the selected grid cell and count the number of different plant species. Do this for every selected grid cell. If uncertain if two that appear to be different but not sure because they could be the same species, take a picture of the two, treat them as separate species, but make a note next to that cell's data entry that two photographs were taken to evaluate if they are separate species.
8. Take two photographs of the plot from each corner, first aiming the camera into the plot, then aiming 180^o in other direction outside the plot. Write on notebook name of plot and date surveyed and take a picture. Always do this after surveying and taking the photographs, so clear which plot is sampled.
9. If you can make it to cell phone hill, take photos on northeast facing side to help calibrate type of year it is (wet or dry) relative to 2011 and 2014. Also, take a picture at Lampbright Outcrop. Take close-ups of plants and soil as well as landscape photos. Be sure to record photos or at least take a picture of notes that label the location and which pictures (before or after) are the area shown. These areas are considered good rangeland condition, with cell phone hill (northeast facing slope) having an OAT score of 40, the best possible score. Lampbright outcrop averages a score of 36 (1 point lost each for lower litter, some crusting, and 2 points lost for pedestals).
10. Optional: Fill out an OAT scoring sheet for each general area around each of the reference area plots (look out over an area up to 500' distance from edge of plot). Ratings should be relative to cell phone hill, remembering how that looked with rating of 40 for each rating category. Do the same for the wildlife reference north and south plots.
11. Finally, visually estimate average size of open patches without vegetation and take photos of patchiness (combined with aerial photo information will show if pCu increased patchiness).

Equipment:

This SOP
Two 100' measuring tapes
20 pin flags
1 m x 1 m PVC sampling frame (with elbows)
Water bottles and cooler with ice for drinking
1 compass
1 GPS and many AA batteries
1 camera
Field notebook
Field forms (OAT and wildlife)
Map with point locations and Field IDs
Pencil/pen and clipboard
PPE (level D), bug spray, sun lotion
Snake chaps
Tailgate safety forms
First aid kit including moleskin

APPENDIX B

Laboratory Reports from ACZ for Soil

ACZ Laboratories, Inc.
2773 Downhill Drive Steamboat Springs, CO 80487 (800) 334-5493

Analytical Report

November 02, 2018

Report to:	Bill to:
Pam Pinson	Accounts Payable
Freeport-McMoRan - Chino Mines Company	Freeport-McMoRan - Chino Mines Company
PO Box 10	P.O. Box 13308
Bayard, NM 88023	Phoenix, AZ 85002-3308

cc: Trish Potter

Project ID: ZN0000036K
ACZ Project ID: L47602

Pam Pinson:

Enclosed are the analytical results for sample(s) submitted to ACZ Laboratories, Inc. (ACZ) on October 15, 2018. This project has been assigned to ACZ's project number, L47602. Please reference this number in all future inquiries.

All analyses were performed according to ACZ's Quality Assurance Plan. The enclosed results relate only to the samples received under L47602. Each section of this report has been reviewed and approved by the appropriate Laboratory Supervisor, or a qualified substitute.

Except as noted, the test results for the methods and parameters listed on ACZ's current NELAC certificate letter (#ACZ) meet all requirements of NELAC.

This report shall be used or copied only in its entirety. ACZ is not responsible for the consequences arising from the use of a partial report.

All samples and sub-samples associated with this project will be disposed of after December 02, 2018. If the samples are determined to be hazardous, additional charges apply for disposal (typically $11/sample). If you would like the samples to be held longer than ACZ's stated policy or to be returned, please contact your Project Manager or Customer Service Representative for further details and associated costs. ACZ retains analytical raw data reports for ten years.

If you have any questions or other needs, please contact your Project Manager.

S. Habermehl

Scott Habermehl has reviewed
and approved this report.

ACCREDITED IN ACCORDANCE WITH nelac

ACIL

Freeport-McMoRan - Chino Mines Company
Project ID: ZN0000036K
Sample ID: STS-2018-REF-FG-1

ACZ Sample ID: ***L47602-01***
Date Sampled: *10/02/18 09:30*
Date Received: *10/15/18*
Sample Matrix: *Soil*

Metals Analysis

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010D ICP	102	22			mg/Kg	1	5	11/02/18 3:31	aeh

Soil Analysis

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
pH, Saturated Paste	EPA 600/2-78-054 section 3.2.2									
Max Particle Size		1	2000		*	um			10/26/18 0:00	llr
pH		1	7.7		*	units	0.1	0.1	10/26/18 0:00	llr
Solids, Percent	D2216-80	1	91.9		*	%	0.1	0.5	10/18/18 18:34	llr

Soil Preparation

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972				*				10/18/18 12:09	llr
Digestion - Hot Plate	M3050B ICP								10/24/18 11:47	dbt
Saturated Paste Extraction	USDA No. 60 (2)				*				10/25/18 15:36	llr
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2				*				10/19/18 14:50	dbt
Water Extraction	ASA No. 9 10-2.3.2				*				10/24/18 13:05	gkh

Wet Chemistry

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Sulfate, soluble (Water)	SM4500 SO4-D	5	60	B	*	mg/Kg	50	250	10/31/18 9:18	emk

Arizona license number: AZ0102

** Please refer to Qualifier Reports for details.*

Freeport-McMoRan - Chino Mines Company
Project ID: ZN0000036K
Sample ID: STS-2018-REF-BR-1

ACZ Sample ID: ***L47602-02***
Date Sampled: *10/02/18 10:40*
Date Received: *10/15/18*
Sample Matrix: *Soil*

Metals Analysis

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010D ICP	101	96			mg/Kg	1	5	11/02/18 3:43	aeh

Soil Analysis

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
pH, Saturated Paste	EPA 600/2-78-054 section 3.2.2									
Max Particle Size		1	2000		*	um			10/26/18 0:00	llr
pH		1	5.7		*	units	0.1	0.1	10/26/18 0:00	llr
Solids, Percent	D2216-80	1	97.7		*	%	0.1	0.5	10/18/18 20:06	llr

Soil Preparation

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972				*				10/18/18 12:13	llr
Digestion - Hot Plate	M3050B ICP								10/24/18 13:04	dbt
Saturated Paste Extraction	USDA No. 60 (2)				*				10/25/18 15:38	llr
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2				*				10/19/18 14:52	dbt
Water Extraction	ASA No. 9 10-2.3.2				*				10/24/18 13:20	gkh

Wet Chemistry

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Sulfate, soluble (Water)	SM4500 SO4-D	5	90	B	*	mg/Kg	50	250	10/31/18 9:21	emk

Arizona license number: AZ0102

** Please refer to Qualifier Reports for details.*

Freeport-McMoRan - Chino Mines Company
Project ID: ZN0000036K
Sample ID: STS-2018-REF-BR-2

ACZ Sample ID: ***L47602-03***
Date Sampled: *10/02/18 13:20*
Date Received: *10/15/18*
Sample Matrix: *Soil*

Metals Analysis

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010D ICP	101	49			mg/Kg	1	5	11/02/18 3:47	aeh

Soil Analysis

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
pH, Saturated Paste	EPA 600/2-78-054 section 3.2.2									
Max Particle Size		1	2000		*	um			10/26/18 0:00	llr
pH		1	6.4		*	units	0.1	0.1	10/26/18 0:00	llr
Solids, Percent	D2216-80	1	98.1		*	%	0.1	0.5	10/18/18 21:38	llr

Soil Preparation

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972				*				10/18/18 12:17	llr
Digestion - Hot Plate	M3050B ICP								10/24/18 13:30	dbt
Saturated Paste Extraction	USDA No. 60 (2)				*				10/25/18 15:42	llr
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2				*				10/19/18 14:55	dbt
Water Extraction	ASA No. 9 10-2.3.2				*				10/24/18 13:35	gkh

Wet Chemistry

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Sulfate, soluble (Water)	SM4500 SO4-D	5		U	*	mg/Kg	50	250	10/31/18 9:24	emk

Arizona license number: AZ0102

** Please refer to Qualifier Reports for details.*

Freeport-McMoRan - Chino Mines Company		ACZ Sample ID:	***L47602-04***
Project ID:	ZN0000036K	Date Sampled:	*10/02/18 13:40*
Sample ID:	STS-2018-REF-FR-1	Date Received:	*10/15/18*
		Sample Matrix:	*Soil*

Metals Analysis

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010D ICP	101	82			mg/Kg	1	5	11/02/18 3:51	aeh

Soil Analysis

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
pH, Saturated Paste	EPA 600/2-78-054 section 3.2.2									
Max Particle Size		1	2000		*	um			10/26/18 0:00	llr
pH		1	6.2		*	units	0.1	0.1	10/26/18 0:00	llr
Solids, Percent	D2216-80	1	98.3		*	%	0.1	0.5	10/18/18 23:11	llr

Soil Preparation

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972				*				10/18/18 12:21	llr
Digestion - Hot Plate	M3050B ICP								10/24/18 13:55	dbt
Saturated Paste Extraction	USDA No. 60 (2)				*				10/25/18 15:44	llr
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2				*				10/19/18 14:58	dbt
Water Extraction	ASA No. 9 10-2.3.2				*				10/24/18 14:05	gkh

Wet Chemistry

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Sulfate, soluble (Water)	SM4500 SO4-D	5		U	*	mg/Kg	50	250	10/31/18 9:30	emk

Arizona license number: AZ0102

** Please refer to Qualifier Reports for details.*

Freeport-McMoRan - Chino Mines Company
Project ID: ZN0000036K
Sample ID: STS-2018-REF-SL1

ACZ Sample ID: ***L47602-05***
Date Sampled: *10/02/18 12:00*
Date Received: *10/15/18*
Sample Matrix: *Soil*

Metals Analysis

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010D ICP	101	72			mg/Kg	1	5	11/02/18 3:55	aeh

Soil Analysis

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
pH, Saturated Paste	EPA 600/2-78-054 section 3.2.2									
Max Particle Size		1	2000		*	um			10/26/18 0:00	llr
pH		1	6.4		*	units	0.1	0.1	10/26/18 0:00	llr
Solids, Percent	D2216-80	1	98.1		*	%	0.1	0.5	10/19/18 0:43	llr

Soil Preparation

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972				*				10/18/18 12:25	llr
Digestion - Hot Plate	M3050B ICP								10/24/18 14:21	dbt
Saturated Paste Extraction	USDA No. 60 (2)				*				10/25/18 15:45	llr
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2				*				10/19/18 15:01	dbt
Water Extraction	ASA No. 9 10-2.3.2				*				10/24/18 14:20	gkh

Wet Chemistry

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Sulfate, soluble (Water)	SM4500 SO4-D	5	60	B	*	mg/Kg	50	250	10/31/18 9:33	emk

Arizona license number: AZ0102

Report Header Explanations

Batch	A distinct set of samples analyzed at a specific time
Found	Value of the QC Type of interest
Limit	Upper limit for RPD, in %.
Lower	Lower Recovery Limit, in % (except for LCSS, mg/Kg)
MDL	Method Detection Limit. Same as Minimum Reporting Limit unless omitted or equal to the PQL (see comment #5). Allows for instrument and annual fluctuations.
PCN/SCN	A number assigned to reagents/standards to trace to the manufacturer's certificate of analysis
PQL	Practical Quantitation Limit. Synonymous with the EPA term "minimum level".
QC	True Value of the Control Sample or the amount added to the Spike
Rec	Recovered amount of the true value or spike added, in % (except for LCSS, mg/Kg)
RPD	Relative Percent Difference, calculation used for Duplicate QC Types
Upper	Upper Recovery Limit, in % (except for LCSS, mg/Kg)
Sample	Value of the Sample of interest

QC Sample Types

AS	Analytical Spike (Post Digestion)	*LCSWD*	Laboratory Control Sample - Water Duplicate
ASD	Analytical Spike (Post Digestion) Duplicate	*LFB*	Laboratory Fortified Blank
CCB	Continuing Calibration Blank	*LFM*	Laboratory Fortified Matrix
CCV	Continuing Calibration Verification standard	*LFMD*	Laboratory Fortified Matrix Duplicate
DUP	Sample Duplicate	*LRB*	Laboratory Reagent Blank
ICB	Initial Calibration Blank	*MS*	Matrix Spike
ICV	Initial Calibration Verification standard	*MSD*	Matrix Spike Duplicate
ICSAB	Inter-element Correction Standard - A plus B solutions	*PBS*	Prep Blank - Soil
LCSS	Laboratory Control Sample - Soil	*PBW*	Prep Blank - Water
LCSSD	Laboratory Control Sample - Soil Duplicate	*PQV*	Practical Quantitation Verification standard
LCSW	Laboratory Control Sample - Water	*SDL*	Serial Dilution

QC Sample Type Explanations

Blanks	Verifies that there is no or minimal contamination in the prep method or calibration procedure.
Control Samples	Verifies the accuracy of the method, including the prep procedure.
Duplicates	Verifies the precision of the instrument and/or method.
Spikes/Fortified Matrix	Determines sample matrix interferences, if any.
Standard	Verifies the validity of the calibration.

ACZ Qualifiers (Qual)

B	Analyte concentration detected at a value between MDL and PQL. The associated value is an estimated quantity.
H	Analysis exceeded method hold time. pH is a field test with an immediate hold time.
L	Target analyte response was below the laboratory defined negative threshold.
U	The material was analyzed for, but was not detected above the level of the associated value. The associated value is either the sample quantitation limit or the sample detection limit.

Method References

(1) EPA 600/4-83-020. Methods for Chemical Analysis of Water and Wastes, March 1983.
(2) EPA 600/R-93-100. Methods for the Determination of Inorganic Substances in Environmental Samples, August 1993.
(3) EPA 600/R-94-111. Methods for the Determination of Metals in Environmental Samples - Supplement I, May 1994.
(4) EPA SW-846. Test Methods for Evaluating Solid Waste.
(5) Standard Methods for the Examination of Water and Wastewater.

Comments

(1) QC results calculated from raw data. Results may vary slightly if the rounded values are used in the calculations.
(2) Soil, Sludge, and Plant matrices for Inorganic analyses are reported on a dry weight basis.
(3) Animal matrices for Inorganic analyses are reported on an "as received" basis.
(4) An asterisk in the "XQ" column indicates there is an extended qualifier and/or certification qualifier associated with the result.
(5) If the MDL equals the PQL or the MDL column is omitted, the PQL is the reporting limit.

For a complete list of ACZ's Extended Qualifiers, please click: http://www.acz.com/public/extquallist.pdf

NOTE: If the Rec% column is null, the high/low limits are in the same units as the result. If the Rec% column is not null, then the high/low limits are in % Rec.

Copper, total (3050)   M6010D ICP

ACZ ID	Type	Analyzed	PCN/SCN	QC	Sample	Found	Units	Rec%	Lower	Upper	RPD	Limit	Qual
WG459758													
WG459758ICV	ICV	11/02/18 2:52	II181002-1	2		1.959	mg/L	98	90	110			
WG459758ICB	ICB	11/02/18 2:55				U	mg/L		-0.03	0.03			
WG459088PBS	PBS	11/02/18 3:20				U	mg/Kg		-3	3			
WG459088LCSS	LCSS	11/02/18 3:24	PCN56332	166		154.9	mg/Kg		139	192			
WG459088LCSSD	LCSSD	11/02/18 3:28	PCN56332	166		158.8	mg/Kg		139	192	2	20	
L47602-01MS	MS	11/02/18 3:35	II181018-2	50.6515	22	68.5	mg/Kg	92	75	125			
L47602-01MSD	MSD	11/02/18 3:39	II181018-2	51.153	22	67.5	mg/Kg	89	75	125	1	20	

pH, Saturated Paste   EPA 600/2-78-054 section 3.2.2

ACZ ID	Type	Analyzed	PCN/SCN	QC	Sample	Found	Units	Rec%	Lower	Upper	RPD	Limit	Qual
WG459368													
WG459368ICV	ICV	10/26/18 11:04	PCN56119	4		4	units	100	3.9	4.1			
L47602-02DUP	DUP	10/26/18 11:10			5.7	5.59	units				2	20	

Solids, Percent   D2216-80

ACZ ID	Type	Analyzed	PCN/SCN	QC	Sample	Found	Units	Rec%	Lower	Upper	RPD	Limit	Qual
WG458824													
WG458824PBS	PBS	10/18/18 12:25				U	%		-0.1	0.1			
L47531-02DUP	DUP	10/18/18 17:01			5.2	5.01	%				4	20	

Sulfate, soluble (Water)   SM4500 SO4-D

ACZ ID	Type	Analyzed	PCN/SCN	QC	Sample	Found	Units	Rec%	Lower	Upper	RPD	Limit	Qual
WG459618													
WG459618PBW	PBW	10/31/18 9:09				U	mg/Kg		-30	30			
WG459618LCSW	LCSW	10/31/18 9:12	WC180914-2	100		100	mg/Kg	100	80	120			
WG459173PBS	PBS	10/31/18 9:15				58	mg/Kg		-150	150			
L47602-03DUP	DUP	10/31/18 9:27			U	U	mg/Kg				0	20	RA

ACZ ID	WORKNUM	PARAMETER	METHOD	QUAL	DESCRIPTION
L47602-01	WG459618	Sulfate, soluble (Water)	SM4500 SO4-D	HD	Analysis is outside the intended scope of the method, which does not provide hold time information for soil extracts. No hold time is observed for collection to extraction. The referenced method hold time is observed for extraction-to-analysis.
			SM4500 SO4-D	RA	Relative Percent Difference (RPD) was not used for data validation because the concentration of the duplicated sample is too low for accurate evaluation (< 10x MDL).
L47602-02	WG459618	Sulfate, soluble (Water)	SM4500 SO4-D	HD	Analysis is outside the intended scope of the method, which does not provide hold time information for soil extracts. No hold time is observed for collection to extraction. The referenced method hold time is observed for extraction-to-analysis.
			SM4500 SO4-D	RA	Relative Percent Difference (RPD) was not used for data validation because the concentration of the duplicated sample is too low for accurate evaluation (< 10x MDL).
L47602-03	WG459618	Sulfate, soluble (Water)	SM4500 SO4-D	HD	Analysis is outside the intended scope of the method, which does not provide hold time information for soil extracts. No hold time is observed for collection to extraction. The referenced method hold time is observed for extraction-to-analysis.
			SM4500 SO4-D	RA	Relative Percent Difference (RPD) was not used for data validation because the concentration of the duplicated sample is too low for accurate evaluation (< 10x MDL).
L47602-04	WG459618	Sulfate, soluble (Water)	SM4500 SO4-D	HD	Analysis is outside the intended scope of the method, which does not provide hold time information for soil extracts. No hold time is observed for collection to extraction. The referenced method hold time is observed for extraction-to-analysis.
			SM4500 SO4-D	RA	Relative Percent Difference (RPD) was not used for data validation because the concentration of the duplicated sample is too low for accurate evaluation (< 10x MDL).
L47602-05	WG459618	Sulfate, soluble (Water)	SM4500 SO4-D	HD	Analysis is outside the intended scope of the method, which does not provide hold time information for soil extracts. No hold time is observed for collection to extraction. The referenced method hold time is observed for extraction-to-analysis.
			SM4500 SO4-D	RA	Relative Percent Difference (RPD) was not used for data validation because the concentration of the duplicated sample is too low for accurate evaluation (< 10x MDL).

Certification Qualifiers

Soil Analysis

The following parameters are not offered for certification or are not covered by AZ certificate #AZ0102.

pH, Saturated Paste	EPA 600/2-78-054 section 3.2.2
Solids, Percent	D2216-80

The following parameters are not offered for certification or are not covered by NELAC certificate #ACZ.

pH, Saturated Paste	EPA 600/2-78-054 section 3.2.2
Solids, Percent	D2216-80

Wet Chemistry

The following parameters are not offered for certification or are not covered by AZ certificate #AZ0102.

Sulfate, soluble (Water)	SM4500 SO4-D

The following parameters are not offered for certification or are not covered by NELAC certificate #ACZ.

Sulfate, soluble (Water)	SM4500 SO4-D

ACZ Laboratories, Inc.
2773 Downhill Drive Steamboat Springs, CO 80487 (800) 334-5493

Sample Receipt

Freeport-McMoRan - Chino Mines Company
ZN0000036K

ACZ Project ID: L47602
Date Received: 10/15/2018 10:49
Received By:
Date Printed: 10/17/2018

Receipt Verification

	YES	NO	NA
1) Is a foreign soil permit included for applicable samples?			X
2) Is the Chain of Custody form or other directive shipping papers present?	X		▨
3) Does this project require special handling procedures such as CLP protocol?		X	▨
4) Are any samples NRC licensable material?			X
5) If samples are received past hold time, proceed with requested short hold time analyses?	X		▨
6) Is the Chain of Custody form complete and accurate?	X		▨
7) Were any changes made to the Chain of Custody form prior to ACZ receiving the samples?	X		▨

A change was made in the Report to: Telephone section prior to ACZ custody.

Samples/Containers

	YES	NO	NA
8) Are all containers intact and with no leaks?	X		▨
9) Are all labels on containers and are they intact and legible?	X		▨
10) Do the sample labels and Chain of Custody form match for Sample ID, Date, and Time?	X		▨
11) For preserved bottle types, was the pH checked and within limits? [1]			X
12) Is there sufficient sample volume to perform all requested work?	X		▨
13) Is the custody seal intact on all containers?			X
14) Are samples that require zero headspace acceptable?			X
15) Are all sample containers appropriate for analytical requirements?	X		▨
16) Is there an Hg-1631 trip blank present?			X
17) Is there a VOA trip blank present?			X
18) Were all samples received within hold time?	X		▨

NA indicates Not Applicable

Chain of Custody Related Remarks

Client Contact Remarks

Shipping Containers

Cooler Id	Temp(°C)	Temp Criteria(°C)	Rad(µR/Hr)	Custody Seal Intact?
4509	2.5	NA	15	Yes

Was ice present in the shipment container(s)?

No - Wet or gel ice was not present in the shipment container(s).

Client must contact an ACZ Project Manager if analysis should not proceed for samples received outside of their thermal preservation acceptance criteria.

Sample Receipt

Freeport-McMoRan - Chino Mines Company
ZN0000036K

ACZ Project ID:	L47602
Date Received:	10/15/2018 10:49
Received By:	
Date Printed:	10/17/2018

[1] The preservation of the following bottle types is not checked at sample receipt: Orange (oil and grease), Purple (total cyanide), Pink (dissolved cyanide), Brown (arsenic speciation), Sterile (fecal coliform), EDTA (sulfite), HCl preserved vial (organics), Na2S2O3 preserved vial (organics), and HG-1631 (total/dissolved mercury by method 1631).

ACZ Laboratories, Inc. L47602

2773 Downhill Drive Steamboat Springs, CO 80487 (800) 334-5493

CHAIN of CUSTODY

Report to:

Name: Pam Pinson
Company: Chino Mines Co
E-mail: ppinson@fmi.com
Address: PO Box 10
Bayard NM 88023
Telephone: 575-912-5213

Copy of Report to:

Name: Trish Potter
Company: Chino
E-mail: tpotter@fmi.com
Telephone: 575-912-5319

Invoice to:

Name: Pam Pinson
Company: As Above
E-mail:
Address: As Above
Telephone:

If sample(s) received past holding time (HT), or if insufficient HT remains to complete analysis before expiration, shall ACZ proceed with requested short HT analyses? YES ☑ NO ☐

If "NO" then ACZ will contact client for further instruction. If neither "YES" nor "NO" is indicated, ACZ will proceed with the requested analyses, even if HT is expired, and data will be qualified.

Are samples for SDWA Compliance Monitoring? Yes ☐ No ☑

If yes, please include state forms. Results will be reported to PQL for Colorado.

Sampler's Name: Nick Lemme Sampler's site Information NM State ____ Zip code ____ Time Zone ____

PROJECT INFORMATION

Quote #:
Project/PO #: SO# ZN000036K
Reporting state for compliance testing:
Check box if samples include NRC licensed material? ☐

SAMPLE IDENTIFICATION	DATE:TIME	Matrix	# of Containers	ANALYSES REQUESTED (attach list or use quote number)							
STS-2018-REF-FG-1	10·2·18 / 0930	SO	1								
STS-2018-REF-BR-1	10·2·18 / 1040	SO	1								
STS-2018-REF-BR-2	10·2·18 / 1320	SO	1								
STS-2018-REF-FR-1	10·2·18 / 1340	SO	1								
STS-2018-REF-SL1	10·2·18 / 1200	SO	1								

Matrix SW (Surface Water) · GW (Ground Water) · WW (Waste Water) · DW (Drinking Water) · SL (Sludge) · SO (Soil) · OL (Oil) · Other (Specify)

REMARKS

Email Pam Pinson for analyses

Please refer to ACZ's terms & conditions located on the reverse side of this COC.

RELINQUISHED BY:	DATE:TIME	RECEIVED BY:	DATE:TIME
Nick Lemme	10·3·18 / 1245		10/15/18 10:45

FRMAD050.02.11.11 White - Return with sample. Yellow - Retain for your records.

L47602 Chain of Custod

APPENDIX C

2018 WILDLIFE HABITAT DATA

Wildlife Habitat Data

Date 10/2/2018

Site ID STS-2018-REF-FG1

Exposed

Bedrock 0%

Investigators David Mercer, Joe Allen, Carolyn Meyer, Pam Pinson, Will, Nick, Lewis

cover averaged over 1 m x 1 m areas

richness is in entire 20 by 20' area

TOTAL COVER					
	midpt cover	midpt cover	midpt cover	midpt cover	avg. midpt
Block 1	63	15	38	15	32.75
Block 2	38	38	38	15	32.25
Block 3	38	38	38	15	32.25
Block 4	15	38	15	38	26.50
Block 5	15	38	85	15	38.25
average	33.8	33.4	42.8	19.6	32.40

TREE/SHRUB COVER					
	midpt cover	midpt cover	midpt cover	midpt cover	avg. midpt
Block 1	63	15	38	2.5	29.63
Block 2	38	38	15	15	26.50
Block 3	38	38	38	15	32.25
Block 4	15	38	15	38	26.50
Block 5	15	38	88	0	35.25
average	33.8	33.4	38.8	14.1	30.03

0.93

GRASS COVER					
	midpt cover	midpt cover	midpt cover	midpt cover	avg. midpt
Block 1	2.5	15	2.5	15	8.75
Block 2	2.5	2.5	2.5	15	5.63
Block 3	2.5	2.5	2.5	2.5	2.50
Block 4	15	15	15	2.5	11.88
Block 5	2.5	2.5	2.5	2.5	2.50
average	5.0	7.5	5.0	7.5	6.25

0.19

FORB COVER					
	midpt cover	midpt cover	midpt cover	midpt cover	avg. midpt
Block 1	2.5	2.5	2.5	2.5	2.50
Block 2	2.5	2.5	2.5	2.5	2.50
Block 3	2.5	2.5	2.5	2.5	2.50
Block 4	2.5	2.5	2.5	2.5	2.50
Block 5	2.5	2.5	2.5	15	5.63
average	2.5	2.5	2.5	5.0	3.13

0.10

CACTUS COVER					
	midpt cover	midpt cover	midpt cover	midpt cover	avg. midpt
Block 1	0	0	0	0	0.00
Block 2	0	0	0	0	0.00
Block 3	0	0	0	0	0.00
Block 4	0	0	0	0	0.00
Block 5	0	0	0	0	0.00
average	0.0	0.0	0.0	0.0	0.00

0.00

# of Species

	#Tree/Shrul	# Grass	# Forb	# Cactus	# Species in block
Block 1	3	1	6	0	10
Block 2	4	1	7	0	12
Block 3	3	1	5	0	9
Block 4	4	1	6	0	11
Block 5	3	2	8	0	13
average	3.4	1.2	6.4	0.0	11.0

	Woody %	Non-Woody %
	0.93	0.19
	0.00	0.10
	0.93	0.29
Relative % c	0.76	0.237944

Table 1. Vegetation Cover Class Midpoints

Cover Range	Cover Class Midpoint
< 5	2.5
5-25	15
25-50	38
50-75	63
75-95	85
95-100	98

Wildlife Habitat Data

Date 10/3/2018
Site ID STS-2018-REF-FG2
Exposed
Bedrock 0%

Investigators PP, CM, JA, DM, LS, WG

cover averaged over 1 m x 1 m areas
richness is in entire 20 by 20' area

TOTAL COVER					
	midpt cover	midpt cover	midpt cover	midpt cover	avg. midpt
Block 1	38	38	15	38	32.25
Block 2	38	15	38	38	32.25
Block 3	38	15	15	15	20.75
Block 4	38	98	63	38	59.25
Block 5	38	38	15	38	32.25
average	38.0	40.8	29.2	33.4	35.35

# of Species

	#Tree/Shrul	# Grass	# Forb	# Cactus	# Species in block
Block 1	2	4	6	0	12
Block 2	1	5	7	1	14
Block 3	3	3	4	1	11
Block 4	2	4	5	1	12
Block 5	2	4	7	1	14
average	2.0	4.0	5.8	0.8	12.6

Table 1. Vegetation Cover Class Midpoints

Cover Range	Cover Class Midpoint
< 5	2.5
5-25	15
25-50	38
50-75	63
75-95	85
95-100	98

TREE/SHRUB COVER						
	midpt cover	midpt cover	midpt cover	midpt cover	avg. midpt	
Block 1	15	15	15	2.5	11.88	
Block 2	15	0	15	0	7.50	
Block 3	15	15	2.5	15	11.88	
Block 4	15	85	15	0	28.75	
Block 5	15	38	15	15	20.75	
average	15.0	30.6	12.5	6.5	16.15	0.46

	Woody %	Non-Woody %
	0.46	0.62
	0.05	0.14
	0.50	0.76
Relative % c	0.40	0.601904

GRASS COVER						
	midpt cover	midpt cover	midpt cover	midpt cover	avg. midpt	
Block 1	38	15	15	15	20.75	
Block 2	15	15	38	38	26.50	
Block 3	15	15	15	15	15.00	
Block 4	15	38	63	15	32.75	
Block 5	15	15	15	15	15.00	
average	19.6	19.6	29.2	19.6	22.00	0.62

FORB COVER						
	midpt cover	midpt cover	midpt cover	midpt cover	avg. midpt	
Block 1	2.5	2.5	2.5	2.5	2.50	
Block 2	2.5	2.5	2.5	2.5	2.50	
Block 3	2.5	2.5	15	2.5	5.63	
Block 4	15	0	2.5	15	8.13	
Block 5	2.5	15	2.5	2.5	5.63	
average	5.0	4.5	5.0	5.0	4.88	0.14

CACTUS COVER						
	midpt cover	midpt cover	midpt cover	midpt cover	avg. midpt	
Block 1	0	0	0	15	3.75	
Block 2	0	0	0	15	3.75	
Block 3	0	0	0	0	0.00	
Block 4	0	2.5	0	0	0.63	
Block 5	0	0	0	0	0.00	
average	0.0	0.5	0.0	6.0	1.63	0.05

Wildlife Habitat Data

Date 10/2/2018
Site ID STS-2018-REF-FR1
Exposed
Bedrock 20%

Investigators PM, DM, CM, J, A, Nick, Will, Lewis

cover averaged over 1 m x 1 m areas
richness is in entire 20 by 20' area

TOTAL COVER					
	midpt cover	midpt cover	midpt cover	midpt cover	avg. midpt
Block 1	2.5	38	15	15	17.63
Block 2	2.5	0	0	63	16.38
Block 3	15	38	38	38	32.25
Block 4	38	38	15	15	26.50
Block 5	38	15	15	15	20.75
average	19.2	25.8	16.6	29.2	22.70

TREE/SHRUB COVER					
	midpt cover	midpt cover	midpt cover	midpt cover	avg. midpt
Block 1	0	0	15	0	3.75
Block 2	0	0	0	63	15.75
Block 3	0	0	15	38	13.25
Block 4	0	0	0	0	0.00
Block 5	0	0	0	0	0.00
average	0.0	0.0	6.0	20.2	6.55

0.29

GRASS COVER					
	midpt cover	midpt cover	midpt cover	midpt cover	avg. midpt
Block 1	2.5	38	15	15	17.63
Block 2	2.5	0	0	2.5	1.25
Block 3	15	15	15	38	20.75
Block 4	38	15	15	15	20.75
Block 5	38	15	15	15	20.75
average	19.2	16.6	12.0	17.1	16.23

0.71

FORB COVER					
	midpt cover	midpt cover	midpt cover	midpt cover	avg. midpt
Block 1	2.5	15	2.5	2.5	5.63
Block 2	0	0	0	2.5	0.63
Block 3	2.5	15	0	2.5	5.00
Block 4	15	2.5	15	2.5	8.75
Block 5	15	0	2.5	15	8.13
average	7.0	6.5	4.0	5.0	5.63

0.25

CACTUS COVER					
	midpt cover	midpt cover	midpt cover	midpt cover	avg. midpt
Block 1	0	0	0	0	0.00
Block 2	0	0	0	0	0.00
Block 3	0	0	0	0	0.00
Block 4	0	0	0	0	0.00
Block 5	0	0	0	0	0.00
average	0.0	0.0	0.0	0.0	0.00

0.00

# of Species

	#Tree/Shrul	# Grass	# Forb	# Cactus	# Species in block
Block 1	3	3	9	0	15
Block 2	4	3	2	0	9
Block 3	1	3	9	0	13
Block 4	2	5	8	0	15
Block 5	3	5	6	0	14
average	2.6	3.8	6.8	0.0	13.2

	Woody %	Non-Woody %
	0.29	0.71
	0.00	0.25
	0.29	0.96
Relative % c	0.23	0.769366

Table 1. Vegetation Cover Class Midpoints

Cover Range	Cover Class Midpoint
< 5	2.5
5-25	15
25-50	38
50-75	63
75-95	85
95-100	98

Date 10/2/2018
Site ID STS-2018-REF-BR1
Exposed
Bedrock 80%

Investigators CM, PP, DM, JA, Nick, Louis, Will

cover averaged over 1 m x 1 m areas
richness is in entire 20 by 20' area

TOTAL COVER					
	midpt cover	midpt cover	midpt cover	midpt cover	avg. midpt
Block 1	2.5	15	0	0	4.38
Block 2	2.5	15	100	2.5	30.00
Block 3	0	0	0	2.5	0.63
Block 4	15	15	0	0	7.50
Block 5	0	0	0	0	0.00
average	4.0	9.0	20.0	1.0	8.50

TREE/SHRUB COVER					
	midpt cover	midpt cover	midpt cover	midpt cover	avg. midpt
Block 1	0	0	0	0	0.00
Block 2	0	15	100	2.5	29.38
Block 3	0	0	0	0	0.00
Block 4	0	0	0	0	0.00
Block 5	0	0	0	0	0.00
average	0.0	3.0	20.0	0.5	5.88

0.69

GRASS COVER					
	midpt cover	midpt cover	midpt cover	midpt cover	avg. midpt
Block 1	2.5	15	0	0	4.38
Block 2	2.5	15	2.5	0	5.00
Block 3	0	0	0	2.5	0.63
Block 4	15	15	0	0	7.50
Block 5	0	0	0	0	0.00
average	4.0	9.0	0.5	0.5	3.50

0.41

FORB COVER					
	midpt cover	midpt cover	midpt cover	midpt cover	avg. midpt
Block 1	0	0	0	0	0.00
Block 2	2.5	2.5	15	0	5.00
Block 3	0	0	2.5	0	0.63
Block 4	0	0	0	0	0.00
Block 5	0	0	0	0	0.00
average	0.5	0.5	3.5	0.0	1.13

0.13

CACTUS COVER					
	midpt cover	midpt cover	midpt cover	midpt cover	avg. midpt
Block 1	0	0	0	0	0.00
Block 2	0	0	0	0	0.00
Block 3	0	0	0	0	0.00
Block 4	0	0	0	0	0.00
Block 5	0	0	0	0	0.00
average	0.0	0.0	0.0	0.0	0.00

0.00

# of Species

	#Tree/Shrul	# Grass	# Forb	# Cactus	# Species in block
Block 1	0	4	3	1	8
Block 2	1	3	5	1	10
Block 3	2	2	6	1	11
Block 4	0	2	0	1	3
Block 5	0	1	0	0	1
average	0.6	2.4	2.8	0.8	6.6

	Woody %	Non-Woody %
	0.69	0.41
	0.00	0.13
	0.69	0.54
Relative % c	0.56	0.440476

Table 1. Vegetation Cover Class Midpoints

Cover Range	**Cover Class Midpoint**
< 5	2.5
5-25	15
25-50	38
50-75	63
75-95	85
95-100	98

Wildlife Habitat Data

Date 10/2/2018

Site ID STS-2018-REF-BR2

Exposed Bedrock 63%

Investigators CM, PP, DM, JA, Nick, Louis, Will

cover averaged over 1 m x 1 m areas
richness is in entire 20 by 20' area

TOTAL COVER					
	midpt cover	midpt cover	midpt cover	midpt cover	avg. midpt
Block 1	0	0	0	0	0.00
Block 2	15	63	0	15	23.25
Block 3	100	98	15	15	57.00
Block 4	15	38	15	15	20.75
Block 5	15	38	15	15	20.75
average	29.0	47.4	9.0	12.0	24.35

TREE/SHRUB COVER					
	midpt cover	midpt cover	midpt cover	midpt cover	avg. midpt
Block 1	0	0	0	0	0.00
Block 2	0	38	0	0	9.50
Block 3	38	85	2.5	0	31.38
Block 4	0	0	0	0	0.00
Block 5	0	15	0	0	3.75
average	7.6	27.6	0.5	0.0	8.93

0.37

GRASS COVER					
	midpt cover	midpt cover	midpt cover	midpt cover	avg. midpt
Block 1	0	0	0	0	0.00
Block 2	15	15	0	15	11.25
Block 3	2.5	15	2.5	15	8.75
Block 4	38	38	15	15	26.50
Block 5	15	15	2.5	15	11.88
average	14.1	16.6	4.0	12.0	11.68

0.48

FORB COVER					
	midpt cover	midpt cover	midpt cover	midpt cover	avg. midpt
Block 1	0	0	0	0	0.00
Block 2	0	2.5	0	0	0.63
Block 3	2.5	2.5	2.5	2.5	2.50
Block 4	2.5	15	15	2.5	8.75
Block 5	2.5	2.5	2.5	2.5	2.50
average	1.5	4.5	4.0	1.5	2.88

0.12

CACTUS COVER					
	midpt cover	midpt cover	midpt cover	midpt cover	avg. midpt
Block 1	0	0	0	0	0.00
Block 2	0	0	0	0	0.00
Block 3	0	0	0	0	0.00
Block 4	0	0	0	0	0.00
Block 5	0	0	0	0	0.00
average	0.0	0.0	0.0	0.0	0.00

0.00

\# of Species

	#Tree/Shrul	# Grass	# Forb	# Cactus	# Species in block
Block 1	2	5	0	3	10
Block 2	1	4	0	0	5
Block 3	3	4	6	1	14
Block 4	2	3	5	1	11
Block 5	0	4	8	1	13
average	1.6	4.0	3.8	1.2	10.6

	Woody %	Non-Woody %
	0.37	0.48
	0.00	0.12
	0.37	0.60
Relative % c	0.38	0.619808

Table 1. Vegetation Cover Class Midpoints

Cover Range	Cover Class Midpoint
< 5	2.5
5-25	15
25-50	38
50-75	63
75-95	85
95-100	98

Wildlife Habitat Data

Date 10/2/2018

Site ID STS-2018-REF-SL1

Exposed

Bedrock 7%

Investigators PM, DM, CM, JA, Nick, Will, Lewis

cover averaged over 1 m x 1 m areas
richness is in entire 20 by 20' area

TOTAL COVER				
	midpt cover	midpt cover	midpt cover	midpt cover	avg. midpt
Block 1	38	63	38	38	44.25
Block 2	98	15	38	15	41.50
Block 3	98	15	63	63	59.75
Block 4	63	38	38	63	50.50
Block 5	38	85	63	38	56.00
average	67.0	43.2	48.0	43.4	50.40

# of Species

	#Tree/Shrul	# Grass	# Forb	# Cactus	# Species in block
Block 1	1	4	7	1	13
Block 2	2	3	2	2	8
Block 3	3	5	7	1	16
Block 4	2	3	6	6	12
Block 5	4	6	5	0	15
average	2.4	4.2	5.4	2.0	12.8

Table 1. Vegetation Cover Class Midpoints

Cover Range	Cover Class Midpoint
< 5	2.5
5-25	15
25-50	38
50-75	63
75-95	85
95-100	98

TREE/SHRUB COVER					
	midpt cover	midpt cover	midpt cover	midpt cover	avg. midpt
Block 1	15	2.5	0	0	4.38
Block 2	0	0	0	0	0.00
Block 3	0	0	15	15	7.50
Block 4	0	0	0	2.5	0.63
Block 5	15	0	0	0	3.75
average	6.0	0.5	3.0	3.5	3.25

0.06

	Woody %	Non-Woody %
	0.06	0.74
	0.23	0.08
	0.29	0.82
Relative % c	0.26	0.736748

GRASS COVER					
	midpt cover	midpt cover	midpt cover	midpt cover	avg. midpt
Block 1	38	38	15	38	32.25
Block 2	38	15	38	15	26.50
Block 3	15	15	38	38	26.50
Block 4	63	38	38	38	44.25
Block 5	38	85	63	38	56.00
average	38.4	38.2	38.4	33.4	37.10

0.74

FORB COVER					
	midpt cover	midpt cover	midpt cover	midpt cover	avg. midpt
Block 1	2.5	2.5	2.5	2.5	2.50
Block 2	2.5	2.5	2.5	0	1.88
Block 3	15	2.5	2.5	15	8.75
Block 4	2.5	15	2.5	2.5	5.63
Block 5	2.5	2.5	2.5	2.5	2.50
average	5.0	5.0	2.5	4.5	4.25

0.08

CACTUS COVER					
	midpt cover	midpt cover	midpt cover	midpt cover	avg. midpt
Block 1	0	0	15	0	3.75
Block 2	85	0	0	0	21.25
Block 3	98	2.5	15	0	28.88
Block 4	0	15	0	0	3.75
Block 5	0	0	0	0	0.00
average	36.6	3.5	6.0	0.0	11.53

0.23

Wildlife Habitat Data

Date 10/3/2018
Site ID STS-2018-REF-S2
Exposed
Bedrock 17%

Investigators CM, JA, PP, DM, W, L

cover averaged over 1 m x 1 m areas
richness is in entire 20 by 20' area

TOTAL COVER					
	midpt cover	midpt cover	midpt cover	midpt cover	avg. midpt
Block 1	63	85	98	85	82.75
Block 2	0	63	85	98	61.50
Block 3	63	15	63	38	44.75
Block 4	63	85	63	86	74.25
Block 5	38	98	85	98	79.75
average	45.4	69.2	78.8	81.0	68.60

TREE/SHRUB COVER					
	midpt cover	midpt cover	midpt cover	midpt cover	avg. midpt
Block 1	15	2.5	15	38	17.63
Block 2	0	0	55	98	38.25
Block 3	0	0	0	0	0.00
Block 4	0	0	0	0	0.00
Block 5	15	0	0	0	3.75
average	6.0	0.5	14.0	27.2	11.93

0.17

GRASS COVER					
	midpt cover	midpt cover	midpt cover	midpt cover	avg. midpt
Block 1	63	38	63	38	50.50
Block 2	0	63	0	38	25.25
Block 3	68	15	38	38	39.75
Block 4	63	85	63	85	74.00
Block 5	38	98	63	85	71.00
average	46.4	59.8	45.4	56.8	52.10

0.76

FORB COVER					
	midpt cover	midpt cover	midpt cover	midpt cover	avg. midpt
Block 1	2.5	2.5	2.5	2.5	2.50
Block 2	0	15	15	0	7.50
Block 3	15	15	38	2.5	17.63
Block 4	2.5	2.5	2.5	2.5	2.50
Block 5	15	15	15	15	15.00
average	7.0	10.0	14.6	4.5	9.03

0.13

CACTUS COVER					
	midpt cover	midpt cover	midpt cover	midpt cover	avg. midpt
Block 1	0	0	0	38	9.50
Block 2	0	0	0	0	0.00
Block 3	0	0	0	0	0.00
Block 4	0	0	0	0	0.00
Block 5	0	0	0	0	0.00
average	0.0	0.0	0.0	7.6	1.90

0.03

# of Species

	#Tree/Shrul	# Grass	# Forb	# Cactus	# Species in block
Block 1	2	5	9	1	17
Block 2	2	5	6	0	13
Block 3	1	5	16	0	22
Block 4	2	6	7	1	16
Block 5	2	6	13	0	21
average	1.8	5.4	10.2	0.4	17.8

	Woody %	Non-Woody %
	0.17	0.76
	0.03	0.13
	0.20	0.89
Relative % c	0.18	0.815544

Table 1. Vegetation Cover Class Midpoints

Cover Range	Cover Class Midpoint
< 5	2.5
5-25	15
25-50	38
50-75	63
75-95	85
95-100	98

Wildlife Habitat Data

Date 10/3/2018
Site ID STS-2018-REF-BR3
Exposed
Bedrock 95%

Investigators PP, CM, JA, DM, LS, WG

cover averaged over 1 m x 1 m areas
richness is in entire 20 by 20' area

TOTAL COVER					
	midpt cover	midpt cover	midpt cover	midpt cover	avg. midpt
Block 1	15	0	15	0	7.50
Block 2	0	0	0	0	0.00
Block 3	0	0	0	0	0.00
Block 4	0	0	15	0	3.75
Block 5	2.5	0	0	0	0.63
average	3.5	0.0	6.0	0.0	2.38

TREE/SHRUB COVER					
	midpt cover	midpt cover	midpt cover	midpt cover	avg. midpt
Block 1	15	0	0	0	3.75
Block 2	0	0	0	0	0.00
Block 3	0	0	0	0	0.00
Block 4	0	0	0	0	0.00
Block 5	0	0	0	0	0.00
average	3.0	0.0	0.0	0.0	0.75

0.32

GRASS COVER					
	midpt cover	midpt cover	midpt cover	midpt cover	avg. midpt
Block 1	15	0	15	0	7.50
Block 2	0	0	0	0	0.00
Block 3	0	0	0	0	0.00
Block 4	0	0	38	0	9.50
Block 5	0	0	0	0	0.00
average	3.0	0.0	10.6	0.0	3.40

1.43

FORB COVER					
	midpt cover	midpt cover	midpt cover	midpt cover	avg. midpt
Block 1	0	0	0	0	0.00
Block 2	0	0	0	0	0.00
Block 3	0	0	0	0	0.00
Block 4	0	0	2.5	0	0.63
Block 5	0	0	0	0	0.00
average	0.0	0.0	0.5	0.0	0.13

0.05

CACTUS COVER					
	midpt cover	midpt cover	midpt cover	midpt cover	avg. midpt
Block 1	0	0	0	0	0.00
Block 2	0	0	0	0	0.00
Block 3	0	0	0	0	0.00
Block 4	0	0	0	0	0.00
Block 5	0	0	0	0	0.00
average	0.0	0.0	0.0	0.0	0.00

0.00

# of Species

	#Tree/Shrul	# Grass	# Forb	# Cactus	# Species in block
Block 1	1	3	2	0	6
Block 2	0	3	1	0	4
Block 3	1	2	1	1	5
Block 4	0	2	2	1	5
Block 5	0	2	0	0	2
average	0.4	2.4	1.2	0.4	4.4

	Woody %	Non-Woody %
	0.32	1.43
	0.00	0.05
	0.32	1.48
Relative % c	0.18	0.824561

Table 1. Vegetation Cover Class Midpoints

Cover Range	Cover Class Midpoint
< 5	2.5
5-25	15
25-50	38
50-75	63
75-95	85
95-100	98

Wildlife Habitat Data

Date 10/3/2018

Investigators CM, JA, PP, DM, LS, CN, CO

Site ID STS-PT-2013-Reference plot S

Exposed

Bedrock 0%

cover averaged over 1 m x 1 m areas

richness is in entire 20 by 20' area

TOTAL COVER					
	midpt cover	midpt cover	midpt cover	midpt cover	avg. midpt
Block 1	2.5	15	15	98	32.63
Block 2	38	63	38	15	38.50
Block 3	15	15	15	2.5	11.88
Block 4	15	15	15	15	15.00
Block 5	38	85	15	15	38.25
average	21.7	38.6	19.6	29.1	27.25

TREE/SHRUB COVER						
	midpt cover	midpt cover	midpt cover	midpt cover	avg. midpt	
Block 1	0	0	15	15	7.50	
Block 2	2.5	15	38	15	17.63	
Block 3	15	2.5	15	2.5	8.75	
Block 4	15	2.5	15	15	11.88	
Block 5	15	2.5	15	2.5	8.75	
average	9.5	4.5	19.6	10.0	10.90	0.40

GRASS COVER						
	midpt cover	midpt cover	midpt cover	midpt cover	avg. midpt	
Block 1	2.5	15	15	0	8.13	
Block 2	38	15	2.5	2.5	14.50	
Block 3	15	15	0	0	7.50	
Block 4	15	15	2.5	2.5	8.75	
Block 5	38	85	15	15	38.25	
average	21.7	29.0	7.0	4.0	15.43	0.57

FORB COVER						
	midpt cover	midpt cover	midpt cover	midpt cover	avg. midpt	
Block 1	0	0	2.5	0	0.63	
Block 2	2.5	15	2.5	2.5	5.63	
Block 3	2.5	2.5	0	2.5	1.88	
Block 4	2.5	0	2.5	2.5	1.88	
Block 5	2.5	2.5	0	2.5	1.88	
average	2.0	4.0	1.5	2.0	2.38	0.09

CACTUS COVER						
	midpt cover	midpt cover	midpt cover	midpt cover	avg. midpt	
Block 1	0	0	0	98	24.50	
Block 2	0	0	0	0	0.00	
Block 3	0	0	0	0	0.00	
Block 4	0	0	0	0	0.00	
Block 5	0	0	0	0	0.00	
average	0.0	0.0	0.0	19.6	4.90	0.18

# of Species

	#Tree/Shrul	# Grass	# Forb	# Cactus	# Species in block
Block 1	2	3	6	2	13
Block 2	3	4	6	1	14
Block 3	4	3	4	0	11
Block 4	3	3	7	0	13
Block 5	2	3	6	0	11
average	2.8	3.2	5.8	0.6	12.4

	Woody %	Non-Woody %
	0.40	0.57
	0.18	0.09
	0.58	0.65
Relative % c	0.47	0.529762

Table 1. Vegetation Cover Class Midpoints

Cover Range	**Cover Class Midpoint**
< 5	2.5
5-25	15
25-50	38
50-75	63
75-95	85
95-100	98

Wildlife Habitat Data

Date 10/3/2018

Investigators PP, CM, JA, NDM, LS, WG

Site ID STS-PT-2013-Reference plot N

Exposed Bedrock 0%

cover averaged over 1 m x 1 m areas
richness is in entire 20 by 20' area

TOTAL COVER					
	midpt cover	midpt cover	midpt cover	midpt cover	avg. midpt
Block 1	63	38	38	38	44.25
Block 2	38	38	63	38	44.25
Block 3	38	85	63	63	62.25
Block 4	38	38	38	98	53.00
Block 5	38	63	38	63	50.50
average	43.0	52.4	48.0	60.0	50.85

TREE/SHRUB COVER					
	midpt cover	midpt cover	midpt cover	midpt cover	avg. midpt
Block 1	63	2.5	15	15	23.88
Block 2	15	38	38	15	26.50
Block 3	38	15	38	38	32.25
Block 4	38	63	2.5	2.5	26.50
Block 5	2.5	15	2.5	15	8.75
average	31.3	26.7	19.2	17.1	23.58

0.46

GRASS COVER					
	midpt cover	midpt cover	midpt cover	midpt cover	avg. midpt
Block 1	0	38	38	15	22.75
Block 2	15	15	15	38	20.75
Block 3	15	68	15	15	28.25
Block 4	15	15	15	98	35.75
Block 5	15	38	38	38	32.25
average	12.0	34.8	24.2	40.8	27.95

0.55

FORB COVER					
	midpt cover	midpt cover	midpt cover	midpt cover	avg. midpt
Block 1	15	2.5	2.5	2.5	5.63
Block 2	2.5	0	0	2.5	1.25
Block 3	0	15	15	15	11.25
Block 4	2.5	2.5	0	15	5.00
Block 5	2.5	15	2.5	0	5.00
average	4.5	7.0	4.0	7.0	5.63

0.11

CACTUS COVER					
	midpt cover	midpt cover	midpt cover	midpt cover	avg. midpt
Block 1	0	0	0	0	0.00
Block 2	0	0	0	0	0.00
Block 3	0	0	0	0	0.00
Block 4	0	0	0	0	0.00
Block 5	38	0	0	0	9.50
average	7.6	0.0	0.0	0.0	1.90

0.04

# of Species

	#Tree/Shrul	# Grass	# Forb	# Cactus	# Species in block
Block 1	1	3	4	0	8
Block 2	1	3	3	0	7
Block 3	1	2	6	0	9
Block 4	1	2	4	0	7
Block 5	2	3	1	1	10
average	1.2	2.6	3.6	0.2	8.2

	Woody %	Non-Woody %
	0.46	0.55
	0.04	0.11
	0.50	0.66
Relative % c	0.43	0.568586

Table 1. Vegetation Cover Class Midpoints

Cover Range	Cover Class Midpoint
< 5	2.5
5-25	15
25-50	38
50-75	63
75-95	85
95-100	98

Wildlife Habitat Data

Date 10/3/2018

Site ID Overgrazed Reference

Exposed

Bedrock 0%

Investigators CM, JA, PP, DM, LS, WG

cover averaged over 1 m x 1 m areas
richness is in entire 20 by 20' area

TOTAL COVER					
	midpt cover	midpt cover	midpt cover	midpt cover	avg. midpt
Block 1	15	2.5	15	15	11.88
Block 2	15	2.5	85		34.17
Block 3	0	2.5	63	2.5	17.00
Block 4	38	100	15	2.5	38.88
Block 5	15	15	63	15	27.00
average	16.6	24.5	48.2	8.8	25.78

# of Species

	#Tree/Shrul	# Grass	# Forb	# Cactus	# Species in block
Block 1	1	1	4	0	6
Block 2	1	1	4	0	6
Block 3	1	3	4	0	8
Block 4	1	1	3	0	5
Block 5	1	1	2	0	4
average	1.0	1.4	3.4	0.0	5.8

Table 1. Vegetation Cover Class Midpoints

Cover Range	Cover Class Midpoint
< 5	2.5
5-25	15
25-50	38
50-75	63
75-95	85
95-100	98

TREE/SHRUB COVER					
	midpt cover	midpt cover	midpt cover	midpt cover	avg. midpt
Block 1	0	0	0	0	0.00
Block 2	15	0	85	0	25.00
Block 3	0	2.5	63	2.5	17.00
Block 4	0	98	0	0	24.50
Block 5	0	0	63	0	15.75
average	3.0	20.1	42.2	0.5	16.45

0.64

	Woody %	Non-Woody %
	0.64	0.11
	0.00	0.32
	0.64	0.43
Relative % c	0.60	0.401274

GRASS COVER					
	midpt cover	midpt cover	midpt cover	midpt cover	avg. midpt
Block 1	2.5	0	15	2.5	5.00
Block 2	0	2.5	2.5	0	1.25
Block 3	0	0	0	0	0.00
Block 4	0	0	0	0	0.00
Block 5	15	0	0	15	7.50
average	3.5	0.5	3.5	3.5	2.75

0.11

FORB COVER					
	midpt cover	midpt cover	midpt cover	midpt cover	avg. midpt
Block 1	15	2.5	2.5	15	8.75
Block 2	15	2.5	0	15	8.13
Block 3	0	2.5	2.5	2.5	1.88
Block 4	38	0	15	2.5	13.88
Block 5	15	15	2.5	2.5	8.75
average	16.6	4.5	4.5	7.5	8.28

0.32

CACTUS COVER					
	midpt cover	midpt cover	midpt cover	midpt cover	avg. midpt
Block 1	0	0	0	0	0.00
Block 2	0	0	0	0	0.00
Block 3	0	0	0	0	0.00
Block 4	0	0	0	0	0.00
Block 5	0	0	0	0	0.00
average	0.0	0.0	0.0	0.0	0.00

0.00

Wildlife Habitat Sampling Form

Site ID: Overgrazed Reference **Lat:** **Long:**

Date 10-3-18 **Investigators** CM, JA, PP, DM, ~~[illegible]~~ LS, WG

Photo number labeled before page - last ones are overgrazed rocky 2 sampled uphill of this one for soil only **% Exposed Bedrock** 0

Nightshade-hots	% Tree/ Shrub Cover	% Grass Cover	% Forb Cover	% Cactus Cover	% Total Cover
Block 1 ✓ tabosa	0 0 0 0	0-5 0 5-25 0-5	5-25 0-5 0-5 5-25	0 0 0 0	5-25 0-5 5-25 5-25
Block 2 ✓	5-25 0 75-95 0	0 0-5 0-5 0	5-25 0-5 0 5-25	0 0 0 0	5-25 0-5 75-95
Block 3 ✓ ~~tobosa gr.~~	0 0-5 50-75 0-5	0 0 0 0	0 0-5 0-5 0-5	0 0 0	0 0-5 50-75 0-5
Block 4 ✓	0 95-100 0 0	0 0 0 0	25-50 0 5-25 0-5	0 0 0 0	25-50 100 5-25 0-5
Block 5 ✓ 3 [illegible].Awn	0 0 50-75 0	5-25 0 0 5-25	5-25 5-25 0-5 0-5	0 0 0 0	5-25 5-25 50-75 5-25

	# Trees shrubs	# Shrubs grasses	# Cactus and Succulents	# ~~Yucca~~ forbs	Number of species in block
Block 1	1	1	0	4	6
Block 2	1	1	0	4	6
Block 3	1	3	0	4	8
Block 4	1	1	0	3	5
Block 5	1	1	0	2	4

	1	2	3	4	5
1	3		1	4	
2					
3					
4	2	5			
5					

Nightshade = Forb

Rangeland Health Evaluation Summary Worksheet

Part 1. Area of Interest Documentation

Location Overgrazed reference

UTM Coord

Picture # Description

Date/Time: Oct 3, 2018

Observer CM, JA

Soil Map Unit Name

Veg Alliance Name

Surface texture

Parent material rhyolite Kneeling Nun - flat rocky - ~~[illegible]~~ eroded

Slope %

Elevation (ft)

Topographic position

Aspect

Signs of Disturbance(s) observed

OAT score of 200-m transect 16

OAT score of polygon

Notes:

mesquite

nightshade

some tobosa [illegible]


- sharp hairpins

up rise to more diverse area - see photos comparing areas

Tailings - maybe in runoff this area?

Still overgrazed

more armored

Sideoats ↑ as go up hill

more lemongrass

beardgrass

then yucca - bigger healthy yucca Sugar loaf

near the top. - lots tobosa, too

took soil sample uphill of overgrazed reference

Overgrazed Rocky Soil

Soil Sample 2 (uphill of overgrazed)

Overgrazed Reference 10-3-18

Criteria used to score Observed Apparent Trend (OAT). ***Check appropriate box in each category which best fits area being observed. Points may vary within each category.***

☐ **VIGOR** (10 points)	Desirable grasses, forbs and shrubs are vigorous, showing good health. These plants have good size, color, and produce abundant herbage.
☐ (6 points)	Desirable grasses, forbs and shrubs have moderate vigor. They are medium size with fair color, and produce moderate amounts of herbage. Some seed stalks and seed heads are present.
☑ (2 points) 2	Desirable grasses, forbs and shrubs have low vigor. They appear unhealthy with small size and poor color. Portions of clumps or entire plants are dead or dying. Seed stalks and seed heads are non-existent, except in protected areas.
☐ **SEEDLINGS** (10 points)	There is seedling establishment of desirable grasses, forbs and shrubs. Seedlings are present in open spaces between plants and along edges of soil pedestals. Few seedlings of invader or undesirable plants are present.
☐ (6 points)	Some seedlings of desirable grasses, forbs and shrubs may or may not be present in open spaces between plants. Some seedlings of invader or undesirable plant species may or may not be present.
☑ (2 points) 2 many dying	Few if any seedlings of desirable grasses, forbs and shrubs are being established. Seedlings of invader or undesirable plants are present in open spaces between plants.
☐ **SURFACE LITTER** (5 points)	Surface litter is accumulating in place.
☐ (3 points) 2	Moderate movement of surface litter is apparent and deposited against obstacles.
☐ (1 point)	Very little surface litter is remaining.
☐ **PEDESTALS** (5 points)	There is little visual evidence of pedestalling. Those pedestals present are sloping or rounding and accumulating litter. Desirable forage grasses may be found along edges of pedestals.
☐ (3 points) 3	There is moderate pedestalling with no visual evidence of healing or deterioration. Small rock and plant pedestals may be occurring in flow patterns.
☐ (1 point)	Most rocks and plants are pedestalled. Pedestals are sharp-sided and eroding, often exposing grass roots.
☐ **SURFACE CRUSTING** (5 points)	There is little visual evidence of surface crusting.
☐ (3 points) 2	There is moderate surface crusting, with no visual evidence of healing or deterioration. (Note reason for cause)
☐ (1 point)	Severe surface crusting. (Note reason for cause)
☐ **RILLS AND GULLIES** (5 points) 5	Gullies (including rills) may be present in stable condition, with moderate sloping or rounded sides. Perennials are establishing themselves on bottom and sides of channel.
☐ (3 points)	Gullies are well developed, with small amounts of active erosion. Some vegetation may be present.
☐ (1 point)	Sharply incised V-shaped gullies cover most of the area, with most of the gullies actively eroding. Gullies are mostly devoid of perennial plants. They have fresh cutting on the bottom.
TOTAL: 16 **FIELD NOTES:**	

2011 30%, 11 sp
2014 30%, 14 sp. 14.4 gr%
2018, ~~30~~%, 8 sp. 29.7 gr% **Wildlife Habitat Sampling Form**

32.6840
-108.0677

Site ID: Wildlife Reference N

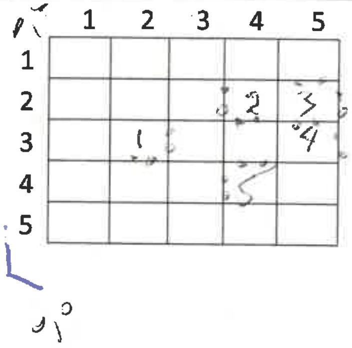
Lat: 32.68399 **Long:** -108.06769

Date 10-3-18 **Investigators** PP, CM, JA, MDM, LS, WG

Photo number labelled after **% Exposed Bedrock** 0

	% Tree/ Shrub Cover	% Grass Cover	% Forb Cover	% Cactus Cover	% Total Cover	
grass 22.5 **Block 1** ✓	50-75 0-5 5-25 5-25	0 25-50 25-50 5-25	5-25 0-5 0-5 0-5	0 0 0 0	50-75 25-50 25-50 25-50	43.75 ~~41.25~~
20.6 **Block 2** ✓	5-25 25-50 25-50 5-25	5-25 5-25 5-25 25-50	0-5 [illegible] 0 0-5	0 0 0 0	25-50 25-50 50-75 25-50	48.7
38.1 **Block 3** Bristlegrass	25-50 5-25 25-50 25-50	5-25 50-75 25-50 5-25	0 5-25 5-25 5-25	0 0 0 0	25-50 75-95 50-75 50-75	61.8
46.9 **Block 4** ~~[illegible]~~	5-25 5-25 25-50 5-25	25-50 25-50 5-25 75-100	0-5 0-5 0 5-25	0 0 0 0	25-50 25-50 25-50 95-100	~~44.4~~ 62.5
20.6 **Block 5** ✓ Lemongrass weed side oats	5-25 5-25 25-50 5-25	5-25 25-50 25-50 25-50	0-5 5-25 0-5 0?	25-50 0 0 0	25-50 50-75 25-50 50-75	59 ~~49.5~~
29.74						~~46.63~~ 50.36

	# ~~Trees~~ Shrubs	# ~~Shrubs~~ grasses	# Cactus and Succulents	# ~~Yucca~~ forbs	Number of species in block
Block 1	1	3	0	4	8
Block 2	1	3	0	3	7
Block 3	1	2	0	6	9
Block 4	1	2	0	4	7
Block 5	2	3	1	4	10



Carelessweed invade?

Rangeland Health Evaluation Summary Worksheet

Part 1. Area of Interest Documentation

Location Wildlife Reference North

UTM Coord

Picture # Description

Date/Time: 10-3-18 ~10am

Observer [illegible]. JA, CM

Soil Map Unit Name

Veg Alliance Name

Surface texture

Parent material Rhyolite / Basalt or Andesite mix

Slope % Slight

Elevation (ft)

Topographic position [illegible]

Aspect N-facing

Signs of Disturbance(s) observed

OAT score of 200-m transect 27

OAT score of polygon

Notes:

mesquite - here + on [illegible]

tobosa

nightshade

carelessweed

Some lemonweed

cactus - coming back from blight

vine mesquite

Wildlife Refuge North

Criteria used to score Observed Apparent Trend (OAT). ***Check appropriate box in each category which best fits area being observed. Points may vary within each category.***

☐ **VIGOR** (10 points)	Desirable grasses, forbs and shrubs are vigorous, showing good health. These plants have good size, color, and produce abundant herbage.
☐ (6 points) 6	Desirable grasses, forbs and shrubs have moderate vigor. They are medium size with fair color, and produce moderate amounts of herbage. Some seed stalks and seed heads are present.
☐ (2 points)	Desirable grasses, forbs and shrubs have low vigor. They appear unhealthy with small size and poor color. Portions of clumps or entire plants are dead or dying. Seed stalks and seed heads are non-existent, except in protected areas.
☐ **SEEDLINGS** (10 points)	There is seedling establishment of desirable grasses, forbs and shrubs. Seedlings are present in open spaces between plants and along edges of soil pedestals. Few seedlings of invader or undesirable plants are present.
☐ (6 points) 5	Some seedlings of desirable grasses, forbs and shrubs may or may not be present in open spaces between plants. Some seedlings of invader or undesirable plant species may or may not be present.
☐ (2 points)	Few if any seedlings of desirable grasses, forbs and shrubs are being established. Seedlings of invader or undesirable plants are present in open spaces between plants.
☐ **SURFACE LITTER** (5 points) 4	Surface litter is accumulating in place.
☐ (3 points)	Moderate movement of surface litter is apparent and deposited against obstacles.
☐ (1 point)	Very little surface litter is remaining.
☐ **PEDESTALS** (5 points) 4	There is little visual evidence of pedestalling. Those pedestals present are sloping or rounding and accumulating litter. Desirable forage grasses may be found along edges of pedestals.
☐ (3 points)	There is moderate pedestalling with no visual evidence of healing or deterioration. Small rock and plant pedestals may be occurring in flow patterns.
☐ (1 point)	Most rocks and plants are pedestalled. Pedestals are sharp-sided and eroding, often exposing grass roots.
☐ **SURFACE CRUSTING** (5 points)	There is little visual evidence of surface crusting.
☐ (3 points) 3	There is moderate surface crusting, with no visual evidence of healing or deterioration. (Note reason for cause)
☐ (1 point)	Severe surface crusting. (Note reason for cause)
☐ **RILLS AND GULLIES** (5 points) 5	Gullies (including rills) may be present in stable condition, with moderate sloping or rounded sides. Perennials are establishing themselves on bottom and sides of channel.
☐ (3 points)	Gullies are well developed, with small amounts of active erosion. Some vegetation may be present.
☐ (1 point)	Sharply incised V-shaped gullies cover most of the area, with most of the gullies actively eroding. Gullies are mostly devoid of perennial plants. They have fresh cutting on the bottom.
TOTAL: 27 **FIELD NOTES:**	

2011, 282, 10 sp
2014, 372, 13 sp 11.32 gr.
2018 272, 12 sp. 14.82 gr.

Wildlife Habitat Sampling Form

Site ID: Wildlife Reference South

Lat: 32.68399 **Long:** -108.06769

32.6748
-108.0601

Date 10-3-18 **Investigators** CM, JA, PP, AM, LS, WC

Photo number info page labelled

% Exposed Bedrock 0

	% Tree/ Shrub Cover	% Grass Cover	% Forb Cover	% Cactus Cover	% Total Cover
Block 1 ✓ Yucca	0 0 5-25 5-25	0-5 5-25 5-25 0	0 0 0-5 0	0 0 0 95-100	3-5 5-25 5-25 95-100
Block 2 ✓	0-5 5-25 25-50 5-25	25-50 5-25 0-5 0-5	0-5 5-25 0-5 0-5	0 0 0 0	25-50 50-75 25-50 5-25
Block 3 ✓ Oak tree	5-25 0-3 5-25 0-5	5-25 5-25 0 0	0-5 0-5 0 0-5	0 0 0 0	5-25 5-25 5-25 0-5
Block 4 ✓ careless weed	5-25 0-5 5-25 5-25	5-25 5-25 0-5 0-5	0-5 0 0-5 0-5	0 0 0 0	5-25 5-25 5-25 5-25
Block 5 ✓	5-25 0-5 5-25 0-5	25-50 75-95 5-25 5-25	0-5 0-5 0 0-5	0 0 0 0	25-50 75-95 5-25 5-25

Grass
8.125
14.3
3.79
9.7
38
14.8

32.5
38
11.875
15
38.1
272

	# Trees Shrubs	# ~~Shrubs~~ Grasses	# Cactus and Succulents	# ~~Yucca~~ Forbs	Number of species in block
Block 1	2	3	2	6	13
Block 2	3	4	1	6	14
Block 3	4	3	0	4	11
Block 4	3	3	0	7	13
Block 5	2	3	0	6	11

	1	2	3	4	5
1					
2		2			1
3					
4			4	3	
5			5		

12.4 avg

Rangeland Health Evaluation Summary Worksheet

Part 1. Area of Interest Documentation

Location Wildlife Reference South

UTM Coord

Picture #	**Description**

Date/Time: 10-3-18 ~9am

Observer JA, CM

Soil Map Unit Name

Veg Alliance Name

Surface texture

Parent material Rhyolite - near bedrock area from knolling [illegible]

Slope % flat ish

Elevation (ft)

Topographic position

Aspect Slightly S-facing

Signs of Disturbance(s) observed

OAT score of 200-m transect 24

OAT score of polygon

Notes:

Vine mesquite

Sideoats

bendgrass

3 awn

tobosa

2 Yucca types

catclaw - small shrub

[illegible] - small seedlings

Wildlife Reference South

Criteria used to score Observed Apparent Trend (OAT). ***Check appropriate box in each category which best fits area being observed. Points may vary within each category.***

☐ **VIGOR** (10 points)	Desirable grasses, forbs and shrubs are vigorous, showing good health. These plants have good size, color, and produce abundant herbage.
☐ (6 points) 7	Desirable grasses, forbs and shrubs have moderate vigor. They are medium size with fair color, and produce moderate amounts of herbage. Some seed stalks and seed heads are present.
☐ (2 points)	Desirable grasses, forbs and shrubs have low vigor. They appear unhealthy with small size and poor color. Portions of clumps or entire plants are dead or dying. Seed stalks and seed heads are non-existent, except in protected areas.
☐ **SEEDLINGS** (10 points)	There is seedling establishment of desirable grasses, forbs and shrubs. Seedlings are present in open spaces between plants and along edges of soil pedestals. Few seedlings of invader or undesirable plants are present.
☐ (6 points)	Some seedlings of desirable grasses, forbs and shrubs may or may not be present in open spaces between plants. Some seedlings of invader or undesirable plant species may or may not be present.
☐ (2 points) 2	Few if any seedlings of desirable grasses, forbs and shrubs are being established. Seedlings of invader or undesirable plants are present in open spaces between plants.
☐ **SURFACE LITTER** (5 points)	Surface litter is accumulating in place.
☐ (3 points) 3	Moderate movement of surface litter is apparent and deposited against obstacles.
☐ (1 point)	Very little surface litter is remaining.
☐ **PEDESTALS** (5 points) 4	There is little visual evidence of pedestalling. Those pedestals present are sloping or rounding and accumulating litter. Desirable forage grasses may be found along edges of pedestals.
☐ (3 points)	There is moderate pedestalling with no visual evidence of healing or deterioration. Small rock and plant pedestals may be occurring in flow patterns.
☐ (1 point)	Most rocks and plants are pedestalled. Pedestals are sharp-sided and eroding, often exposing grass roots.
☐ **SURFACE CRUSTING** (5 points)	There is little visual evidence of surface crusting.
☐ (3 points) 3	There is moderate surface crusting, with no visual evidence of healing or deterioration. (Note reason for cause)
☐ (1 point)	Severe surface crusting. (Note reason for cause)
☐ **RILLS AND GULLIES** (5 points) 5	Gullies (including rills) may be present in stable condition, with moderate sloping or rounded sides. Perennials are establishing themselves on bottom and sides of channel.
☐ (3 points)	Gullies are well developed, with small amounts of active erosion. Some vegetation may be present.
☐ (1 point)	Sharply incised V-shaped gullies cover most of the area, with most of the gullies actively eroding. Gullies are mostly devoid of perennial plants. They have fresh cutting on the bottom.
TOTAL: 24 **FIELD NOTES:**	

Wildlife Habitat Sampling Form

Site ID: SB-2018-REFBR3 **Lat:** **Long:**

Date 10-3-18 **Investigators** PP, CM, JH, DM, LS, WG

Photo number Labelled **% Exposed Bedrock** 95%

	% Tree/ Shrub Cover	% Grass Cover	% Forb Cover	% Cactus Cover	% Total Cover
Block 1 ✓	5-25 0 0 0	5-25 0 5-25 0	0 0 0 0	0 0 0 0	5-25 0 5-25 0
Block 2 ✓	0 0 0 0	0 0 0 0	0 0 0 0	0 0 0 0	0 0 0 0
Block 3	0 0 0 0	0 0 0 0	0 0 0 0	0 0 0 0	0 0 0 0
Block 4 ✓	0 0 0 0	0 0 25-50 0	0 0 0-5 0	0 0 0 0	0 0 25-50 0
Block 5 ✓	0 0 0 0	0-5 0 0 0	0 0 0 0	0 0 0 0	0-5 0 0 0

	# Trees Shrubs	# ~~Shrubs~~ Grasses	# Cactus and Succulents	# ~~Yucca~~ Forbs	Number of species in block
Block 1	1	3	0	2	6
Block 2	0	3	0	1	4
Block 3	1	2	1	1	5
Block 4	0	2	1	2	5
Block 5	0	2	0	0	2

	1	2	3	4	5
1					
2				1	
3	3				
4				4	5
5 ✓					2

RS3

Rangeland Health Evaluation Summary Worksheet

Part 1. Area of Interest Documentation

Location STS-2018-REF-BR3

UTM Coord

Picture #	Description

Date/Time: 10-3-18

Observer JA, CM 4pm

Soil Map Unit Name

Veg Alliance Name

Surface texture

Parent material Rhyolite Kneeling Nun

Slope % steeper

Elevation (ft)

Topographic position

Aspect

Signs of Disturbance(s) observed

OAT score of 200-m transect 16

OAT score of polygon

Notes: Oak trees

tall condensed mound-like

Bunchgrass

STB-2018-REP-B3 10-3-18

Criteria used to score Observed Apparent Trend (OAT). ***Check appropriate box in each category which best fits area being observed. Points may vary within each category.***

☐ **VIGOR** (10 points)	Desirable grasses, forbs and shrubs are vigorous, showing good health. These plants have good size, color, and produce abundant herbage.
☐ (6 points)	Desirable grasses, forbs and shrubs have moderate vigor. They are medium size with fair color, and produce moderate amounts of herbage. Some seed stalks and seed heads are present.
☐ (2 points) 2	Desirable grasses, forbs and shrubs have low vigor. They appear unhealthy with small size and poor color. Portions of clumps or entire plants are dead or dying. Seed stalks and seed heads are non-existent, except in protected areas.
☐ **SEEDLINGS** (10 points)	There is seedling establishment of desirable grasses, forbs and shrubs. Seedlings are present in open spaces between plants and along edges of soil pedestals. Few seedlings of invader or undesirable plants are present.
☐ (6 points)	Some seedlings of desirable grasses, forbs and shrubs may or may not be present in open spaces between plants. Some seedlings of invader or undesirable plant species may or may not be present.
☐ (2 points) [illegible] 1	Few if any seedlings of desirable grasses, forbs and shrubs are being established. Seedlings of invader or undesirable plants are present in open spaces between plants.
☐ **SURFACE LITTER** (5 points)	Surface litter is accumulating in place.
☐ (3 points)	Moderate movement of surface litter is apparent and deposited against obstacles.
☐ (1 point) 1	Very little surface litter is remaining.
☐ **PEDESTALS** (5 points) 4	There is little visual evidence of pedestalling. Those pedestals present are sloping or rounding and accumulating litter. Desirable forage grasses may be found along edges of pedestals.
☐ (3 points)	There is moderate pedestalling with no visual evidence of healing or deterioration. Small rock and plant pedestals may be occurring in flow patterns.
☐ (1 point)	Most rocks and plants are pedestalled. Pedestals are sharp-sided and eroding, often exposing grass roots.
☐ **SURFACE CRUSTING** (5 points)	There is little visual evidence of surface crusting.
☐ (3 points) 3	There is moderate surface crusting, with no visual evidence of healing or deterioration. (Note reason for cause)
☐ (1 point)	Severe surface crusting. (Note reason for cause)
☐ **RILLS AND GULLIES** (5 points) 5 ?	Gullies (including rills) may be present in stable condition, with moderate sloping or rounded sides. Perennials are establishing themselves on bottom and sides of channel.
☐ (3 points)	Gullies are well developed, with small amounts of active erosion. Some vegetation may be present.
☐ (1 point)	Sharply incised V-shaped gullies cover most of the area, with most of the gullies actively eroding. Gullies are mostly devoid of perennial plants. They have fresh cutting on the bottom.
TOTAL: 16 **FIELD NOTES:**	

Wildlife Habitat Sampling Form

Site ID: STJ-2018-REF-S2 **Lat:** **Long:**

Date 10-3-18 **Investigators** CM, JA, PP, DM, W, L

Photo number labelled before pic

% Exposed Bedrock 17% - boulders/bedrock

	% Tree/ Shrub Cover	% Grass Cover	% Forb Cover	% Cactus Cover	% Total Cover
Block 1 ✓ Side Oats blue grama	5-25 0-5 5-25 25-50	50-75 25-50 50-75 25-50	0-5 0-5 0-5 0-5	0 25-50 0 0	50-75 75-95 95-100 75-95
Block 2 ✓ Oak tree	0 0 35-75 75-100	0 50-75 0 25-50	0 5-25 5-25 0	0 0 0 0	0 50-75 75-95 95-100
Block 3 ✓	0 0 0 0	50-75 5-25 25-50 25-50	5-25 5-25 25-50 0-5	0 0 0 0	50-75 5-25 50-75 25-50
Block 4 ✓	0 0 0 0	50-75 75-95 50-75 75-95	0-5 0-5 0-5 0-5	0 0 0 0	50-75 75-95 50-75 75-95
Block 5 ✓	5-25 0 0 0	25-50 95-100 50-75 75-95	5-25 5-25 5-25 5-25	0 0 0 0	25-50 95-100 75-95 95-100

	# Trees Shrubs	# ~~Shrubs~~ grasses	# Cactus and Succulents	# ~~Yucca~~ forbs	Number of species in block
Block 1	2	5	1	9	17
Block 2	2	5	0	6	13
Block 3	1	5	0	16	22
Block 4	2	6	1	7	16
Block 5	2	6	0	13	21

	1	2	3	4	5
1	1				
2					4
3	5				
4		3			
5					2

L

RS 2

Rangeland Health Evaluation Summary Worksheet

Part 1. Area of Interest Documentation

Location STS-2018-REF-52

UTM Coord

Picture # **Description**

Date/Time: 10-3-18 3pm

Observer JA, CM

Soil Map Unit Name

Veg Alliance Name

Surface texture

Parent material Rhyolite -Kneeling Nun

Slope % Steep

Elevation (ft)

Topographic position

Aspect

Signs of Disturbance(s) observed

OAT score of 200-m transect 36

OAT score of polygon

Notes:

Sideoats
Manna grass -
blue grama
beard grass
lemonweed
lambsquarter

has big boulders
some bedrock
Very nice condition
cows probably
do not
come up
this steep
a slope

→
big
grass

STS-2018-REF-S2 10-3-18

Criteria used to score Observed Apparent Trend (OAT). ***Check appropriate box in each category which best fits area being observed. Points may vary within each category.***

☐ **VIGOR** (10 points) 9	Desirable grasses, forbs and shrubs are vigorous, showing good health. These plants have good size, color, and produce abundant herbage.
☐ (6 points)	Desirable grasses, forbs and shrubs have moderate vigor. They are medium size with fair color, and produce moderate amounts of herbage. Some seed stalks and seed heads are present.
☐ (2 points)	Desirable grasses, forbs and shrubs have low vigor. They appear unhealthy with small size and poor color. Portions of clumps or entire plants are dead or dying. Seed stalks and seed heads are non-existent, except in protected areas.
☐ **SEEDLINGS** (10 points) 9	There is seedling establishment of desirable grasses, forbs and shrubs. Seedlings are present in open spaces between plants and along edges of soil pedestals. Few seedlings of invader or undesirable plants are present.
☐ (6 points)	Some seedlings of desirable grasses, forbs and shrubs may or may not be present in open spaces between plants. Some seedlings of invader or undesirable plant species may or may not be present.
☐ (2 points)	Few if any seedlings of desirable grasses, forbs and shrubs are being established. Seedlings of invader or undesirable plants are present in open spaces between plants.
☐ **SURFACE LITTER** (5 points) 5	Surface litter is accumulating in place.
☐ (3 points)	Moderate movement of surface litter is apparent and deposited against obstacles.
☐ (1 point)	Very little surface litter is remaining.
☐ **PEDESTALS** (5 points) 4	There is little visual evidence of pedestalling. Those pedestals present are sloping or rounding and accumulating litter. Desirable forage grasses may be found along edges of pedestals.
☐ (3 points)	There is moderate pedestalling with no visual evidence of healing or deterioration. Small rock and plant pedestals may be occurring in flow patterns.
☐ (1 point)	Most rocks and plants are pedestalled. Pedestals are sharp-sided and eroding, often exposing grass roots.
☐ **SURFACE CRUSTING** (5 points) 4	There is little visual evidence of surface crusting.
☐ (3 points)	There is moderate surface crusting, with no visual evidence of healing or deterioration. (Note reason for cause)
☐ (1 point)	Severe surface crusting. (Note reason for cause)
☐ **RILLS AND GULLIES** (5 points) 5	Gullies (including rills) may be present in stable condition, with moderate sloping or rounded sides. Perennials are establishing themselves on bottom and sides of channel.
☐ (3 points)	Gullies are well developed, with small amounts of active erosion. Some vegetation may be present.
☐ (1 point)	Sharply incised V-shaped gullies cover most of the area, with most of the gullies actively eroding. Gullies are mostly devoid of perennial plants. They have fresh cutting on the bottom.
TOTAL: 36 **FIELD NOTES:**	

Slope 1

Wildlife Habitat Sampling Form

Slope ~14%

Site ID: SJJ-2018-REF-SL1 **Lat:** **Long:**

Date 10-2-2018 **Investigators** PM, DM, CM, JA, Nick, Will, Lewis

Photo number SL1-1 to SL1-6 **% Exposed Bedrock** 7%

	% Tree/ Shrub Cover	% Grass Cover	% Forb Cover	% Cactus Cover	% Total Cover
Block 1 ✓	5-25 0-5 0 0	25-50 25-50 5-25 25-50	0-5 0-5 0-5 0-5	0 0 5-25 0	25-50 50-75 25-50 25-50
Block 2 ✓	0 0 0 0	25-50 5-25 25-50 5-25	0-5 0-5 0-5 0	75-95 0 0 0	95-100 5-25 25-50 5-25
Block 3 ✓ Mesquite	0 0 5-25 5-25	5-25 5-25 25-50 25-50	5-25 0-5 0-5 5-25	75-100 0-5 5-25 0	75-100 5-25 50-75 50-75
Block 4 ✓ Lemon grass	0 0 0 0-5	50-75 25-50 25-50 25-50	0-5 5-25 0-5 0-5	0 5-25 0 0	50-75 25-50 25-50 50-75
Block 5	0 0 0 0	25-50 75-95 50-75 25-50	0-5 0-5 0-5 0-5	0 0 0 0	25-50 75-95 50-75 25-50

	# Trees Shrubs	# ~~Shrubs~~ grasses	# Cactus and Succulents	# ~~Yucca~~ forbs	Number of species in block
Block 1	1	4	1	7	13
Block 2	2	3	0	2	8
Block 3	3	5	1	7	16
Block 4	2	3	1	6	12
Block 5	4	6	0	5	15

	1	2	3	4	5
1					5
2					
3		4			
4	3	1			
5		2			

L

S3

Rangeland Health Evaluation Summary Worksheet

Part 1. Area of Interest Documentation

Location STS - 2018 - REF - SL1

UTM Coord

Picture # **Description**

Date/Time: Oct 2, 2018 11am
Observer CM, TA
Soil Map Unit Name
Veg Alliance Name
Surface texture
Parent material
Slope % ~14%
Elevation (ft) 5177
Topographic position
Aspect

Signs of Disturbance(s) observed

OAT score of 200-m transect 29
OAT score of polygon

Notes: Sotol, juniper trees,
sideoats  -bearded grass

blue grama
hairy grama

catclaw

tobosa

lemmonweed?

FR-1 had shrub
for globemallow

STJ-2018-REF-SL1 10-2-18

Criteria used to score Observed Apparent Trend (OAT). ***Check appropriate box in each category which best fits area being observed. Points may vary within each category.***

☐ **VIGOR** (10 points) 8	Desirable grasses, forbs and shrubs are vigorous, showing good health. These plants have good size, color, and produce abundant herbage.
☐ (6 points)	Desirable grasses, forbs and shrubs have moderate vigor. They are medium size with fair color, and produce moderate amounts of herbage. Some seed stalks and seed heads are present.
☐ (2 points)	Desirable grasses, forbs and shrubs have low vigor. They appear unhealthy with small size and poor color. Portions of clumps or entire plants are dead or dying. Seed stalks and seed heads are non-existent, except in protected areas.
☐ **SEEDLINGS** (10 points) 7	There is seedling establishment of desirable grasses, forbs and shrubs. Seedlings are present in open spaces between plants and along edges of soil pedestals. Few seedlings of invader or undesirable plants are present.
☐ (6 points)	Some seedlings of desirable grasses, forbs and shrubs may or may not be present in open spaces between plants. Some seedlings of invader or undesirable plant species may or may not be present.
☐ (2 points)	Few if any seedlings of desirable grasses, forbs and shrubs are being established. Seedlings of invader or undesirable plants are present in open spaces between plants.
☐ **SURFACE LITTER** (5 points)	Surface litter is accumulating in place.
☐ (3 points) 2	Moderate movement of surface litter is apparent and deposited against obstacles.
☐ (1 point)	Very little surface litter is remaining.
☐ **PEDESTALS** (5 points)	There is little visual evidence of pedestalling. Those pedestals present are sloping or rounding and accumulating litter. Desirable forage grasses may be found along edges of pedestals.
☐ (3 points) 3	There is moderate pedestalling with no visual evidence of healing or deterioration. Small rock and plant pedestals may be occurring in flow patterns.
☐ (1 point)	Most rocks and plants are pedestalled. Pedestals are sharp-sided and eroding, often exposing grass roots.
☐ **SURFACE CRUSTING** 5 (5 points)	There is little visual evidence of surface crusting.
☐ (3 points)	There is moderate surface crusting, with no visual evidence of healing or deterioration. (Note reason for cause)
☐ (1 point)	Severe surface crusting. (Note reason for cause)
☐ **RILLS AND GULLIES** (5 points) 4	Gullies (including rills) may be present in stable condition, with moderate sloping or rounded sides. Perennials are establishing themselves on bottom and sides of channel.
☐ (3 points)	Gullies are well developed, with small amounts of active erosion. Some vegetation may be present.
☐ (1 point)	Sharply incised V-shaped gullies cover most of the area, with most of the gullies actively eroding. Gullies are mostly devoid of perennial plants. They have fresh cutting on the bottom.
TOTAL: 29 **FIELD NOTES:**	

Bedrock 1

Wildlife Habitat Sampling Form

Site ID: STS-2018 REF-BR1

Lat: 32°35.552' N Long: 107°55.520' W

Date Oct 2, 2018

Investigators CM, PP, DM, J.A, Nick, Louis, Will

Photo number before BR1 + one after labeled

% Exposed Bedrock 80%

	% Tree/ Shrub Cover	% Grass Cover	% Forb Cover	% Cactus Cover	% Total Cover
Block 1 ✓	0 0 0 0	0-5 5-25 0 0	0 0 0 0	0 0 0 0	0-5 5-25 0 0
Block 2 ✓ juniper!	0 5-25 100 0-5	0-5 5-25 0-5 0	0-5 0-5 5-25 0	0 0 0 0	0-5 5-25 100 0-5
Block 3 ✓	0 0 0 0	0 0 0 0-5	0 0 0-5 0	0 0 0 0	0 0 0 0-5
Block 4 ✓	0 0 0 0	5-25 5-25 0 0	0 0 0 0	0 0 0 0	5-25 5-25 0 0
Block 5	0 0 0	0 0 0 0	0 0 0 0	0 0 0 0	0 0 0 0

	# Trees Shrubs	# ~~Shrubs~~ grasses	# Cactus and Succulents	# ~~Yucca~~ forbs	Number of species in block
Block 1	0	4	1	3	8
Block 2	1	3	1	5	10
Block 3	2	2	1	6	11
Block 4	0	0	1	0	3
Block 5	0	1	0	0	1

	1	2	3	4	5
1			5		
2			1		
3	2		3		
4					
5	4				

016

RS4

BR1

Rangeland Health Evaluation Summary Worksheet

Part 1. Area of Interest Documentation

Location SB-2018-REP-BR1

UTM Coord

Picture #	**Description**

Date/Time: 10-2-18 12pm

Observer CM, JA

Soil Map Unit Name

Veg Alliance Name

Surface texture bedrock - 80%

Parent material Kneeling nun rhyolite

Slope %

Elevation (ft) 5156'

Topographic position

Aspect

Signs of Disturbance(s) observed

OAT score of 200-m transect 17

OAT score of polygon

Notes:

Sotol oak ocotillo

Aristida

prickly pear

tobosa

Some dead yucca + see photos of shrub health

blue grama

bristlegrass patch w/ Ocotillo

10-2-18 STS-2018-REF-BR1

Criteria used to score Observed Apparent Trend (OAT). ***Check appropriate box in each category which best fits area being observed. Points may vary within each category.***

☐ **VIGOR** (10 points)	Desirable grasses, forbs and shrubs are vigorous, showing good health. These plants have good size, color, and produce abundant herbage.
☐ (6 points)	Desirable grasses, forbs and shrubs have moderate vigor. They are medium size with fair color, and produce moderate amounts of herbage. Some seed stalks and seed heads are present.
☐ (2 points) 3	Desirable grasses, forbs and shrubs have low vigor. They appear unhealthy with small size and poor color. Portions of clumps or entire plants are dead or dying. Seed stalks and seed heads are non-existent, except in protected areas.
☐ **SEEDLINGS** (10 points)	There is seedling establishment of desirable grasses, forbs and shrubs. Seedlings are present in open spaces between plants and along edges of soil pedestals. Few seedlings of invader or undesirable plants are present.
☐ (6 points)	Some seedlings of desirable grasses, forbs and shrubs may or may not be present in open spaces between plants. Some seedlings of invader or undesirable plant species may or may not be present.
☐ (2 points) 1	Few if any seedlings of desirable grasses, forbs and shrubs are being established. Seedlings of invader or undesirable plants are present in open spaces between plants.
☐ **SURFACE LITTER** (5 points)	Surface litter is accumulating in place.
☐ (3 points) 2	Moderate movement of surface litter is apparent and deposited against obstacles.
☐ (1 point)	Very little surface litter is remaining.
☐ **PEDESTALS** (5 points)	There is little visual evidence of pedestalling. Those pedestals present are sloping or rounding and accumulating litter. Desirable forage grasses may be found along edges of pedestals.
☐ (3 points) 3	There is moderate pedestalling with no visual evidence of healing or deterioration. Small rock and plant pedestals may be occurring in flow patterns.
☐ (1 point)	Most rocks and plants are pedestalled. Pedestals are sharp-sided and eroding, often exposing grass roots.
☐ **SURFACE CRUSTING** (5 points)	There is little visual evidence of surface crusting.
☐ (3 points) 4	There is moderate surface crusting, with no visual evidence of healing or deterioration. (Note reason for cause)
☐ (1 point)	Severe surface crusting. (Note reason for cause)
☐ **RILLS AND GULLIES** (5 points) 4	Gullies (including rills) may be present in stable condition, with moderate sloping or rounded sides. Perennials are establishing themselves on bottom and sides of channel.
☐ (3 points)	Gullies are well developed, with small amounts of active erosion. Some vegetation may be present.
☐ (1 point)	Sharply incised V-shaped gullies cover most of the area, with most of the gullies actively eroding. Gullies are mostly devoid of perennial plants. They have fresh cutting on the bottom.
TOTAL: 17 **FIELD NOTES:**	

Bedrock 2

Wildlife Habitat Sampling Form

Site ID: STS- 2018 -~~REF~~ BR2

Lat: 32°35.444 N **Long:** 107°55.204 'W

Date Oct 2, 2018 **Investigators** CM, PP, DM, JA, Nick Lowe, Will Lewis

C before BR2 then after

Photo number ~~BR~~ BR1-1 to BR1-7

% Exposed Bedrock 60-65 2 = 62.5%

	% Tree/ Shrub Cover	% Grass Cover	% Forb Cover	% Cactus Cover	% Total Cover
Block 1 Bedrock	0 0 0 0	0 8 0	0 8 0	0 8 0	0 0 0 0
Block 2 ✓ Catclaw shrub	0 25-50 0 0	5-25 5-25 0 5-25	0 0-5 0 0	0 0 0 0	5-25 50-75 0 5-25
Block 3 ✓ Flat granular ✓	95-100 75-98 0-5 0	0-5 5-25 0-5 5-25	0-5 0-5 0-5 0-5	0 0 0 0	100 75-100 5-25 5-25
Block 4 ✓ Flat granular	0 0 0 0	25-50 25-50 5-25 5-25	0-5 5-25 5-25 0-5	0 0 0 0	5-25 25-50 5-25 5-25
Block 5 ✓ not bedrock Flat granular ✓	0 5-25 0 0	5-25 5-25 0-5 5-25	0-5 0-5 0-5 0-5	0 0 0 0	5-25 25-50 5-25 5-25

	# Trees shrubs	# ~~Shrubs~~ grasses	# Cactus and Succulents	# ~~Yucca~~ forbs	Number of species in block
Block 1	2	5	3	0	10
Block 2	1	4	0	0	5
Block 3	3	4	1	6	14
Block 4	2	3	1	5	11
Block 5	0	4	1	8	13

	1	2	3	4	5
1	1				2
2					
3					4
4					
5			5		3

52

BR2

Rangeland Health Evaluation Summary Worksheet

Part 1. Area of Interest Documentation

Location STB-2018-REF-BR2

UTM Coord

Picture #	**Description**

Date/Time: 10/2/18 3pm
Observer CM, JA
Soil Map Unit Name
Veg Alliance Name
Surface texture bedrock -60% + flat granular -40%
Parent material rhyolite - Kneeling Nun
Slope % Low
Elevation (ft) 5047
Topographic position
Aspect

Signs of Disturbance(s) observed

OAT score of 200-m transect 14
OAT score of polygon similar

Notes:

sideoats grama
blue grama
beardgrass - some
Aristida - threeawn
catclaw
mesquite
lemmon grass
bristlegrass

UT5-2018-REF-BRZ 10-2-18

Criteria used to score Observed Apparent Trend (OAT). ***Check appropriate box in each category which best fits area being observed. Points may vary within each category.***

☐ **VIGOR** (10 points)	Desirable grasses, forbs and shrubs are vigorous, showing good health. These plants have good size, color, and produce abundant herbage.
☐ (6 points)	Desirable grasses, forbs and shrubs have moderate vigor. They are medium size with fair color, and produce moderate amounts of herbage. Some seed stalks and seed heads are present.
☑ (2 points) 2	Desirable grasses, forbs and shrubs have low vigor. They appear unhealthy with small size and poor color. Portions of clumps or entire plants are dead or dying. Seed stalks and seed heads are non-existent, except in protected areas.
☐ **SEEDLINGS** (10 points)	There is seedling establishment of desirable grasses, forbs and shrubs. Seedlings are present in open spaces between plants and along edges of soil pedestals. Few seedlings of invader or undesirable plants are present.
☐ (6 points)	Some seedlings of desirable grasses, forbs and shrubs may or may not be present in open spaces between plants. Some seedlings of invader or undesirable plant species may or may not be present.
☑ (2 points) 2	Few if any seedlings of desirable grasses, forbs and shrubs are being established. Seedlings of invader or undesirable plants are present in open spaces between plants.
☐ **SURFACE LITTER** (5 points)	Surface litter is accumulating in place.
☑ (3 points) 3	Moderate movement of surface litter is apparent and deposited against obstacles.
☐ (1 point)	Very little surface litter is remaining.
☐ **PEDESTALS** (5 points)	There is little visual evidence of pedestalling. Those pedestals present are sloping or rounding and accumulating litter. Desirable forage grasses may be found along edges of pedestals.
☐ (3 points)	There is moderate pedestalling with no visual evidence of healing or deterioration. Small rock and plant pedestals may be occurring in flow patterns.
☐ (1 point) 2	Most rocks and plants are pedestalled. Pedestals are sharp-sided and eroding, often exposing grass roots.
☐ **SURFACE CRUSTING** (5 points)	There is little visual evidence of surface crusting.
☑ (3 points) 3	There is moderate surface crusting, with no visual evidence of healing or deterioration. (Note reason for cause)
☐ (1 point)	Severe surface crusting. (Note reason for cause)
☐ **RILLS AND GULLIES** (5 points)	Gullies (including rills) may be present in stable condition, with moderate sloping or rounded sides. Perennials are establishing themselves on bottom and sides of channel.
☐ (3 points) 2	Gullies are well developed, with small amounts of active erosion. Some vegetation may be present.
☐ (1 point)	Sharply incised V-shaped gullies cover most of the area, with most of the gullies actively eroding. Gullies are mostly devoid of perennial plants. They have fresh cutting on the bottom.
TOTAL: 14 **FIELD NOTES:**	

6

Flatrockday 1

Wildlife Habitat Sampling Form

Site ID: SK-2018-REF-FR-1

Lat: 32°35.442 N

Long: 107°55.243 W

Date 10-2-18

Investigators PM, DM, CM, J, A, Nick, Will, Lewis

Photo number After FR-1 photo FRL1 to FRL4

% Exposed Bedrock 20

	% Tree/ Shrub Cover	% Grass Cover	% Forb Cover	% Cactus Cover	% Total Cover
Block 1	0- 0 525 0	0-5 25-50 5-25 5-25	0-5 5-25 0-5 0-5	0 0 0 0	0-5 25-50 5-25 5-25
Block 2 Bedrock N Soil	0 0 0 50-75	0-5 0 0 0-5	0 0 0 0-5	0 0 0 0	0-5 0 0 50-75
Block 3	0 0 5-25 25-50	5-25 5-25 5-25 25-50	0-5 5-25 0 0-5	0 0 0 0	5-25 25-50 25-50 25-50
Block 4✓	0 0 0 0	25-50 5-25 5-25 5-25	5-25 0-5 5-25 0-5	0 0 0 0	25-50 25-50 5-25 5-25
Block 5	0 0 0 0	25-50 5-25 5-25 5-25	5-25 0 0-5 5-25	0 0 0 0	25-50 5-25 5-25 5-25

	# Trees Shrubs	# ~~Shrubs~~ grasses	# Cactus and Succulents	# ~~Yucca~~ forbs	Number of species in block
Block 1	3	3	0	9	15
Block 2	4	3	0	2	9
Block 3	1	3	0	9	13
Block 4	2	5	0	8	15
Block 5	3	5	0	6	14

	1	2	3	4	5
1					
2					
3					2
4			5		
5			3	4	1

Sideoats

51

Rangeland Health Evaluation Summary Worksheet

Part 1. Area of Interest Documentation

Location SJS - 2018 - RFF - PR-1

UTM Coord ,

Picture #	Description

Date/Time: 10-2-18 9.30 am

Observer CM, JA, PP

Soil Map Unit Name

Veg Alliance Name

Surface texture

Parent material Rhyolite bedrock - Emily Nun.

Slope % slight

Elevation (ft) 5076

Topographic position

Aspect

Signs of Disturbance(s) observed

OAT score of 200-m transect 22.

OAT score of polygon

Notes:

S deaty
mesqiote
globe mallow

bedrock more than surface
crusting

SB - 2018 - REF - FR - 1

Criteria used to score Observed Apparent Trend (OAT). ***Check appropriate box in each category which best fits area being observed. Points may vary within each category.***

☐ **VIGOR** (10 points)	Desirable grasses, forbs and shrubs are vigorous, showing good health. These plants have good size, color, and produce abundant herbage.
☐ (6 points) 5	Desirable grasses, forbs and shrubs have moderate vigor. They are medium size with fair color, and produce moderate amounts of herbage. Some seed stalks and seed heads are present.
☐ (2 points)	Desirable grasses, forbs and shrubs have low vigor. They appear unhealthy with small size and poor color. Portions of clumps or entire plants are dead or dying. Seed stalks and seed heads are non-existent, except in protected areas.
☐ **SEEDLINGS** (10 points)	There is seedling establishment of desirable grasses, forbs and shrubs. Seedlings are present in open spaces between plants and along edges of soil pedestals. Few seedlings of invader or undesirable plants are present.
☐ (6 points)	Some seedlings of desirable grasses, forbs and shrubs may or may not be present in open spaces between plants. Some seedlings of invader or undesirable plant species may or may not be present.
☐ (2 points) 2	Few if any seedlings of desirable grasses, forbs and shrubs are being established. Seedlings of invader or undesirable plants are present in open spaces between plants.
☐ **SURFACE LITTER** (5 points)	Surface litter is accumulating in place.
☐ (3 points)	Moderate movement of surface litter is apparent and deposited against obstacles.
☐ (1 point) 2	Very little surface litter is remaining.
☐ **PEDESTALS** (5 points) 4	There is little visual evidence of pedestalling. Those pedestals present are sloping or rounding and accumulating litter. Desirable forage grasses may be found along edges of pedestals.
☐ (3 points)	There is moderate pedestalling with no visual evidence of healing or deterioration. Small rock and plant pedestals may be occurring in flow patterns.
☐ (1 point)	Most rocks and plants are pedestalled. Pedestals are sharp-sided and eroding, often exposing grass roots.
☐ **SURFACE CRUSTING** (5 points) 5	There is little visual evidence of surface crusting.
☐ (3 points)	There is moderate surface crusting, with no visual evidence of healing or deterioration. (Note reason for cause)
☐ (1 point)	Severe surface crusting. (Note reason for cause)
☐ **RILLS AND GULLIES** (5 points) 4	Gullies (including rills) may be present in stable condition, with moderate sloping or rounded sides. Perennials are establishing themselves on bottom and sides of channel.
☐ (3 points)	Gullies are well developed, with small amounts of active erosion. Some vegetation may be present.
☐ (1 point)	Sharply incised V-shaped gullies cover most of the area, with most of the gullies actively eroding. Gullies are mostly devoid of perennial plants. They have fresh cutting on the bottom.
TOTAL: 22 **FIELD NOTES:**	

Wildlife Habitat Sampling Form

Site ID: STS-2018-REF-FG-1

Lat: 32°33.308'N **Long:** 107°56.161'W

Date 10-2-18

Investigators David Mercer, Joe Alley, Carolyn Meyer, Pam Pinson, Will, Nick, Lewis

Photo number 3 before FG-1 photo on paper FG-1 1st FG1_4

% Exposed Bedrock 0

	% Tree/ Shrub Cover		% Grass Cover		% Forb Cover		% Cactus Cover		% Total Cover	
Block 1	50-75	5-25	0-5	5-25	0-5	0-5	0	0	50-75	5-25
	25-50	0-5	0-5	5-25	0-5	0-5	0	0	25-50	5-25
Block 2	25-50	25-50	0-5	0-5	0-5	0-5	0	0	25-50	25-50
	5-25	5-25	0-5	5-25	0-5	0-5	0	0	25-50	5-25
Block 3	25-50	25-50	0-5	0-5	0-5	0-5	0	0	25-50	25-50
	25-50	5-25	0-5	0-5	0-5	0-5	0	0	25-50	5-25
Block 4	5-25	25-50	5-25	5-25	0-5	0-5	0	0	5-25	25-50
	5-25	25-50	5-25	0-5	0-5	0-5	0	0	5-25	25-50
Block 5	5-25	25-50	0-5	0-5	0-5	0-5	0	0	5-25	25-50
	25-50	0	0-5	0-5	0-5	5-25	0	0	25-50	5-25

5-25

	# Trees/ Shrubs	~~# Shrubs~~ # grasses	# Cactus and Succulents	# ~~Yucca~~ forbs	Number of species in block
Block 1	~~4~~ 3	1	0	6	~~9~~ 10
Block 2	~~3~~ 4	1	0	7	12
Block 3	~~4~~ 3	1	0	~~4~~ 5	9
Block 4	~~3~~ 4	1	0	6	11
Block 5	3	2	0	8	13

Lemon weed-[illegible]

	1	2	3	4	5
1			1		
2					
3		2		5	
4			3		
5					4

↑

BRL

Rangeland Health Evaluation Summary Worksheet

Part 1. Area of Interest Documentation

Location STS-2018-REF-FG-1

UTM Coord

Picture #	**Description**
	Flat granular

Date/Time: 10-2-18 8am

Observer CM, JA, PP

Soil Map Unit Name Tertiary Sugar Lump Formation

Veg Alliance Name

Surface texture Shallow soil - see picture after FG-1 pic

Parent material Rhyolite - Sugar Lump

Slope % Very Flat

Elevation (ft) 5103'

Topographic position

Aspect

Signs of Disturbance(s) observed

OAT score of 200-m transect 28

OAT score of polygon

Notes:

tobosa
lemonweed - herb + woody
small mesquite
globemallow
creosote

5 to 1?
very little
cactus
tufted
th
grass
good.

STS-2018-REF-FG-1 10-2-18

Criteria used to score Observed Apparent Trend (OAT). ***Check appropriate box in each category which best fits area being observed. Points may vary within each category.***

☐ **VIGOR** (10 points)	Desirable grasses, forbs and shrubs are vigorous, showing good health. These plants have good size, color, and produce abundant herbage.
☐ (6 points) 7	Desirable grasses, forbs and shrubs have moderate vigor. They are medium size with fair color, and produce moderate amounts of herbage. Some seed stalks and seed heads are present.
☐ (2 points)	Desirable grasses, forbs and shrubs have low vigor. They appear unhealthy with small size and poor color. Portions of clumps or entire plants are dead or dying. Seed stalks and seed heads are non-existent, except in protected areas.
☐ **SEEDLINGS** (10 points)	There is seedling establishment of desirable grasses, forbs and shrubs. Seedlings are present in open spaces between plants and along edges of soil pedestals. Few seedlings of invader or undesirable plants are present.
☐ (6 points) 6	Some seedlings of desirable grasses, forbs and shrubs may or may not be present in open spaces between plants. Some seedlings of invader or undesirable plant species may or may not be present.
☐ (2 points)	Few if any seedlings of desirable grasses, forbs and shrubs are being established. Seedlings of invader or undesirable plants are present in open spaces between plants.
☐ **SURFACE LITTER** (5 points)	Surface litter is accumulating in place.
☐ (3 points) 2	Moderate movement of surface litter is apparent and deposited against obstacles.
☐ (1 point)	Very little surface litter is remaining.
☐ **PEDESTALS** (5 points) 4	There is little visual evidence of pedestalling. Those pedestals present are sloping or rounding and accumulating litter. Desirable forage grasses may be found along edges of pedestals.
☐ (3 points)	There is moderate pedestalling with no visual evidence of healing or deterioration. Small rock and plant pedestals may be occurring in flow patterns.
☐ (1 point)	Most rocks and plants are pedestalled. Pedestals are sharp-sided and eroding, often exposing grass roots.
☐ **SURFACE CRUSTING** 4 (5 points)	There is little visual evidence of surface crusting.
☐ (3 points)	There is moderate surface crusting, with no visual evidence of healing or deterioration. (Note reason for cause)
☐ (1 point)	Severe surface crusting. (Note reason for cause)
☐ **RILLS AND GULLIES** (5 points) 5	Gullies (including rills) may be present in stable condition, with moderate sloping or rounded sides. Perennials are establishing themselves on bottom and sides of channel.
☐ (3 points)	Gullies are well developed, with small amounts of active erosion. Some vegetation may be present.
☐ (1 point)	Sharply incised V-shaped gullies cover most of the area, with most of the gullies actively eroding. Gullies are mostly devoid of perennial plants. They have fresh cutting on the bottom.
TOTAL: 28 **FIELD NOTES:**	

Wildlife Habitat Sampling Form

Site ID: SB-2018-REF-FG2 **Lat:** **Long:**

Date 10-3-18 **Investigators** PP, CM, JA, DM, LS, WG

Photo number ~~after~~ bedrock pics labeled **% Exposed Bedrock** 0

	% Tree/ Shrub Cover	% Grass Cover	% Forb Cover	% Cactus Cover	% Total Cover
Block 1 Prickly Rose	[illegible] 5-25 5-25 0-5	25-50 5-25 5-25 5-25	0-5 0-5 0-5 0-5	0 0 0 5-25	25-50 25-50 5-25 25-50
Block 2 ✓	5-25 8 5-25	5-25 5-25 25-50 25-50	0-5 0-5 0-5 0-5	0 0 0 5-25	25-50 5-25 25-50 25-50
Block 3 ✓	5-25 5-25 0-5 5-25	5-25 5-25 5-25 5-25	0-5 0-5 5-25 0-5	0 0 0 0	25-50 5-25 5-25 5-25
Block 4	5-25 5-95 5-25 0	5-25 25-50 50-75 5-25	5-25 0 0-5 5-25	0 0-5 0 0	25-50 95-100 50-75 25-50
Block 5 ✓	5-25 25-50 5-25 5-25	5-25 5-25 5-25 5-25	0-5 5-25 0-5 0-5	0 0 0 0	25-50 25-50 5-25 25-50

	# Trees Shrubs	# Shrubs Grasses	# Cactus and Succulents	# ~~Yucca~~ Forbs	Number of species in block
Block 1	2	4	0	6	12
Block 2	1	5	1	7	14
Block 3	3	3	1	4	11
Block 4	2	4	1	5	12
Block 5	2	4	1	7	14

	1	2	3	4	5
1					
2	4				
3		3	5		
4	2				
5		1			

BR2

Criteria used to score Observed Apparent Trend (OAT). ***Check appropriate box in each category which best fits area being observed. Points may vary within each category.***

☐ **VIGOR** (10 points)	Desirable grasses, forbs and shrubs are vigorous, showing good health. These plants have good size, color, and produce abundant herbage.
☐ (6 points) 5	Desirable grasses, forbs and shrubs have moderate vigor. They are medium size with fair color, and produce moderate amounts of herbage. Some seed stalks and seed heads are present.
☐ (2 points)	Desirable grasses, forbs and shrubs have low vigor. They appear unhealthy with small size and poor color. Portions of clumps or entire plants are dead or dying. Seed stalks and seed heads are non-existent, except in protected areas.
☐ **SEEDLINGS** (10 points)	There is seedling establishment of desirable grasses, forbs and shrubs. Seedlings are present in open spaces between plants and along edges of soil pedestals. Few seedlings of invader or undesirable plants are present.
☐ (6 points) 5	Some seedlings of desirable grasses, forbs and shrubs may or may not be present in open spaces between plants. Some seedlings of invader or undesirable plant species may or may not be present.
☐ (2 points)	Few if any seedlings of desirable grasses, forbs and shrubs are being established. Seedlings of invader or undesirable plants are present in open spaces between plants.
☐ **SURFACE LITTER** (5 points)	Surface litter is accumulating in place.
☐ (3 points) 2	Moderate movement of surface litter is apparent and deposited against obstacles.
☐ (1 point)	Very little surface litter is remaining.
☐ **PEDESTALS** (5 points)	There is little visual evidence of pedestalling. Those pedestals present are sloping or rounding and accumulating litter. Desirable forage grasses may be found along edges of pedestals.
☐ (3 points) 3	There is moderate pedestalling with no visual evidence of healing or deterioration. Small rock and plant pedestals may be occurring in flow patterns.
☐ (1 point)	Most rocks and plants are pedestalled. Pedestals are sharp-sided and eroding, often exposing grass roots.
☐ **SURFACE CRUSTING** (5 points) 4	There is little visual evidence of surface crusting.
☐ (3 points)	There is moderate surface crusting, with no visual evidence of healing or deterioration. (Note reason for cause)
☐ (1 point)	Severe surface crusting. (Note reason for cause)
☐ **RILLS AND GULLIES** (5 points)	Gullies (including rills) may be present in stable condition, with moderate sloping or rounded sides. Perennials are establishing themselves on bottom and sides of channel.
☐ (3 points)	Gullies are well developed, with small amounts of active erosion. Some vegetation may be present.
☐ (1 point) 1	Sharply incised V-shaped gullies cover most of the area, with most of the gullies actively eroding. Gullies are mostly devoid of perennial plants. They have fresh cutting on the bottom.
TOTAL: 20 **FIELD NOTES:**	

APPENDIX D

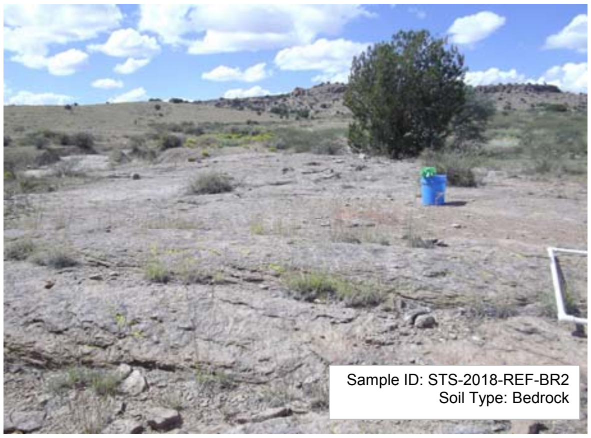
PHOTOLOG OF 2018 SAMPLED LOCATIONS

Sample ID: STS-2018-REF-BR3
Soil Type: Bedrock

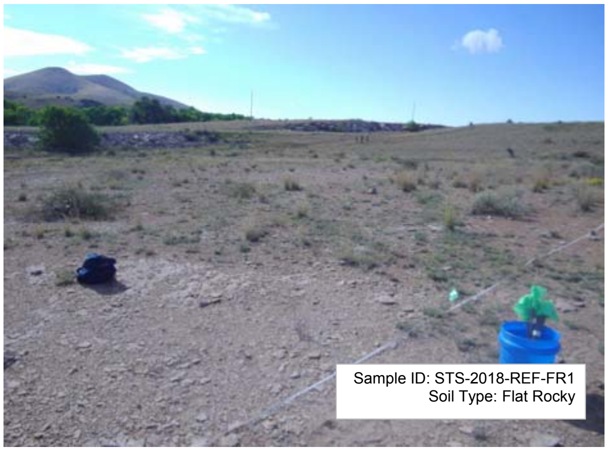
Sample ID: STS-2018-REF-SL2
Soil Type: Slope

Sample ID: STS-2018-REF-SL1
Soil Type: Slope

Sample ID: STS-2018-REF-BR1
Soil Type: Bedrock



Sample ID: STS-2018-REF-BR2
Soil Type: Bedrock

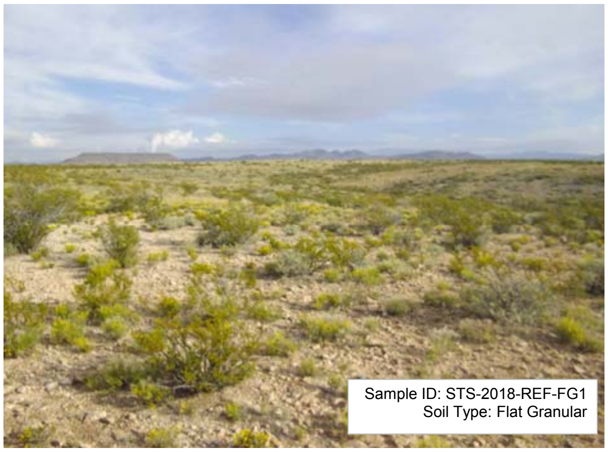


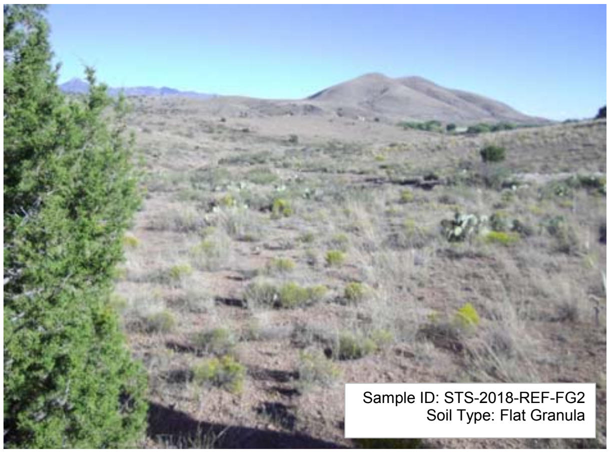
Sample ID: STS-2018-REF-FR1
Soil Type: Flat Rocky

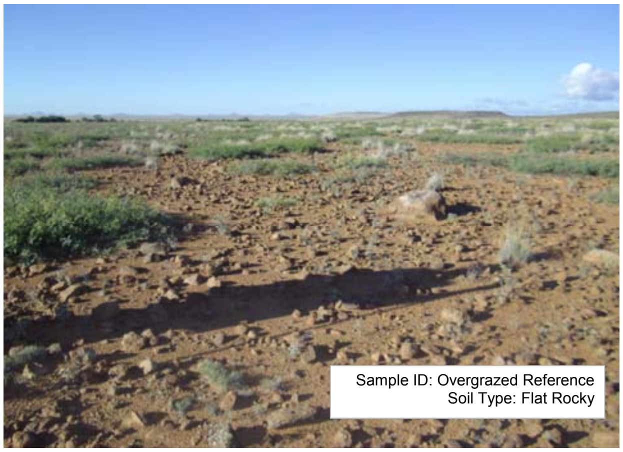
FREEPORT-MCMORAN CHINO MINES COMPANY
VANADIUM, NEW MEXICO
TECHNICAL MEMORANDUM ON REFERENCE AREAS

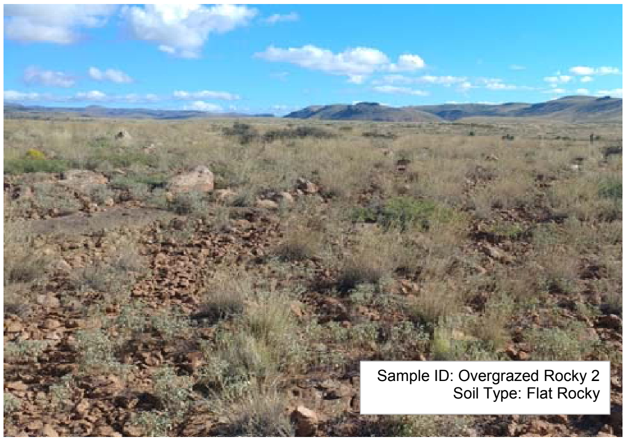
COMMUNITY STUDY PHOTO LOG

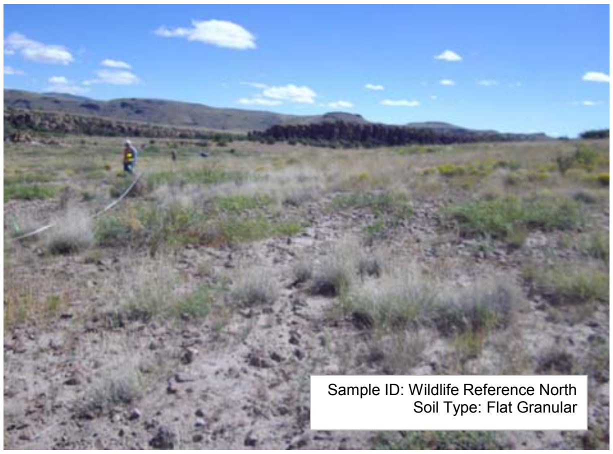
ARCADIS

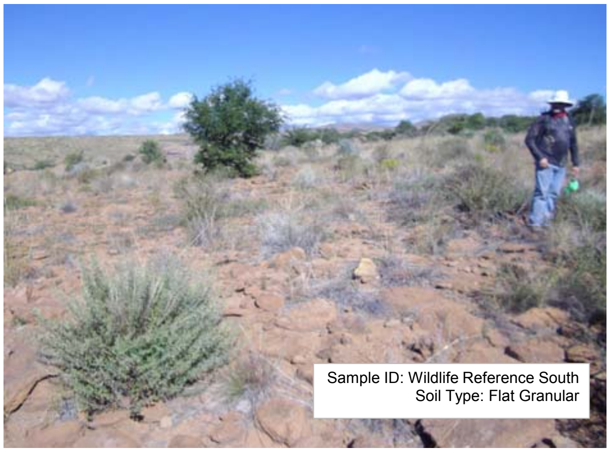

Sample ID: STS-2018-REF-FG1
Soil Type: Flat Granular


Sample ID: STS-2018-REF-FG2
Soil Type: Flat Granula


Sample ID: Overgrazed Reference
Soil Type: Flat Rocky


Sample ID: Overgrazed Rocky 2
Soil Type: Flat Rocky


Sample ID: Wildlife Reference North
Soil Type: Flat Granular


Sample ID: Wildlife Reference South
Soil Type: Flat Granular

FREEPORT-MCMORAN CHINO MINES COMPANY
VANADIUM, NEW MEXICO
TECHNICAL MEMORANDUM ON REFERENCE AREAS

COMMUNITY STUDY PHOTO LOG

ARCADIS

APPENDIX D

APPENDIX E

STSIU AND REFERENCE COMMUNITY AND SOIL DATA

Table E-1. Data for Community Analysis

Freeport-McMoran Chino Mines Company
Vanadium, New Mexico
Technical Memorandum on Reference Areas

Site ID	Site Type	Latitude	Longitude	Percent Cover Unadjusted	Cover Adjusted to 2011 Conditions	Species Richness	OAT Score	Shrub/ Tree Cover (%)	Grass Cover (%)	Forb Cover (%)	Succulent Cover (%)	Shrub/ Tree Richness	Grass Richness	Forb Richness	Succulent Richness	Soil Category	Acceptability richness	Acceptability cover	Acceptability OAT
STS-RWU-2011-1	Site	32.7124	-108.1083	6	6	1	12	-	-	-	-	0.0	0.0	0.8	0.2	bedrock	unacceptable	unacceptable	unacceptable
STS-RWU-2011-2	Site	32.7045	-108.1050	8	8	0.4	8	-	-	-	-	0.0	0.0	0.4	0.0	bedrock	unacceptable	acceptable	unacceptable
STS-RWU-2011-9	Site	32.6959	-108.1000	3	3	0.8	11	-	-	-	-	0.4	0.0	0.0	0.4	bedrock	unacceptable	unacceptable	unacceptable
STS-RWU-2011-11	Site	32.6747	-108.0920	4	4	1.6	6	-	-	-	-	0.8	0.0	0.0	0.8	bedrock	unacceptable	unacceptable	unacceptable
STS-PT-2013-9	Site	32.6978	-108.1069	5	6	1.8	7	4.9	0.0	0.1	0.0	0.6	0.0	1.0	0.2	bedrock	unacceptable	unacceptable	acceptable
STS-PT-2013-12	Site	32.6700	-108.0511	20	24	7.2	17	10.1	10.5	2.2	0.0	1.8	3.2	1.8	0.4	bedrock	acceptable	acceptable	acceptable
STS-RWU-2011-4	Site	32.7123	-108.1430	64	64	9.8	35	-	-	-	-	0.8	4.4	4.4	0.2	flat granular	acceptable	acceptable	acceptable
STS-RWU-2011-5	Site	32.7067	-108.0950	34	34	10	33	-	-	-	-	2.4	4.0	3.2	0.4	flat granular	acceptable	acceptable	acceptable
STS-RWU-2011-10	Site	32.6748	-108.0840	24	24	10	16	-	-	-	-	1.0	2.6	5.8	0.8	flat granular	acceptable	acceptable	unacceptable
STS-RWU-2011-13	Site	32.6768	-108.0940	26	26	3.6	8	-	-	-	-	1.4	0.2	1.8	0.2	flat granular	unacceptable	acceptable	unacceptable
STS-RWU-2011-15	Site	32.7092	-108.1180	18	18	7.4	14	-	-	-	-	1.4	0.6	5.4	0.0	flat granular	acceptable	acceptable	unacceptable
STS-RWU-2011-16	Site	32.7048	-108.0850	22	22	13	23	-	-	-	-	2.8	5.2	4.2	0.8	flat granular	acceptable	acceptable	acceptable
STS-PT-2013-20	Site	32.6892	-108.1566	24	76	12.8	30	1.8	22.0	22.0	0.1	2.2	3.8	6.2	0.6	flat granular	acceptable	acceptable	acceptable
STS-PT-2013-33	Site	32.6928	-108.1220	0	0	0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	flat granular	unacceptable	unacceptable	unacceptable
STS-RWU-2011-7	Site	32.6972	-108.1060	11	11	1.8	9	-	-	-	-	0.2	0.2	1.2	0.2	flat rocky	unacceptable	unacceptable	unacceptable
STS-RWU-2011-12	Site	32.6642	-108.0870	9	9	2	10	-	-	-	-	1.0	0.2	0.4	0.0	flat rocky	unacceptable	unacceptable	unacceptable
STS-RWU-2011-17	Site	32.6762	-108.0960	36	36	5.4	10	-	-	-	-	2.8	0.0	2.6	0.0	flat rocky	unacceptable	acceptable	unacceptable
STS-PT-2013-1	Site	32.6890	-108.1064	32	50	3.2	12	31.1	0.0	1.5	0.0	1.0	0.4	1.6	0.4	flat rocky	unacceptable	acceptable	unacceptable
STS-PT-2013-2	Site	32.6850	-108.1047	31	74	5.2	9	29.3	3.0	1.4	0.0	1.2	1.0	3.2	0.0	flat rocky	unacceptable	acceptable	unacceptable
STS-PT-2013-17	Site	32.6897	-108.1040	19	20	5.8	19	18.5	0.6	1.6	0.0	1.6	1.2	3.0	0.0	flat rocky	unacceptable	acceptable	unacceptable
STS-PT-2013-19	Site	32.6925	-108.1046	5	5	4.4	15	3.4	0.0	1.0	0.0	2.2	0.2	1.6	0.4	flat rocky	unacceptable	unacceptable	unacceptable
STS-RWU-2011-3	Site	32.7076	-108.1070	59	59	6.2	24	-	-	-	-	0.6	2.8	1.6	1.2	slope	unacceptable	acceptable	acceptable
STS-RWU-2011-6	Site	32.7085	-108.1209	25	25	8	16	-	-	-	-	2.2	1.4	3.8	0.6	slope	unacceptable	unacceptable	unacceptable
STS-RWU-2011-8	Site	32.7103	-108.0939	45	45	21.6	37	-	-	-	-	4.0	5.8	11.3	0.4	slope	acceptable	acceptable	acceptable
STS-PT-2013-5	Site	32.7056	-108.1135	38	55	8.6	27	20.2	3.6	0.9	17.7	2.6	1.8	2.8	1.4	slope	unacceptable	acceptable	acceptable
STS-RWU-2011-14	Site	32.7081	-108.1150	27	28	8	26	-	-	-	-	1.8	2.0	4.0	0.2	slope	unacceptable	unacceptable	acceptable
Overgazed reference	Site	32.6459	-108.0656	26	6	5.8	16	16.5	2.8	8.3	0.0	1.0	1.4	3.4	0.0	flat rocky	unacceptable	unacceptable	unacceptable
STS-RWU-2012-B1	De Minimus	32.6714	-108.0445	18	18	3.4	17	13.2	3.0	0.1	0.8	1.4	0.6	0.2	1.2	bedrock	unacceptable	acceptable	acceptable
STS-RWU-2012-B2	De Minimus	32.6714	-108.0423	3	3	5	11	0.3	2.4	0.0	1.0	1.8	1.0	1.0	1.2	bedrock	acceptable	unacceptable	unacceptable
STS-RWU-2012-B3	De Minimus	32.6738	-108.0449	3	3	2.6	15	3.4	0.0	0.0	0.0	1.2	0.8	0.2	0.4	bedrock	unacceptable	unacceptable	acceptable
WILDLIFE REFERENCE SOUTH	De Minimus	32.6748	-108.0601	20/37/27	20	11/14.2/12.4	24	22.6/10.9	11.3/15.4	11.3/2.4	0.1/4.9	0.0	0.0	0.0	0.0	flat granular	acceptable	acceptable	acceptable
STS-PT-2013-26	Reference	32.6394	-108.0500	37	51	15.8	20	13.9	16.2	16.2	0.0	1.0	7.0	7.8	0.0	flat granular	acceptable	acceptable	unacceptable
WILDLIFE REFERENCE NORTH	Reference	32.6840	-108.0677	30/30/51	30	10/13.2/8.2	27	18.4/23.6	14.5/28.0	14.5/5.6	0/1.9	3.2	4.2	2.8	0.0	flat granular	acceptable	acceptable	acceptable
STS-2018-REF-FG1	Reference	32.5551	-107.9360	32.4	10	11	28	30.0	6.3	3.1	0.0	3.4	1.2	6.4	0.0	flat granular	acceptable	acceptable	acceptable
STS-2018-REF-FG2	Reference	32.5916	-107.9259	35.35	36	12.6	20	16.2	22.0	4.9	1.6	2.0	4.0	5.8	0.8	flat granular	acceptable	acceptable	unacceptable
STS-2018-REF-BR1	Reference	32.5922	-107.9253	8.5	12	6.6	17	5.9	3.5	1.1	0.0	0.6	2.4	2.8	0.8	bedrock	acceptable	acceptable	acceptable
STS-2018-REF-BR2	Reference	32.5916	-107.9284	24.35	33	10.6	14	8.9	11.7	2.9	0.0	1.6	4.0	3.8	1.2	bedrock	acceptable	acceptable	acceptable
STS-2018-REF-BR3	Reference	32.5935	-107.9261	2.375	7	4.4	16	0.8	3.4	0.1	0.0	0.4	2.4	1.2	0.4	bedrock	acceptable	acceptable	acceptable
STS-2018-REF-FR1	Reference	32.5907	-107.9207	22.7	20	13.2	22	6.6	16.2	5.6	0.0	2.6	3.8	6.8	0.0	flat rocky	acceptable	acceptable	acceptable
STS-2018-REF-SL1	Reference	32.5954	-107.9236	50.4	49	12.8	29	3.3	37.1	4.3	11.5	2.4	4.2	5.4	2.0	slope	acceptable	acceptable	acceptable
STS-2018-REF-SL2	Reference	32.5946	-107.9268	68.6	58	17.8	36	11.9	52.1	9.0	1.9	1.8	5.4	10.2	0.4	slope	acceptable	acceptable	acceptable

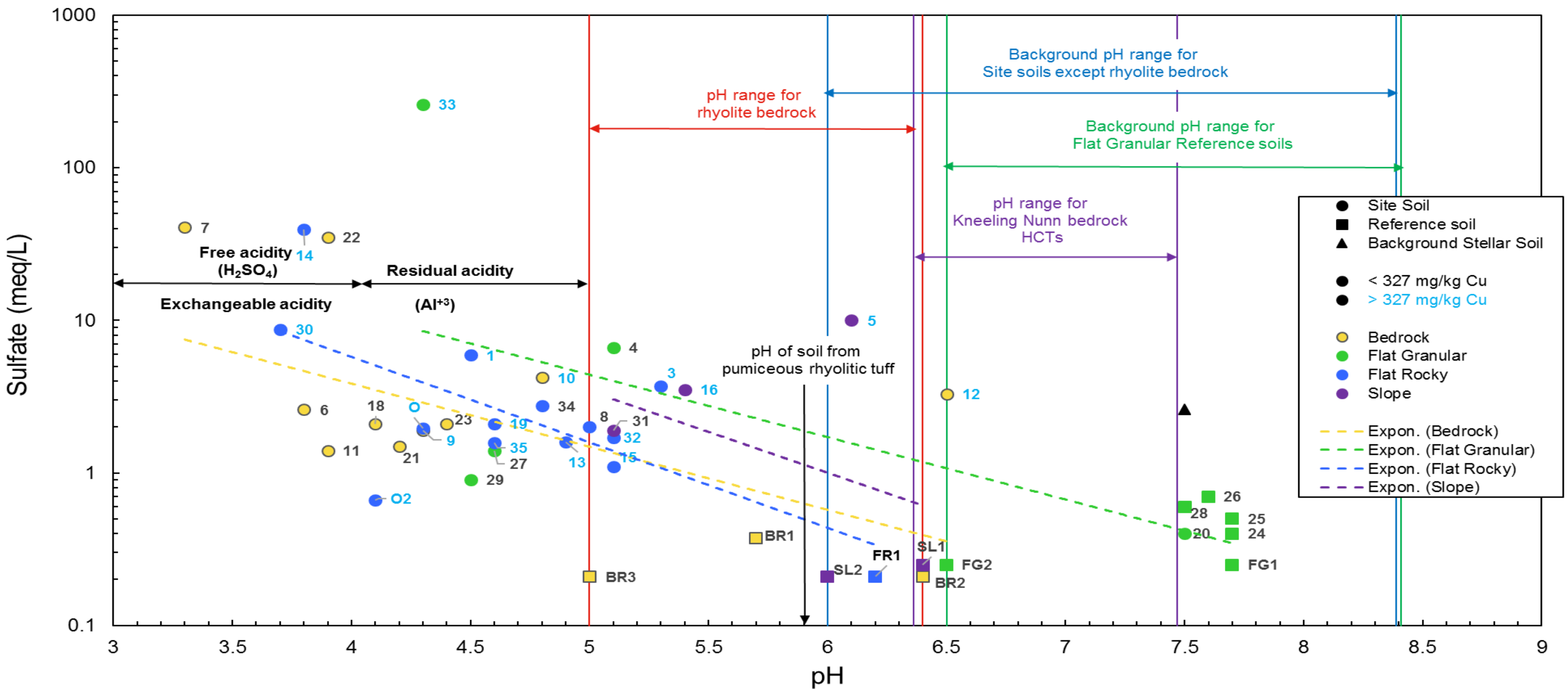
Table E-2. Soil (0-6 inch depth) with Chemistry Data from Greenhouse study and 2018 Sampling Event

Freeport-McMoran Chino Mines Company
Vanadium, New Mexico
Technical Memorandum on Reference Areas

Location ID	Site Type	Community Data	Soil Category	pH Saturated Paste (s.u.)	Copper Total (mg/kg)	Calculated pCu	Sulfate Saturated Paste (meq/L)	Calcium Saturated Paste (meq/L)	Magnesium Saturated Paste (meq/L)	Potassium Saturated Paste (meq/L)	Sodium Saturated Paste (meq/L)	Alkalinity Saturated Paste (meq/L)	Bicarbonate Saturated Paste (meq/L)	Chloride Saturated Paste (meq/L)	Lime (%)
STS-PT-2013-1	Site	Yes	Flat Rocky	4.5	1030	3.55	5.9	4.14	1.19	0.24	0.69	0.44	0.44	0.2	0.53
Dup1 for STS-PT-2013-1	Site	Yes	Flat Rocky	4.8	879	4.01	9.1	4.51	1.25	0.25	0.82	0.44	0.44	0.3	0.57
STS-PT-2013-2	Site	Yes	Flat Rocky	6.7	809	5.87	17.7	16.8	2.74	0.24	0.66	3.53	3.53	0.3	2.07
STS-PT-2013-3	Site	No	Flat Rocky	5.3	189	6.24	3.7	3.46	1.46	0.42	0.61	0.56	0.56	0.2	0.58
STS-PT-2013-4	Site	No	Flat Granular	5.1	193	6.03	6.6	7.77	3.59	0.69	1.04	0.62	0.62	0.8	0.66
STS-PT-2013-5	Site	Yes	Slope	6.1	632	5.60	10	8.21	2.62	0.21	1.47	1.75	1.75	0.3	1.99
STS-PT-2013-6	Site	No	Bedrock	3.8	202	4.77	2.6	1.72	0.34	0.26	0.33	0.11	0.11	0.2	<0.01
STS-PT-2013-7	Site	No	Bedrock	3.3	279	3.93	40.6	25.1	4.08	0.1	0.81	<0.02	<0.02	0.2	<0.01
STS-PT-2013-8	Site	No	Flat Rocky	5	626	4.58	2	1.16	0.5	0.15	1.1	0.64	0.64	0.4	1.41
STS-PT-2013-9	Site	Yes	Bedrock	4.3	1350	3.05	1.9	1.45	0.4	0.17	0.59	0.43	0.43	0.2	0.24
STS-PT-2013-10	Site	No	Bedrock	4.8	557	4.53	4.2	2.86	0.7	0.18	0.81	0.44	0.44	0.3	0.24
STS-PT-2013-11	Site	No	Bedrock	3.9	189	4.94	1.4	0.94	0.18	0.14	0.5	0.41	0.41	0.2	0.06
STS-PT-2013-12	Site	Yes	Bedrock	6.5	449	6.36	3.3	4.51	0.76	0.14	0.8	2.92	2.91	0.2	0.75
STS-PT-2013-13	Site	No	Flat Rocky	4.9	360	5.13	1.6	1.07	0.58	0.33	0.95	0.58	0.58	0.3	0.84
STS-PT-2013-14	Site	No	Flat Rocky	3.8	725	3.30	39.3	24.6	10.5	0.33	1.32	<0.02	<0.02	0.2	0.86
STS-PT-2013-15	Site	No	Flat Rocky	5.1	501	4.93	1.1	0.35	0.18	0.08	0.63	0.55	0.55	0.4	0.97
STS-PT-2013-16	Site	No	Slope	5.4	1200	4.21	3.5	2.46	1.01	0.19	1.21	0.85	0.85	0.5	1.66
STS-PT-2013-17	Site	Yes	Flat Rocky	7.6	1120	6.33	2.8	4.6	0.65	0.23	0.71	3.03	3.02	0.4	3.69
STS-PT-2013-18	Site	No	Bedrock	4.1	311	4.55	2.1	1.14	0.29	0.1	0.75	0.41	0.41	0.2	0.09
STS-PT-2013-19	Site	Yes	Flat Rocky	4.6	714	4.06	2.1	1.79	0.44	0.13	0.79	0.43	0.43	0.2	0.3
STS-PT-2013-20	Site	Yes	Flat Granular	7.5	131	8.71	<0.4	3.67	0.37	0.09	0.94	4.24	4.24	0.8	22.3
Dup3 for STS-PT-2013-20	Site	No	Flat Granular	7.6	174	8.48	4.4	3.68	0.37	0.13	0.37	3.66	3.66	0.5	21.7
STS-PT-2013-21	De Minimus	No	Bedrock	4.2	61	6.52	1.5	0.71	0.24	0.11	0.71	0.43	0.43	0.2	0.1
STS-PT-2013-22	De Minimus	No	Bedrock	3.9	248	4.63	35	22.4	5.78	0.33	1.89	<0.02	<0.02	0.4	0.24
STS-PT-2013-23	De Minimus	No	Bedrock	4.4	253	5.07	2.1	1.52	0.35	0.17	0.61	0.41	0.41	0.2	0.16
STS-PT-2013-24	Reference	No	Flat Granular	7.7	56	9.87	<0.4	3.73	0.31	0.23	0.52	4.5	4.49	0.3	2.41
STS-PT-2013-25	Reference	No	Flat Granular	7.7	130	8.90	0.5	3.57	0.46	0.8	0.55	4.85	4.85	0.4	0.91
STS-PT-2013-26	Reference	No	Flat Granular	7.6	109	9.01	0.7	2.74	0.23	0.26	0.61	3.08	3.08	0.3	18.1
STS-PT-2013-27	De Minimus	Yes	Flat Granular	4.6	164	5.75	1.4	0.78	0.33	0.16	0.87	0.48	0.48	0.3	0.45
STS-PT-2013-28	Reference	No	Flat Granular	7.5	58	9.65	0.6	2.02	0.42	0.15	0.84	2.74	2.74	0.4	1.68
STS-PT-2013-29	Site	Yes	Flat Granular	4.5	234	5.25	0.9	0.56	0.16	0.25	0.61	0.46	0.46	0.3	0.2
STS-PT-2013-30	Site	Yes	Flat Rocky	3.7	152	5.00	8.7	5.8	0.94	0.27	0.61	<0.02	<0.02	0.3	<0.01
STS-PT-2013-31	Site	Yes	Slope	5.1	153	6.30	1.9	1.53	0.6	0.09	1.2	0.46	0.46	0.5	1.39
STS-PT-2013-32	Site	No	Flat Rocky	5.1	816	4.37	1.7	1.89	0.58	0.32	0.44	0.63	0.63	0.3	0.6
STS-PT-2013-33	Site	Yes	Flat Granular	4.3	95300	-1.85	260	18.8	35.4	<0.03	1.33	0.64	0.64	4.9	<0.01
Dup2 for STS-PT-2013-33	Site	Yes	Flat Granular	4	92500	-2.09	491	18.1	42.6	0.03	1.23	0.59	0.59	5.5	<0.01
STS-PT-2013-34	Site	No	Flat Rocky	4.8	1200	3.65	2.74	2.74	0.86	0.31	0.31	0.44	0.44	0.16	0.33
STS-PT-2013-35	Site	No	Flat Rocky	4.6	1630	3.11	1.57	1.7	0.61	0.16	0.24	0.42	0.42	0.13	0.51
STS-PT-2013-36	Site	No	Flat Rocky	5.9	3770	3.36	31.7	31.2	5.02	0.18	0.56	4.23	4.22	0.22	1.38
STS-2018-REF-FG1	Reference	Yes	Flat Granular	7.7	22	10.95	0.25	--	--	--	--	--	--	--	--
STS-2018-REF-FG2	Reference	Yes	Flat Granular	6.5	82	8.32	0.25	--	--	--	--	--	--	--	--
STS-2018-REF-BR1	Reference	Yes	Bedrock	5.7	96	7.39	0.38	--	--	--	--	--	--	--	--
STS-2018-REF-BR2	Reference	Yes	Bedrock	6.4	49	8.82	0.21	--	--	--	--	--	--	--	--
STS-2018-REF-BR3	Reference	Yes	Bedrock	5	180	6.02	0.21	--	--	--	--	--	--	--	--
STS-2018-REF-FR1	Reference	Yes	Flat Rocky	6.2	82	8.04	0.21	--	--	--	--	--	--	--	--
STS-2018-REF-SL1	Reference	Yes	Slope	6.4	72	8.37	0.25	--	--	--	--	--	--	--	--
STS-2018-REF-SL2	Reference	Yes	Slope	6	100	7.62	0.21	--	--	--	--	--	--	--	--
Wildlife Reference North	Reference	Yes	Flat Granular	4.6	164	5.75	--	--	--	--	--	--	--	--	--
Overgrazed Reference	Site	Yes	Flat rocky	4.3	361	4.57	1.96	--	--	--	--	--	--	--	--
Overgrazed Rocky 2	Site	No	Flat Rocky	4.1	348	4.42	0.67	--	--	--	--	--	--	--	--

APPENDIX F

SOIL CHEMISTRY PLOTS



Notes:

Numbers represent the last number of the location IDs on Figure 2.

HCTs = Humidity Cell Tests for kinetic testing of rock

Location 27 is wildlife reference south.

Location 2,17,and 36 had flat, rocky soils with high alkalinity, and were removed in this plot. Within the pH range of site soils, flat granular has highest quality and bedrock has lowest quality in terms of plant endpoints or sulfate impacts relative to pH or pCu.

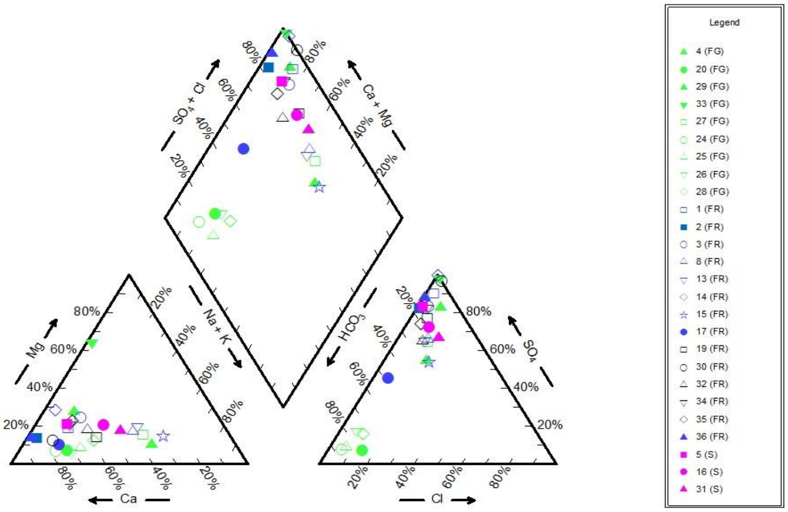
FREEPORT-MCMORAN CHINO MINES COMPANY
VANADIUM, NEW MEXICO

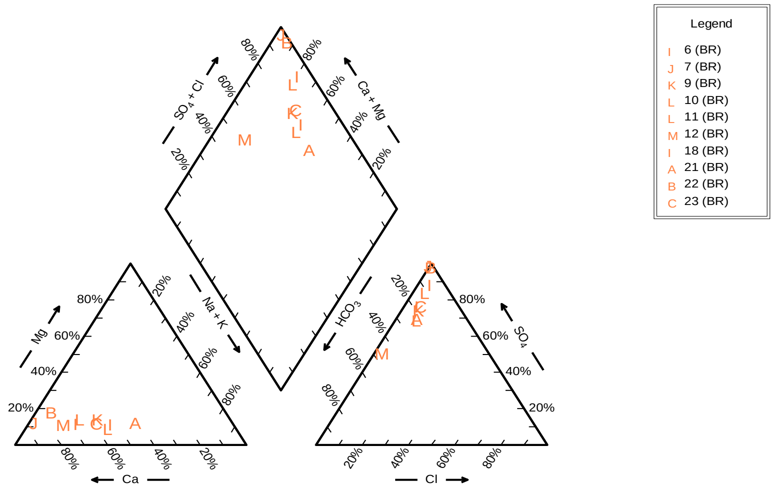
TECHNICAL MEMORANDUM ON REFERENCE AREAS

Relationship between Soluble Sulfate and pH used to Identify Impacted Locations without outliers

ARCADIS

FIGURE
F-1





Notes: Bedrock category is in bottom graph, other 3 categories in top graph.

FREEPORT-MCMORAN CHINO MINES COMPANY
VANADIUM, NEW MEXICO

TECHNICAL MEMORANDUM ON REFERENCE AREAS

Piper Diagrams of Locations in the Soil Categories

ARCADIS

FIGURE

F-2

Attachment B: URS Data Validation Report

Draft REPORT

DATA VALIDATION REPORT FEASIBILITY STUDY PROPOSAL-SMELTER/TAILINGS SOIL INVESTIGATIONAL UNIT

Prepared for
Freeport-McMoRan Copper & Gold

May 21, 2012

URS

URS Corporation
8181 East Tufts Avenue
Denver, Colorado 80237

Project No. 22242587 Task 00003

TABLE OF CONTENTS

LIST OF TABLES

LIST OF APPENDICES

1. INTRODUCTION

This report contains the results of the data validation conducted for the soil samples collected during the Feasibility Study Proposal –Smelter/Tailing Soils Investigation Unit. The data were reviewed in accordance with the approved Quality Assurance Plan (QAP) prepared by Chino Mines Company and Steffen, Robertson and Kirsten (U.S.), Inc. (March 1997).

The samples were collected in September and October 2011. The samples were sent to ACZ Laboratories, Inc. (ACZ) in Steamboat, Colorado for analysis. The soil samples were analyzed for one or more of the following parameters: total copper, copper (Synthetic Precipitation Leaching Procedure (SPLP)), pH, total calcium, total organic carbon (TOC), total carbon (TC), nitrate/ nitrite as nitrogen (N), ammonia nitrogen, total Kjedahl nitrogen, nitrate as N, nitrite as N, total potassium, neutralization potential as $CaCO_3$, sulfur organic residual, sulfur pyritic sulfide, sulfur sulfate, total sulfur, and total sulfur minus sulfate. Results of the data validation performed on samples reported in these packages are presented in Sections 4 and 5.1 – 5.17 of this report.

Table 1-1 lists the samples for which data were validated, the corresponding data package, and the review narrative section in which validation results are presented. The cross reference to the laboratory identification numbers can be found in each of the review sections.

TABLE 1-1
DATA PACKAGE AND SAMPLE IDENTIFICATION SUMMARY

Data Package	Report Section[1]	Field Sample Identification	Depth (inches)
L90608	5.1	STS-BWC-2011-3	-
		STS-BWC-2011-4	-
		STS-BWC-2011-5	-
		STS-BWC-2011-6	-
		STS-BWC-2011-7	-
		STS-BWC-2011-8	-
		STS-BWC-2011-9	-
		STS-BWC-2011-10	-
		STS-BWC-2011-11	-
		STS-BWC-2011-12	-
		STS-BWC-2011-1	-
		STS-BWC-2011-2	-

TABLE 1-1
DATA PACKAGE AND SAMPLE IDENTIFICATION SUMMARY

Data Package	Report Section[1]	Field Sample Identification	Depth (inches)
L91218[1]	5.2	STS-AMD-2011-E3 0-6	0-6
		STS-AMD-2011-E1 6-12	6-12
		STS-AMD-2011-E2 6-12	6-12
		STS-AMD-2011-E3 6-12	6-12
		STS-AMD-2011-WREF1 0-6	0-6
		STS-AMD-2011-WREF2 0-6	0-6
		STS-AMD-2011-WREF1 12-18	12-18
		STS-AMD-2011-WREF2 18-24	18-24
		STS-AMD-2011-NREF1 0-6	0-6
		STS-AMD-2011-NREF2 0-6	0-6
		STS-AMD-2011-NREF1 18-24	18-24
		STS-AMD-2011-NREF2 18-24	18-24
		STS-AMD-2011-NEREF1 0-6	0-6
		STS-AMD-2011-NEREF2 0-6	0-6
		STS-AMD-2011-NEREF1 18-24	18-24
		STS-AMD-2011-NEREF2 12-18	12-18
		STS-AMD-2011-EREF1 0-6	0-6
		STS-AMD-2011-EREF2 0-6	0-6
		STS-AMD-2011-EREF1 6-12	6-12
		STS-AMD-2011-EREF2 6-12	6-12
L91360	5.3	STS-CG-2011-31	-
		DUP5	-
		STS-CG-2011-33	-
		STS-CG-2011-34	-
		STS-CG-2011-35	-
		STS-CG-2011-36	-
		DUP6	-
		STS-CG-2011-38	-
		STS-CG-2011-39	-
		STS-CG-2011-40	
L91219	5.4	DUP13	0-6
		DUP14	0-6
		DUP15	0-6
		DUP16	0-6
L91358	5.5	STS-PH-2011-FID37	-
		STS-PCUG-2011-40	-
		STS-PH-2011-FID101	-
		STS-PH-2011-REFPLOT3	-

TABLE 1-1
DATA PACKAGE AND SAMPLE IDENTIFICATION SUMMARY

Data Package	Report Section[1]	Field Sample Identification	Depth (inches)
		STS-PH-2011-REFPLOT4	-
		DUP11	-
		STS-PH-2011-FID105	-
		DUP12	-
		STS-PH-2011-REFPLOT1	-
		STS-PH-2011-REFPLOT2	-
		STS-PH-2011-FID22	-
		STS-PH-2011-FID10	-
		STS-PH-2011-FID15	-
		STS-PH-2011-FID16	-
		STS-PH-2011-FID17	-
		STS-PH-2011-FID18	-
L91357	5.6	STS-PCUG-2011-11	-
		STS-PCUG-2011-12	-
		STS-PCUG-2011-13	-
		STS-PCUG-2011-14	-
		STS-PCUG-2011-41	-
		STS-PCUG-2011-16	-
		STS-PCUG-2011-17	-
		STS-PCUG-2011-18	-
		STS-PCUG-2011-19	-
		STS-PCUG-2011-20	-
		STS-CG-2011-21	-
		STS-CG-2011-09	-
		STS-CG-2011-10	-
		STS-CG-2011-24	-
		STS-CG-2011-25	-
		STS-CG-2011-26	-
		STS-CG-2011-27	-
		STS-CG-2011-28	-
		STS-CG-2011-29	-
		STS-CG-2011-30	-
L91355	5.7	STS-PCUG-2011-21	-
		STS-PCUG-2011-22	-
		STS-PCUG-2011-23	-
		STS-PCUG-2011-24	-
		STS-PCUG-2011-25	-
		DUP1	-

TABLE 1-1
DATA PACKAGE AND SAMPLE IDENTIFICATION SUMMARY

Data Package	Report Section[1]	Field Sample Identification	Depth (inches)
		DUP2	-
		STS-PCUG-2011-28	-
		STS-PCUG-2011-29	-
		STS-PCUG-2011-30	-
		DUP7	-
		STS-CG-2011-42	-
		STS-CG-2011-43	-
		DUP8	-
		STS-CG-2011-45	-
		STS-CG-2011-46	-
		DUP9	-
		DUP3	-
		STS-CG-2011-49	-
		STS-CG-2011-50	-
L91220	5.8	STS-AMD-2011-W1 0-6	0-6
		STS-AMD-2011-W2 0-6	0-6
		STS-AMD-2011-W3 0-6	6-12
		STS-AMD-2011-W1 6-12	6-12
		STS-AMD-2011-W2 12-18	12-18
		STS-AMD-2011-W3 12-18	12-18
		STS-AMD-2011-N1 0-6	0-6
		STS-AMD-2011-N2 0-6	0-6
		STS-AMD-2011-N3 0-6	0-6
		STS-AMD-2011-N1 18-24	18-24
		STS-AMD-2011-N2 18-24	18-24
		STS-AMD-2011-N3 18-24	18-24
		STS-AMD-2011-NE1 0-6	0-6
		STS-AMD-2011-NE2 0-6	0-6
		STS-AMD-2011-NE3 0-6	0-6
		STS-AMD-2011-NE1 18-24	18-24
		STS-AMD-2011-NE2 18-24	18-24
		STS-AMD-2011-NE3 18-24	18-24
		STS-AMD-2011-E1 0-6	0-6
		STS-AMD-2011-E2 0-6	0-6
L91393	5.9	RINSATE3	-
		RINSATE4	-
		RINSATE1	-
		RINSATE5	-

TABLE 1-1
DATA PACKAGE AND SAMPLE IDENTIFICATION SUMMARY

Data Package	Report Section[1]	Field Sample Identification	Depth (inches)
		RINSATE7	-
		RINSATE8	-
		RINSATE2	-
		RINSATE6	-
L91526	5.10	STS-PCUG-2011-27	-
		STS-PCUG-2011-31	-
		DUP4	-
		STS-PCUG-2011-5	-
		STS-PCUG-2011-6	-
		STS-PCUG-2011-8	-
		STS-PCUG-2011-9	-
		STS-PCUG-2011-15	-
		STS-PH-2011-FID106	-
		STS-PCUG-2011-32	-
		STS-PCUG-2011-34	-
		STS-PCUG-2011-35	-
		STS-PCUG-2011-36	-
		STS-PCUG-2011-37	-
		DUP10	-
		STS-CG-2011-44	-
		STS-CG-2011-47	-
		STS-CG-2011-48	-
		STS-CG-2011-16	-
		STS-CG-2011-7	-
L91527	5.11	STS-CG-2011-51	-
		STS-CG-2011-52	-
		STS-CG-2011-53	-
		STS-CG-2011-54	-
		STS-CG-2011-55	-
		STS-CG-2011-56	-
		STS-CG-2011-57	-
		STS-CG-2011-32	-
		STS-CG-2011-37	-
		STS-CG-2011-41	-
		STS-CG-2011-1	-
		STS-CG-2011-2	-
		STS-CG-2011-3	-
		STS-CG-2011-4	-

TABLE 1-1
DATA PACKAGE AND SAMPLE IDENTIFICATION SUMMARY

Data Package	Report Section[1]	Field Sample Identification	Depth (inches)
		STS-CG-2011-5	-
		STS-CG-2011-6	-
		STS-CG-2011-18	-
		STS-CG-2011-8	-
		STS-CG-2011-22	-
		STS-CG-2011-23	-
L91528	5.12	STS—PH-2011-FID102	-
		STS—PH-2011-FID7	-
		STS—PH-2011-FID8	-
		STS—PH-2011-FID28	-
L92172	5.13	STS—PH-2011-FID37	-
		STS—PH-2011-FID101	-
		STS—PH-2011-REFPLOT3	-
		STS—PH-2011-REFPLOT4	-
		STS—PH-2011-FID105	-
		STS—PH-2011-REFPLOT1	-
		STS—PH-2011-REFPLOT2	-
		STS—PH-2011-FID22	-
		STS—PH-2011-FID10	-
		STS—PH-2011-FID15	-
		STS—PH-2011-FID16	-
		STS—PH-2011-FID17	-
		STS—PH-2011-FID18	-
		STS—PH-2011-FID106	-
		STS—PH-2011-FID102	-
		STS—PH-2011-FID7	-
		STS—PH-2011-FID8	-
		STS—PH-2011-FID28	-
L92223[1]	5.14	STS-AMD-2011-W1 0-6	0-6
		STS-AMD-2011-W2 0-6	0-6
		STS-AMD-2011-W3 0-6	0-6
		STS-AMD-2011-W1 6-12	6-12
		STS-AMD-2011-W2 12-18	12-18
		STS-AMD-2011-W3 12-18	12-18
		STS-AMD-2011-N1 0-6	0-6
		STS-AMD-2011-N2 0-6	0-6
		STS-AMD-2011-N3 0-6	0-6
		STS-AMD-2011-N1 18-24	18-24

TABLE 1-1
DATA PACKAGE AND SAMPLE IDENTIFICATION SUMMARY

Data Package	Report Section[1]	Field Sample Identification	Depth (inches)
		STS-AMD-2011-N2 18-24	18-24
		STS-AMD-2011-N3 18-24	18-24
		STS-AMD-2011-NE1 0-6	0-6
		STS-AMD-2011-NE2 0-6	0-6
		STS-AMD-2011-NE3 0-6	0-6
		STS-AMD-2011-NE1 18-24	18-24
		STS-AMD-2011-NE2 18-24	18-24
		STS-AMD-2011-NE3 18-24	18-24
		STS-AMD-2011-E1 0-6	0-6
		STS-AMD-2011-E2 0-6	0-6
L92224	5.15	STS-AMD-2011-E3 0-6	0-6
		STS-AMD-2011-E1 6-12	6-12
		STS-AMD-2011-E2 6-12	6-12
		STS-AMD-2011-E3 6-12	6-12
		STS-AMD-2011-WREF1 0-6	0-6
		STS-AMD-2011-WREF2 0-6	0-6
		STS-AMD-2011-WREF1 12-18	12-18
		STS-AMD-2011-WREF2 18-24	18-24
		STS-AMD-2011-NREF1 0-6	0-6
		STS-AMD-2011-NREF2 0-6	0-6
		STS-AMD-2011-NREF1 18-24	18-24
		STS-AMD-2011-NREF2 18-24	18-24
		STS-AMD-2011-NEREF1 0-6	0-6
		STS-AMD-2011-NEREF2 0-6	0-6
		STS-AMD-2011-NEREF1 18-24	18-24
		STS-AMD-2011-NEREF2 12-18	12-18
		STS-AMD-2011-EREF1 0-6	0-6
		STS-AMD-2011-EREF2 0-6	0-6
		STS-AMD-2011-EREF1 6-12	6-12
		STS-AMD-2011-EREF2 6-12	6-12
L91359	5.16	STS-CG-2011-11	-
		STS-CG-2011-12	-
		STS-CG-2011-13	-
		STS-CG-2011-14	-
		STS-CG-2011-15	-
		STS-CG-2011-17	-
		STS-CG-2011-19	-
		STS-CG-2011-20	-

TABLE 1-1
DATA PACKAGE AND SAMPLE IDENTIFICATION SUMMARY

Data Package	Report Section[1]	Field Sample Identification	Depth (inches)
		STS-PCUG-2011-1	-
		STS-PCUG-2011-2	-
		STS-PCUG-2011-3	-
		STS-PCUG-2011-4	-
		STS-PCUG-2011-33	-
		STS-PCUG-2011-7	-
		STS-PCUG-2011-38	-
		STS-PCUG-2011-39	-
		STS-PCUG-2011-10	-
L90609	5.17	RINSATE BLANK #1	-

[1] Data packages L91218 and L92223 were used to evaluate both laboratory performance criteria (Section 4) and sample specific criteria (Section 5).
- No depth given

This data validation report describes the data validation process used and presents the data review results for surface water samples and associated quality control (QC) sample analyses.

In accordance with the QAP, a review of all data was conducted independently of the laboratory. The review consisted of evaluation of laboratory performance criteria and sample-specific criteria using guidance from the USEPA National Functional Guidelines for Inorganic Data Review (January 2010). The laboratory performance criteria evaluated included: initial calibration procedures and results, continuing calibration procedures and results, inductively coupled plasma (ICP) interference check sample results, contract required detection limit (CRDL) standard analysis and results, laboratory control sample results, and result quantitation and verification, as applicable to the method. An evaluation of laboratory performance criteria was conducted on at least 10% of the data set per analysis type. Section 2 and Tables 2-1 and 2-2 provide the QC requirements for the laboratory performance criteria.

The sample-specific criteria evaluated included: chain-of-custody (COC) and sample receipt documentation, holding times, blank contamination, duplicate sample analysis, matrix spike/matrix spike duplicate sample analysis, serial dilution results (as applicable to the method), post digestion spike recovery (as applicable to the method), and field duplicate results agreement as applicable to the method. The sample specific criteria were evaluated for every data package received. Section 3 and Table 3-1 summarize the sample-specific criteria that were used in the data validation process and how data were qualified.

Section 4 presents the results of the evaluation of laboratory performance criteria. The review of sample-specific criteria is presented in Section 5. The results obtained for field quality control samples are discussed in Section 6 and an overall assessment of data, with respect to the data quality indicators, is presented in Section 7.

During the data validation process, the data reviewer annotated on the analytical data sheets any data validation qualifiers assigned (“U”, “J”, “UJ”, and “R”) and associated qualifier and bias codes as listed in Tables 1-2 and 1-3. The purpose of the qualifier codes is to provide information with regard to the data quality condition(s) that resulted in the assigned qualifiers. The bias code provides an indication of the bias direction of the results qualified as estimated based on data quality condition(s) that resulted in the data qualification and the results of the other associated quality control analyses. The data qualifier codes are followed by a hyphen and the applicable bias code. For example, a result qualified as estimated due to a holding time exceedance, which resulted in a potential low bias in the result, has the following code annotated on the data sheet, “HT-L.” In the case of multiple data quality conditions resulting in qualification, each qualifier code is listed and separated by a comma. For example, a result qualified as estimated due to low matrix spike recovery and poor method duplicate precision would have the following codes annotated on the data sheet, “MS, D – I. The data reporting forms with assigned data qualifiers are included in Appendix A.

TABLE 1-2
DATA VALIDATION QUALIFIER DEFINITIONS

Qualifier	Definitions [1]
U	The analyte was analyzed for, but was not detected above the level of the associated value. The associate value is either the sample quantitation limit or the sample detection limit.
J	The associated value is an estimated quantity.
UJ	The material was analyzed for, but was not detected. The associated value is an estimate and may be inaccurate or imprecise.
R	The data are unusable. (Note: Analyte may or may not be present.)

[1] USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review, January 2010.

TABLE 1-3
DATA VALIDATION QUALIFIER CODES

Qualifier Code	Data Quality Condition Resulting In Assigned Qualification
General use	
HT	Holding time requirement was not met
MB or PB	Method blank or preparation blank contamination
LCS	Laboratory control sample evaluation criteria not met
RB	Rinsate blank contamination
FD	Field duplicate evaluation criteria not met
P	Preservation requirement was not met
EF	Extraction fluid contamination
RL	Reporting limit exceeds decision criteria (for nondetects)
Inorganic methods	
ICV	Initial calibration verification evaluation criteria not met
CCV	Continuing calibration verification evaluation criteria not met
CCB	Continuing calibration blank contamination
PB	Preparation blank contamination
ICS	Interference check sample evaluation criteria not met
MS and/or MSD	Matrix spike and/or matrix spike duplicate recovery outside acceptance range
PDS	Post-digestion spike recovery outside acceptance range
MSA	Method of standard additions correlation coefficient ≤ 0.995
D	Duplicate precision evaluation criteria not met
IS	Internal standard recovery outside acceptance range for ICP-MS
ICS	Interferent check solution evaluation criteria not met
SD	Serial dilution results did not meet evaluation criteria
CRDL	Contract Required Detection Limit standard recovery not met
CE	Counting error
Bias Codes	**Bias Direction**
H	Bias in sample result likely to be high
L	Bias in sample result likely to be low
I	Bias in sample result is indeterminate

2. EVALUATION OF LABORATORY PERFORMANCE CRITERIA

The laboratory performance review criteria used in validation are summarized in Tables 2-1 and 2-2. Table 2-1 is pertinent to metals determination by ICP and ICP-MS. Table 2-2 is pertinent to general chemistry parameters. Laboratory performance criteria were evaluated for one of the packages for each analysis parameter group. The results of the laboratory performance criteria review are presented in Section 4.

TABLE 2-1
LABORATORY PERFORMANCE CRITERIA – METALS

Method	QC Check*	Minimum Frequency	Acceptance Criteria	Qualifiers
ICP (6010B or 200.7)/ ICP-MS (6020 or 200.8)	Initial calibration (minimum 1 standard and a blank)	Daily prior to sample analysis	• Correlation Coefficient ≥0.995 for linear regression.	• If r <0.995, qualify all results as estimated (J/UJ).
	Second source initial calibration verification (ICV)	Daily after initial calibration	• All analytes within ±10% of expected value. • RSD of replicate integrations <5%.	• If %R falls outside the acceptance range but within range of 75-89% or 111-125%, qualify results >IDL (MDL) as estimated (J). • If %R is within 111-125%, results <IDL (MDL) are acceptable. • If %R is 75-89%, qualify results <IDL (MDL) as estimated (UJ). • If %R is <75%, qualify all results as unusable (R). • If %R is >125%, qualify results >IDL (MDL) as unusable (R); results <IDL (MDL) are acceptable without qualification. • No qualification issued for RSD >5%.
	Continuing calibration verification (CCV)	After every 10 samples and at the end of the analysis sequence	• All analytes within ±10% of expected value. • RSD of replicate integrations <5%.	
	Linear Range Analysis (LRA)	Quarterly	• All analytes agree within 5% of true value.	• NA
	Contract Required Detection Limit (CRDL) standard	At beginning and end of each sample analysis	• None	• Professional judgment will be used for the need for qualification for %Rs outside 50-150% based on the relative concentration of the CRDL standard and the sample concentration.
	Interference check solution (ICS)	At the beginning and end of the analytical run	• Recovery of spiked analytes within ±20% of expected value. • Results for analytes not present in the ICS solution must be <RL (PQL).	• If %R is >120%, results <IDL (MDL) are acceptable. • If %R is >120%, qualify results >IDL (MDL) as estimated (J). • If %R is within 50-79%, qualify results >IDL (MDL) as estimated (J). • If %R is within 50-79%, qualify results <IDL (MDL) as estimated (UJ). • If %R is <50%, qualify all results as unusable (R). • If results > IDL (MDL) are observed that are not present in the ICS solution and the sample has concentrations at the level of the interferents concentrations, qualify sample results >IDL (MDL) as estimated (J) if the amount of bias is ≥25% of sample result. • If negative concentrations are observed that are not present in the ICS solution at a concentration where the absolute value is >IDL (MDL), qualify sample results as estimated (J/UJ) if the bias is more than 25% of the reported result and the sample has a concentration comparable to the interferent concentrations in the ICS solution.
	Laboratory Control Sample (LCS) (aqueous)	One per analytical batch containing aqueous samples	• 80-120% recovery for water samples.	• If %R is within 50-79% or >120%, qualify results >IDL (MDL) as estimated (J). • If %R >120%, results <IDL (MDL) are acceptable without qualification. • If %R is within 50-79%, qualify results <IDL (MDL) as estimated (J/UJ) • If %R is <50%, qualify all results as unusable (R).
	Laboratory Control Sample (LCS) (solid)	One per analytical batch containing solid samples	• LCS results must fall within the control limits established by the EPA.	• If LCS recovery falls outside the control limits, qualify results >IDL (MDL) as estimated (J). • If LCS recovery is > control limits, results <IDL (MDL) are acceptable without qualification. • If LCS recovery is>50 % and < control limits, qualify results <IDL (MDL) as estimated (J/UJ). • If %R is <50%, qualify all results as unusable (R).

*As applicable to the method.

TABLE 2-2
LABORATORY PERFORMANCE CRITERIA – GENERAL CHEMISTRY PARAMETERS

Method	QC Check*	Minimum Frequency	Acceptance Criteria	Qualifiers
General Chemistry Parameters	Initial multipoint calibration (minimum 3 standards and a blank)	Daily prior to sample analysis	• Correlation Coefficient ≥0.995 for linear regression.	• If r <0.995, qualify all results as estimated (J/UJ).
	CRDL standard	At beginning and end of each sample analysis	None	• Professional judgment will be used for the need for qualification for %Rs outside 50-150% based on the relative concentration of the CRDL standard and the sample concentration.
	Second source initial calibration verification (ICV)	Daily after initial calibration	• Analyte within ± 20% of expected value.	• If %R falls outside the acceptance range but within range of 65-79% or 121-135%, qualify results >IDL (MDL) as estimated (J). • If %R is within 121-135%, results <IDL (MDL) are acceptable without qualification. • If %R is 65-79%, qualify results <IDL (MDL) as estimated (UJ). • If %R is <65%, qualify all results as unusable (R). • If %R is >135%, qualify results >IDL (MDL) as unusable (R); results <IDL (MDL) are acceptable.
	Continuing calibration verification (CCV)	After every 10 samples and at the end of the analysis sequence	• Analyte within 20% of expected value.	• If %R falls outside the acceptance range but within range of 65-79% or 121-135%, qualify results >IDL (MDL) as estimated (J). • If %R is within 121-135%, results <IDL (MDL) are acceptable without qualification. • If %R is 65-79%, qualify results <IDL (MDL) as estimated (UJ). • If %R is <65%, qualify all results as unusable (R). • If %R is >135%, qualify results >IDL (MDL) as unusable (R); results <IDL (MDL) are acceptable.
	Laboratory Control Sample (LCS) (aqueous)	One per analytical batch containing aqueous samples	• 80-120% recovery for water samples.	• If %R is within 50-79% or >120%, qualify results >IDL (MDL) as estimated (J). • If %R >120%, results <IDL (MDL) are acceptable without qualification. • If %R is within 50-79%, qualify results <IDL (MDL) as estimated (J/UJ) • If %R is <50%, qualify all results as unusable (R).
	Laboratory Control Sample (LCS) (solid)	One per analytical batch containing solid samples	• LCS results must fall within the control limits.	• If LCS recovery falls outside the control limits, qualify results >IDL (MDL) as estimated (J). • If LCS recovery is > control limits, results <IDL (MDL) are acceptable without qualification. • If LCS recovery is>50 % and < control limits, qualify results <IDL (MDL) as estimated (J/UJ). • If %R is <50%, qualify all results as unusable (R).

*As applicable to the method.

3. EVALUATION OF SAMPLE-SPECIFIC CRITERIA

Sample-specific criteria were reviewed for all data packages. The review criteria and resultant actions are summarized in Table 3-1. The results of the sample-specific review are detailed in Section 5. Each subsection of Section 5 presents the review narrative for one data package.

TABLE 3-1
SAMPLE-SPECIFIC CRITERIA

Method*	QC Check	Minimum Frequency	Acceptance Criteria	Qualifiers
ICP (6010B or 200.7) ICPMS (6020 or 200.8) General Chemistry Parameters	Holding Time	Each Sample	• Analysis within the holding time requirements specified in the QAPP. • No holding time was specified in the QAPP for pH. The reviewer used a holding time of 2 days for soil samples. • No holding time was specified in the QAPP for soil general chemistry parameters. The reviewer used general chemistry parameter water limits. • There is no holding time criterion for acid base accounting over burden parameters or the sulfur forms.	• If sample was analyzed outside the holding time requirements, then the sample results were qualified as estimated (J/UJ).
	Continuing calibration blank (CCB)	After every calibration verification	• <RL (PQL) for positive results. • <RL (PQL) for |negative results|.	• Sample results, for an analyte detected in an associated blank at a concentration, <5x the blank concentration, qualify as nondetect (U). • Sample results for an analyte reported in an associated blank at a negative concentration <|4x blank concentration|, qualify results as estimated (J/UJ).
	Method Blank	One per analytical batch	• No analytes detected ≥ RL (PQL).	• Sample results, for an analyte detected in the method blank at a concentration, <5x the blank concentration, qualify as nondetect (U). • Sample results for an analyte reported in the method blank at a negative concentration <|4x blank concentration|, qualify results as estimated (J/UJ).
	ICP Serial Dilution Test	One per analytical batch	• 1:5 dilution must agree within ±10% of the original determination for analytes present at concentrations >50x MDL.	• If %D is >10%, qualify associated data as estimated (J/UJ).
	Matrix Spike (MS)	One per 20 samples	• Recovery within 75-125% for both water and soils. • If sample result is ≥4x the spike amount then the matrix spike is not an appropriate for assessing accuracy measurement.	• If % R is >125%, results <IDL (MDL) are acceptable without qualification. • If %R is >125% or <75%, qualify results >IDL (MDL) as estimated (J). • If % R is within 30-74%, qualify results <IDL (MDL) as estimated (J/UJ). • If % R is <30%, qualify results <IDL (MDL) as unusable(R).

TABLE 3-1
SAMPLE-SPECIFIC CRITERIA (continued)

Method*	QC Check	Minimum Frequency	Acceptance Criteria	Qualifiers
	Laboratory Duplicate or Matrix Spike Duplicate	One per 20 samples	If both results >5x RL (PQL) • RPD for water is ≤20%. • RPD for soils is ≤35%. If either sample result is <5x the RL (PQL) then • Absolute difference ≤1x RL (PQL) (waters). • Absolute difference ≤2x RL (PQL) (soils).	• If the RPD or absolute difference falls outside the appropriate fixed control windows, qualify the results for that analyte as estimated (J/UJ).
	Field Duplicate		If both results >5x RL (PQL) • RPD for soils is ≤50%. If either sample result is <5x then • Absolute difference ≤ 3x RL (PQL).	• If the RPD or absolute difference falls outside the appropriate fixed control windows, qualify the results for that analyte as estimated (J/UJ).
	Post-digestion spike (PDS) 200.7 (ICP)	Typically, when the MS failed or at analyst discretion	• Recovery within 75-125% for both water and soils. • If sample result is ≥4x the spike amount then the PDS is not an appropriate for assessing accuracy measurement.	• No qualification was issued. • Post-digestion spikes were conducted to aid in determining whether the MS results that were out of acceptance limits were caused by the sample matrix, a bias in the analytical system, or a combination of both.
	Internal Standard Recoveries (200.8 ICPMS and 6020)	Required for all samples	• Recoveries within 65-125% (200.8) • Recoveries within 30-120% (6020)	• Qualify associated sample results as estimated (J/UJ).

*As applicable to the method.

4. REVIEW OF LABORATORY PERFORMANCE EVALUATION CRITERIA

Data packages L91218 and L92223 were used to evaluate laboratory performance parameters for metals (Method 200.7), total carbon (TC), total organic carbon (TOC), saturated paste pH, percent solids, nitrate as N, nitrite as N, nitrate/ nitrite as N, total Kjeldahl nitrogen, and ammonia as N. The data reported in these data packages accounted for greater than 10% of the investigation data. The evaluation of laboratory performance criteria was conducted as summarized in Tables 2-1 and 2-2. No information could be provided for recalculation for acid base accounting over burden analyses (ABA) including the sulfur forms.

4.1 Initial Calibration

ICP – Each ICP analytical run was initiated with the analysis of a blank and at least one standard, which satisfied the initial calibration criterion. All metals in the second source ICV standard were recovered within the acceptance range of 90-110% for all ICV analyses. Target analytes were not detected in the initial calibration blank sample. Site-specific samples were not analyzed directly after the initial calibration blank and before the first continuing calibration blank. Therefore, data qualification for ICP metals data was not necessary based on the initial calibration.

General Chemistry

- TC/ TOC – The laboratory used 3 calibration standards (high sulfur, low sulfur, and carbon). Each standard is run through the instrument at three different weights that bracket our standard sample size (0.1 grams, 0.3 grams, and 0.5 grams). These three points are then plotted on a linear graph that is fixed at the origin to validate each instrument response cell against the true value of the standard. The percent concentrations and intensities are calculated from the mass analyzed as part of the computer program designed for the instrument. As ACZ could not provide this information, the calibration curves could not be recalculated.

- Saturated Paste pH – The relationship between instrument response and concentration was established with a pH 2 buffer, pH 7 buffer, and pH 10 buffer.

- Nitrate/ Nitrite as N – The relationship between instrument response and concentrations was established with a blank and six standards.

- Nitrite as N – The relationship between instrument response and concentration was established with a blank and six standards.

- Ammonia as N – The relationship between instrument response and concentration was established with a blank and four standards.

- Total Kjeldahl Nitrogen – The relationship between instrument response and concentration was established with a blank and five standards.

The correlation coefficients for all general chemistry methods were >0.995. The calibrations were verified with the analysis of an ICV. All analytes were recovered within the acceptance range of 80-120%. Because all response and linearity criteria were met, data qualification on the basis of initial calibration was not necessary.

4.2 Continuing Calibration Verification

The continuing calibration verification solutions (CCV) were analyzed at the required frequency for all methods. All continuing calibration criteria were satisfied and data qualification was not necessary.

4.3 Interference Check Sample (ICS) for Metals

The ICS AB solutions were analyzed at the proper frequency. The target analytes were recovered within the acceptance range of 80-120% in the ICS AB solution. Interferent elements (e.g. aluminum, calcium, and iron) were present in some or all of the samples in this data package at concentrations approaching the interfering element concentrations for the ICSAB solution. As the laboratory did not analyze the ICSA solution, those samples with interfering elements present could not be evaluated for positive and negative biases suggested by the ICSA.

As method 6010B requires an ICS be analyzed, the subsequent data packages were evaluated on the basis of ICS results where applicable. Method 200.8 (rinsate blanks) does not require that an ICS be analyzed.

4.4 Laboratory Control Samples (LCS)

Laboratory control samples were prepared with each batch of samples. The recoveries for all analytes were within the control limits of 80-120%. Therefore, data qualification based on LCS results was not necessary.

4.5 CRDL Standard (Metals Only)

A CRDL standard (a low standard with concentrations at the laboratory reporting limit) is not required by methods 200.7, 200.8, 6010B, or 6020 and was not run by the laboratory. Further action was not necessary.

4.6 Tune (ICP-MS)

Tune was evaluated for data package L91393 in Section 5.9.

4.7 Sample Quantitation and Result Verification

Sample quantitation was checked by recalculating a minimum of 10% of the reported sample results from the raw system printouts. Examples of calculated results included correlation coefficients, reported sample results, percent differences for serial dilutions, recoveries for calibration standards, and RPDs between duplicate results. No calculation or reporting errors were found.

5. REVIEW OF SAMPLE SPECIFIC CRITERIA FOR ALL DATA PACKAGES

Sample-specific criteria were evaluated for all data packages. The evaluation of sample-specific criteria was conducted as summarized in Table 3-1. The data review narratives for the fourteen data packages are presented in Subsection 5.1 -5.17.

5.1 ACZ Data Package L90608

Data package L90608 contained the analytical results for twelve soil samples. The table below lists the laboratory IDs, corresponding field IDs, and QC designations.

Laboratory ID	Field ID	Analyses	QC Designation	Depth
L90608-01	STS-BWC-2011-3	Total Copper, pH, percent solids	MS/MSD - Total Copper MD - pH	-
L90608-02	STS-BWC-2011-4			-
L90608-03	STS-BWC-2011-5			-
L90608-04	STS-BWC-2011-6		SD – Total Copper	-
L90608-05	STS-BWC-2011-7			-
L90608-06	STS-BWC-2011-8			-
L90608-07	STS-BWC-2011-9			-
L90608-08	STS-BWC-2011-10			-
L90608-09	STS-BWC-2011-11			-
L90608-10	STS-BWC-2011-12			-
L90608-11	STS-BWC-2011-1			-
L90608-12	STS-BWC-2011-2			-

ID – Identification
MS/MSD – Matrix Spike/ Matrix Spike Duplicate
SD – Serial Dilution
MD – Method Duplicate
QC – Quality Control
- no depth given

5.1.1 *Overall Assessment*

The data are considered usable for meeting project objectives with the qualifications noted in the following narrative. The data qualifiers and associated bias codes were hand-entered on the sample reporting forms. The sample reporting forms are included in Appendix A.

5.1.2 *COC and Sample Receipt Documentation*

The samples were shipped to ACZ under COC. The laboratory sample custodian noted that all samples were received intact. The cooler was received at a temperature of 15.8 °C, above the temperature criterion of ≤6°C. Based on the stability of total copper, pH, and percent solids, data qualification was not considered necessary for these analytes.

Sample DUPLICATE#1STS-BWC-2 was listed on the COC; however, this samples is not associated with the Smelter/ Tailing Soils Investigation Unit and was not included in the report. Further action was not considered necessary.

5.1.3 Holding Times

With the exception listed below, the samples were prepared and analyzed within the required holding time limits.

The holding time criterion of 2 days for pH analysis was exceeded for all the samples in this data package. The pH results for the samples were qualified as estimated (J HT-L) to reflect the potential low bias.

5.1.4 Method Blanks, Calibration Blanks, and Rinsate Blanks

Method/ Calibration Blanks

Target analytes were not detected in the method or calibration blanks.

Rinsate Blanks

A rinsate blank sample was not reported in this data package. Detections in rinsate blanks are discussed in Section 6.

5.1.5 Duplicate Sample Analysis

Method duplicate results are discussed in Section 6.

5.1.6 Matrix Spike Analysis

Matrix spike and matrix spike duplicate results are discussed in Section 6.

5.1.7 Serial Dilution

A serial dilution is required for Method 6010B for all sample delivery groups, but is only pertinent to analytes present at greater than 50x the detection limit. A serial dilution was conducted on sample STS-BWC-2011-6. The applicable percent differences were within ±10% for the 1:5 dilution of the sample. Data qualification was not necessary.

5.1.8 Post Digestion Spike

For Method 6010B, a post digestion spike is required when the matrix spike recovery is outside of the acceptance limits of 75-125%. As the matrix spike recoveries were within the QAP acceptance limits of 75-125%, a post digestion spike was not necessary.

5.1.9 Field Duplicate

A field duplicate pair was not reported in this data package. Field duplicate results are discussed in Section 6.

5.1.10 Internal Standards (ICP-MS Methods 6020 or 200.8)

The samples in this data package were not analyzed for metals by Methods 6020 or 200.8. Further action was not necessary.

5.1.11 ICP Interference Check Standards (ICS)

The ICS AB solutions were analyzed at the proper frequency. The target analytes were recovered within the acceptance range of 80-120% in the ICS AB solution. Interferent elements (e.g. aluminum, calcium, and iron) were present in some or all of the samples in this data package at concentrations approaching the interfering element concentrations for the ICSAB solution. As the laboratory did not analyze the ICSA solution, those samples with interferent elements present could not be evaluated for positive and negative biases suggested by the ICSA.

5.2 ACZ Data Package L91218

Data package L91218 contained the analytical results for twenty soil samples. The table below lists the laboratory IDs, corresponding field IDs, and QC designations.

Laboratory ID	Field ID	Analyses	QC Designation	Depth (Inches)
L91218-01	STS-AMD-2011-E3 0-6	Total Calcium, Copper (SPLP), Total Copper, Total Potassium, TC, TOC, pH, Percent Solids, Nitrate as N, Nitrate/Nitrite as N, Nitrite as N, Ammonia as N*, Total Kjeldahl Nitrogen*	MD – TC, TOC, Nitrate/Nitrite as N, Nitrite as N, pH MS/MSD – Copper (SPLP)	0-6
L91218-02	STS-AMD-2011-E1 6-12		MS – Nitrate/ Nitrite as N, Nitrite as N	6-12
L91218-03	STS-AMD-2011-E2 6-12			6-12
L91218-04	STS-AMD-2011-E3 6-12			6-12
L91218-05	STS-AMD-2011-WREF1 0-6			0-6
L91218-06	STS-AMD-2011-WREF2 0-6		SD – Total Calcium, Total Copper, Total Potassium	0-6
L91218-07	STS-AMD-2011-WREF1 12-18		SD – Total Copper	12-18
L91218-08	STS-AMD-2011-WREF2 18-24			18-24
L91218-09	STS-AMD-2011-NREF1 0-6			0-6
L91218-10	STS-AMD-2011-NREF2 0-6		MS/MSD – Total Calcium, Total Copper, Total Potassium SD – Copper (SPLP)	0-6
L91218-11	STS-AMD-2011-NREF1 18-24			18-24
L91218-12	STS-AMD-2011-NREF2 18-24			18-24
L91218-13	STS-AMD-2011-NEREF1 0-6			0-6
L91218-14	STS-AMD-2011-NEREF2 0-6			0-6
L91218-15	STS-AMD-2011-NEREF1 18-24			18-24
L91218-16	STS-AMD-2011-NEREF2 12-18			12-18
L91218-17	STS-AMD-2011-EREF1 0-6			0-6
L91218-18	STS-AMD-2011-EREF2 0-6			0-6
L91218-19	STS-AMD-2011-EREF1 6-12			6-12
L91218-20	STS-AMD-2011-EREF2 6-12		MD – Copper (SPLP), Percent Solids	6-12

ID – Identification
MS/MSD – Matrix Spike/ Matrix Spike Duplicate
SD – Serial Dilution
TOC – Total Organic Carbon
MD – Method Duplicate
QC – Quality Control
TC – Total Carbon
SPLP – Synthetic Precipitation Leaching Procedure

* Ammonia as nitrogen and total Kjeldahl nitrogen were requested on the COC, but not reported in this data package. The ammonia as nitrogen and total Kjeldahl nitrogen results for all samples are reported in SDG L92224.

5.2.1 Overall Assessment

With two exceptions, data are considered usable for meeting project objectives with the qualifications noted in the following narrative. The non-detect nitrite as N results for samples STS-AMD-2011-EREF2 6-12 and STS-AMD-2011-EREF2 0-6 were analyzed 2x past the 48 hour holding time criterion and were qualified as unusable (R) due to holding time exceedance. The data qualifiers and associated bias codes were hand-entered on the sample reporting forms. The sample reporting forms are included in Appendix A.

5.2.2 COC and Sample Receipt Documentation

The samples were shipped to ACZ under COC. The laboratory sample custodian noted that all samples were received intact.

The cooler temperatures upon receipt ranged from 8°C - 11°C above the required ≤6°C temperature criterion. As the samples were air-dried and sieved upon receipt; the elevated cooler temperatures are not considered to affect the usability of the results to meet projects. Data qualification was not considered necessary.

Ammonia as nitrogen and total Kjeldahl nitrogen were requested on the COC, but not reported in this data package. The ammonia as nitrogen and total Kjeldahl nitrogen results for all samples are reported in SDG L92224. Further action was not necessary.

The field IDs for numerous samples were truncated on the data sheets due to laboratory software limitations. The datasheets were updated to include the depths and reflect the proper nomenclature. Further action was not necessary.

5.2.3 Holding Times

With the exceptions below, the samples were prepared and analyzed within the required holding time limits.

The total carbon and total organic carbon results for all samples were analyzed 5-8 days outside of the 28 day holding time requirement. Therefore, the total carbon and total organic carbon results for all samples were qualified as estimated (J HT-L) to reflect the potential low bias.

The nitrite as N results for all samples were analyzed >2x the 48 hour holding time requirement. The detected nitrite as N results were qualified as estimated (J HT-L) and the non-detect nitrite as N results for samples STS-AMD-2011-EREF2 0-6 and STS-AMD-2011-EREF2 6-12 were qualified as unusable (R).

The nitrate/ nitrite as N results for all samples were analyzed 5-8 days outside of the 28 day holding time requirement. The nitrite/ nitrate as N results were qualified as estimated (J HT-L) to reflect the potential low bias.

As the nitrate as N results were calculated from the nitrite as N and nitrate/ nitrite as N results, the detected nitrate as N results were qualified as estimated (J HT-L) to reflect the potential low bias.

The holding time criterion of 2 days for pH analysis was exceeded for all the samples in this data package. The pH results for the samples were qualified as estimated (J HT-L) to reflect the potential low bias.

5.2.4 Method Blanks, Calibration Blanks, and Rinsate Blanks

Method/ Calibration Blanks

With the exceptions noted below, target analytes were not detected in the method or calibration blanks.

Blank	Analyte	Concentration	Data Qualification
WG313308			
MB	Total Calcium	22 mg/Kg	None. The associated sample listed analytical results were reported at concentrations >5x the blank contamination.
CCB02		0.21 mg/L*	
CCB01	Total Copper	0.025 mg/L*	
CCB03	Total Potassium	0.57 mg/L*	
WG313352			
MB	Total Copper	3.5 mg/Kg	None. The associated sample listed analytical results were reported at concentrations >5x the blank contamination.
CCB01		0.033 mg/L*	
CCB02		0.067 mg/L*	

\> – Greater Than
mg/Kg – Milligrams per kilogram
CCB – Continuing Calibration Blank
mg/L – Milligrams per Liter
MB – Method Blank
* The CCB concentration was converted from mg/L to mg/Kg by multiplying by 100.

Rinsate Blanks

A rinsate blank sample was not reported in this data package. Detections in rinsate blanks are discussed in Section 6.

5.2.5 Duplicate Sample Analysis

Method duplicate results are discussed in Section 6.

5.2.6 Matrix Spike Analysis

Matrix spike and matrix spike duplicate results are discussed in Section 6.

5.2.7 Serial Dilution

A serial dilution is required for Method 6010B for all sample delivery groups, but is only pertinent to analytes present at greater than 50x the detection limit. Serial dilutions were conducted on samples STS-AMD-2011-WREF2 0-6, STS-AMD-2011-WREF1 12-18, and STS-AMD-2011-NREF2 0-6. The applicable percent differences were within ±10% for the 1:5 dilution of the sample. Data qualification was not necessary.

5.2.8 Post Digestion Spike

For Method 6010B, a post digestion spike is required when the matrix spike recovery is outside of the acceptance limits of 75-125%. As the matrix spike recoveries were within the QAP acceptance limits of 75-125%, a post digestion spike was not necessary.

5.2.9 Field Duplicate

A field duplicate pair was not reported in this data package. Field duplicate results are discussed in Section 6.

5.2.10 Internal Standards (ICP-MS Methods 6020 or 200.8)

The samples in this data package were not analyzed for metals by Methods 6020 or 200.8. Further action was not necessary.

5.2.11 ICP Interference Check Standards (ICS)

The ICS AB solutions were analyzed at the proper frequency. The target analytes were recovered within the acceptance range of 80-120% in the ICS AB solution. Interferent elements (e.g. aluminum, calcium, and iron) were present in some or all of the samples in this data package at concentrations approaching the interfering element concentrations for the ICSAB solution. As the laboratory did not analyze the ICSA solution, those samples with interferent elements present could not be evaluated for positive and negative biases suggested by the ICSA.

5.3 ACZ Data Package L91360

Data package L91360 contained the analytical results for eight soil samples and two field duplicates. The table below lists the laboratory IDs, corresponding field IDs, and QC designations.

Laboratory ID	Field ID	Analyses	QC Designation	Depth
L91360-01	STS-CG-2011-31	Total Copper, Percent Solids	MS/MSD – Total Copper MD – Percent Solids	-
L91360-02	DUP5		FD to STS-CG-2011-28	-
L91360-03	STS-CG-2011-33			-
L91360-04	STS-CG-2011-34			-
L91360-05	STS-CG-2011-35		SD – Total Copper	-
L91360-06	STS-CG-2011-36			-
L91360-07	DUP6		FD to STS-PCUG-2011-7	-
L91360-8	STS-CG-2011-38			-
L91360-09	STS-CG-2011-39			-
L91360-10	STS-CG-2011-40			-

FD – Field Duplicate
ID – Identification
MD – Method Duplicate
- no depth given
MS/MSD – Matrix Spike/ Matrix Spike Duplicate
QC – Quality Control
SD – Serial Dilution

5.3.1 Overall Assessment

The data are considered usable for meeting project objectives with the qualifications noted in the following narrative. The data qualifiers and associated bias codes were hand-entered on the sample reporting forms. The sample reporting forms are included in Appendix A.

5.3.2 COC and Sample Receipt Documentation

The samples were shipped to ACZ under COC. The laboratory sample custodian noted that all samples were received intact.

The cooler temperatures upon receipt ranged from 10.4°C – 13.6°C above the required ≤6°C temperature criterion. As the samples were air-dried and sieved upon receipt; the elevated cooler temperatures are not considered to affect the usability of the results to meet projects. Data qualification was not considered necessary.

5.3.3 Holding Times

The samples were prepared and analyzed within the required holding time limits. Data qualification was not necessary.

5.3.4 Method Blanks, Calibration Blanks, and Rinsate Blanks

Method/ Calibration Blanks

With the exception noted below, target analytes were not detected in the method and calibration blanks.

Blank	Analyte	Concentration	Data Qualification
WG313584			
MB	Total Copper	1.4 mg/Kg	None. The associated sample total copper sample results were reported at concentrations >5x the blank contamination.

> – Greater Than
mg/Kg – Milligrams per kilogram
MB – Method Blank

Rinsate Blanks

A rinsate blank sample was not reported in this data package. Detections in rinsate blanks are discussed in Section 6.

5.3.5 Duplicate Sample Analysis

Method duplicate results are discussed in Section 6.

5.3.6 Matrix Spike Analysis

Matrix spike and matrix spike duplicate results are discussed in Section 6.

5.3.7 Serial Dilution

A serial dilution is required for Method 6010B for all sample delivery groups, but is only pertinent to analytes present at greater than 50x the detection limit. A serial dilution was conducted on sample STS-CG-2011-35. The applicable percent differences were within ±10% for the 1:5 dilution of the sample. Data qualification was not necessary.

5.3.8 Post Digestion Spike

For Method 6010B, a post digestion spike is required when the matrix spike recovery is outside of the acceptance limits of 75-125%. As the matrix spike recoveries were within the QAP acceptance limits of 75-125%, a post digestion spike was not necessary.

5.3.9 Field Duplicate

Two field duplicates, DUP5 and DUP6, were reported in this data package. Field duplicate results are discussed in Section 6.

5.3.10 Internal Standards (ICP-MS Methods 6020 or 200.8)

The samples in this data package were not analyzed for metals by Methods 6020 or 200.8. Further action was not necessary.

5.3.11 ICP Interference Check Standards (ICS)

The ICS AB solutions were analyzed at the proper frequency. The target analytes were recovered within the acceptance range of 80-120% in the ICS AB solution. Interferent elements (e.g. aluminum, calcium, and iron) were present in some or all of the samples in this data package at concentrations approaching the interfering element concentrations for the ICSAB solution. As the laboratory did not analyze the ICSA solution, those samples with interferent elements present could not be evaluated for positive and negative biases suggested by the ICSA.

5.4 ACZ Data Package L91219

Data package L91219 contained the analytical results for four field duplicate soil samples. The table below lists the laboratory IDs, corresponding field IDs, and QC designations.

Laboratory ID	Field ID	Analyses	QC Designation	Depth (Inches)
L91219-01	DUP13	Total Calcium, Copper (SPLP), Total Copper, Total Potassium, TC, TOC, pH, Percent Solids, Nitrate as N, Nitrate/Nitrite as N, Nitrite as N	MS/MSD – Total Calcium, Total Copper, Total Potassium MD – TC, TOC, Copper (SPLP), Nitrite/ Nitrate as N, Nitrite as N, pH FD to STS-AMD-2011-W3 0-6	0-6
L91219-02	DUP14		SD – Copper (SPLP) MS – Nitrate/Nitrite as N, Nitrite as N FD to STS-AMD-2011-NREF1 0-6	0-6
L91219-03	DUP15		FD to STS-AND-2011-E1 0-6	0-6
L91219-04	DUP16		SD – Total Calcium, Total Copper, Total Potassium MS/MSD – Copper (SPLP) MD – Percent Solids FD to STS-AMD-2011-NE1 0-6	0-6

FD – Field Duplicate
MD – Method Duplicate
QC – Quality Control
TC – Total Carbon
TOC – Total Organic Carbon
ID – Identification
MS/MSD – Matrix Spike/ Matrix Spike Duplicate
SD – Serial Dilution
SPLP – Synthetic Precipitation Leaching Procedure

5.4.1 Overall Assessment

With two exceptions, data are considered usable for meeting project objectives with the qualifications noted in the following narrative. The non-detect nitrite as N results for samples DUP14 and DUP16 were analyzed >2x the 48 hour holding time criterion and were therefore qualified as unusable (R) due to holding time exceedance. The data qualifiers and associated bias codes were hand-entered on the sample reporting forms. The sample reporting forms are included in Appendix A.

5.4.2 COC and Sample Receipt Documentation

The samples were shipped to ACZ under COC. The laboratory sample custodian noted that all samples were received intact.

The cooler temperatures upon receipt ranged from 10°C – 12°C above the required ≤6°C temperature criterion. As the samples were air-dried and sieved upon receipt; the elevated cooler temperatures are not considered to affect the usability of the results to meet projects. Data qualification was not considered necessary.

5.4.3 Holding Times

With the exceptions below, the samples were prepared and analyzed within the required holding time limits.

The total carbon and total organic carbon results for all samples were analyzed 8 days outside of the 28 day holding time requirement. Therefore, the total carbon and total organic carbon results were qualified as estimated (J HT-L) to reflect the potential low bias.

The nitrite as N results for all samples were analyzed >2x the 48 hour holding time requirement. The detected nitrite as N results for were qualified as estimated (J HT-L) and the non-detect nitrite as N results for samples DUP14 and DUP16 were qualified as unusable (R).

The nitrite/ nitrate as N results for all samples were analyzed 9 days outside of the 28 day holding time requirement. The nitrite/ nitrate as N results for all samples were qualified as estimated (J HT-L) to reflect the potential low bias.

As the nitrate as N results were calculated from the nitrite as N and nitrate/ nitrite as N results, the detected nitrate as N results for all samples were qualified as estimated (J HT-L) to reflect the potential low bias.

The holding time criterion of 2 days for pH analysis was exceeded for all the samples in this data package. The pH results for the samples were qualified as estimated (J HT-L) to reflect the potential low bias.

5.4.4 Method Blanks, Calibration Blanks, and Rinsate Blanks

Method/ Calibration Blanks

With the exception noted below, target analytes were not detected in the method and calibration blanks.

Blank	Analyte	Concentration	Data Qualification
WG313470			
MB	Nitrate/ Nitrite as N	0.1 mg/Kg	None. The associated sample nitrate/ nitrite as N sample results were reported at concentrations >5x the blank contamination.

> – Greater Than
MB – Method Blank
mg/Kg – Milligrams per kilogram
N – Nitrogen

Rinsate Blanks

A rinsate blank sample was not reported in this data package. Detections in rinsate blanks are discussed in Section 6.

5.4.5 Duplicate Sample Analysis

Method duplicate results are discussed in Section 6.

5.4.6 Matrix Spike Analysis

Matrix spike and matrix spike duplicate results are discussed in Section 6.

5.4.7 Serial Dilution

A serial dilution is required for Method 6010B for all sample delivery groups, but is only pertinent to analytes present at greater than 50x the detection limit. Serial dilutions were conducted on samples DUP14 (SPLP copper) and DUP16 (total calcium, total copper, and total potassium). With the exceptions listed below, the applicable percent differences were within ±10% for the 1:5 dilution of the sample.

Associated Sample	Analyte	%D	Qualification
DUP16			
All Samples	Total Calcium	14.7	The detected results for the listed analytes in the associated samples were qualified as estimated (J SD-L) to reflect the potential low bias. The bias is considered to be low as the native sample concentration is less than the diluted result.
	Total Copper	13.1	
	Total Potassium	14.2	

%D – Percent Difference
L – Low Bias
J – Estimated
SD – Serial Dilution

5.4.8 Post Digestion Spike

For Method 6010B, a post digestion spike is required when the matrix spike recovery is outside of the acceptance limits of 75-125%. As the matrix spike recoveries were within the QAP acceptance limits of 75-125%, a post digestion spike was not necessary.

5.4.9 Field Duplicate

Four field duplicate, DUP13, DUP14, DUP15, and DUP16, were reported in this data package. Field duplicate results are discussed in Section 6.

5.4.10 Internal Standards (ICP-MS Methods 6020 or 200.8)

The samples in this data package were not analyzed for metals by Methods 6020 or 200.8. Further action was not necessary.

5.4.11 ICP Interference Check Standards (ICS)

The ICS AB solutions were analyzed at the proper frequency. The target analytes were recovered within the acceptance range of 80-120% in the ICS AB solution. Interferent elements (e.g. aluminum, calcium, and iron) were present in some or all of the samples in this data package at concentrations approaching the interfering element concentrations for the ICSAB solution. As the laboratory did not analyze the ICSA solution, those samples with interferent elements present could not be evaluated for positive and negative biases suggested by the ICSA.

5.5 ACZ Data Package L91358

Data package L91358 contained the analytical results for fourteen soil samples and two field duplicate soil samples. The table below lists the laboratory IDs, corresponding field IDs, and QC designations.

Laboratory ID	Field ID	Analyses	QC Designation	Depth (Inches)
L91358-01	STS-PH-2011-FID37	Total Copper, ABA Parameters	MS/MSD – Total Copper MD – Sulfur Organic Residual, Sulfur Pyritic Sulfide, Sulfur Sulfate, Total Sulfur, Total Sulfur minus Sulfate	-
L91358-02	STS-PCUG-2011-40	Total Copper, pH, Percent Solids		-
L91358-03	STS-PH-2011-FID101	Total Copper, ABA Parameters		-
L91358-04	STS-PH-2011-REFPLOT3			-
L91358-05	STS-PH-2011-REFPLOT4		SD – Total Copper	-
L91358-06	DUP11		FD to STS-PH-2011-FID 101	-
L91358-07	STS-PH-2011-FID105			-
L91358-08	DUP12		FD to STS-PH-2011-FID22	-
L91358-09	STS-PH-2011-REFPLOT1			-
L91358-10	STS-PH-2011-REFPLOT2			-
L91358-11	STS-PH-2011-FID22			-
L91358-12	STS-PH-2011-FID10			-
L91358-13	STS-PH-2011-FID15		MD - Percent Solids	-
L91358-14	STS-PH-2011-FID16			-

Laboratory ID	Field ID	Analyses	QC Designation	Depth (Inches)
L91358-15	STS-PH-2011-FID17			-
L91358-16	STS-PH-2011-FID18			-

ABA – Acid Base Accounting Overburden Analysis
ID – Identification
MS/MSD – Matrix Spike/ Matrix Spike Duplicate
SD – Serial Dilution
FD – Field Duplicate
MD – Method Duplicate
QC – Quality Control
- no depth given

ABA parameters include: Acid Generation, Acid Neutralization, Acid-Base Potential, Neutralization Potential as $CaCO_3$, pH, Percent Solids, Organic Sulfur, Sulfur Pyritic Sulfide, Sulfur Sulfate, Total Sulfur, and Total Sulfur minus Sulfate.

5.5.1 Overall Assessment

Data are considered usable for meeting project objectives with the qualifications noted in the following narrative. The data qualifiers and associated bias codes were hand-entered on the sample reporting forms. The sample reporting forms are included in Appendix A.

5.5.2 COC and Sample Receipt Documentation

The samples were shipped to ACZ under COC. The laboratory sample custodian noted that all samples were received intact.

The cooler temperatures upon receipt ranged from 7.2°C – 11.6°C above the required ≤6°C temperature criterion. As the samples were air-dried and sieved upon receipt; the elevated cooler temperatures are not considered to affect the usability of the results to meet projects. Data qualification was not considered necessary.

5.5.3 Holding Times

With the exceptions below, the samples were prepared and analyzed within the required holding time limits.

The holding time criterion of 2 days for pH analysis was exceeded for sample STS-PCUG-2011-40. The pH result for this sample was qualified as estimated (J HT-L) to reflect the potential low bias.

5.5.4 Method Blanks, Calibration Blanks, and Rinsate Blanks

Method/ Calibration Blanks

Target analytes were not detected in the method or calibration blanks.

Rinsate Blanks

A rinsate blank sample was not reported in this data package. Detections in rinsate blanks are discussed in Section 6.

5.5.5 Duplicate Sample Analysis

Method duplicate results are discussed in Section 6.

5.5.6 Matrix Spike Analysis

Matrix spike and matrix spike duplicate results are discussed in Section 6.

5.5.7 Serial Dilution

A serial dilution is required for Method 6010B for all sample delivery groups, but is only pertinent to analytes present at greater than 50x the detection limit. A serial dilution was conducted on sample STS-PH-2011-REFPLOT4. The applicable percent differences were within ±10% for the 1:5 dilution of the sample. Data qualification was not necessary.

5.5.8 Post Digestion Spike

For Method 6010B, a post digestion spike is required when the matrix spike recovery is outside of the acceptance limits of 75-125%. As the matrix spike recoveries were within the QAP acceptance limits of 75-125%, a post digestion spike was not necessary.

5.5.9 Field Duplicate

Two field duplicates, DUP11 and DUP12, were reported in this data package. Field duplicate results are discussed in Section 6.

5.5.10 Internal Standards (ICP-MS Methods 6020 or 200.8)

The samples in this data package were not analyzed for metals by Methods 6020 or 200.8. Further action was not necessary.

5.5.11 ICP Interference Check Standards (ICS)

The ICS AB solutions were analyzed at the proper frequency. The target analytes were recovered within the acceptance range of 80-120% in the ICS AB solution.

Interferent elements (e.g. aluminum, calcium, and iron) were present in some or all of the samples in this data package at concentrations approaching the interfering element concentrations for the ICSAB solution. As the laboratory did not analyze the ICSA solution, those samples with interferent elements present could not be evaluated for positive and negative biases suggested by the ICSA.

5.6 ACZ Data Package L91357

Data package L91357 contained the analytical results for twenty soil samples. The table below lists the laboratory IDs, corresponding field IDs, and QC designations.

Laboratory ID	Field ID	Analyses	QC Designation	Depth
L91357-01	STS-PCUG-2011-11	Total Copper, pH, percent solids	MS/MSD - Total Copper	-
L91357-02	STS-PCUG-2011-12			-
L91357-03	STS-PCUG-2011-13			-
L91357-04	STS-PCUG-2011-14			-
L91357-05	STS-PCUG-2011-41			-
L91357-06	STS-PCUG-2011-16			-
L91357-07	STS-PCUG-2011-17			-
L91357-08	STS-PCUG-2011-18			-
L91357-09	STS-PCUG-2011-19			-
L91357-10	STS-PCUG-2011-20			-
L91357-11	STS-PCUG-2011-21	Total Copper, percent solids		-
L91357-12	STS-PCUG-2011-09			-
L91357-13	STS-PCUG-2011-10		SD – Total Copper	-
L91357-14	STS-PCUG-2011-24			-
L91357-15	STS-PCUG-2011-25			-
L91357-16	STS-PCUG-2011-26			-
L91357-17	STS-PCUG-2011-27			-
L91357-18	STS-PCUG-2011-28			-
L91357-19	STS-PCUG-2011-29			-
L91357-20	STS-PCUG-2011-30		MD – percent solids	-

ID – Identification
MD – Method Duplicate
MS/MSD – Matrix Spike/ Matrix Spike Duplicate
QC – Quality Control
SD – Serial Dilution
- no depth given

5.6.1 Overall Assessment

The data are considered usable for meeting project objectives with the qualifications noted in the following narrative. The data qualifiers and associated bias codes were hand-entered on the sample reporting forms. The sample reporting forms are included in Appendix A.

5.6.2 COC and Sample Receipt Documentation

The samples were shipped to ACZ under COC. The laboratory sample custodian noted that all samples were received intact.

The cooler temperatures upon receipt ranged from 9.2°C – 13.6°C above the required ≤6°C temperature criterion. As the samples were air-dried and sieved upon receipt; the elevated cooler temperatures are not considered to affect the usability of the results to meet projects. Data qualification was not considered necessary.

5.6.3 Holding Times

With the exceptions below, the samples were prepared and analyzed within the required holding time limits.

The holding time criterion of 2 days for pH analysis was exceeded for all samples in this data package. The pH results for these samples were qualified as estimated (J HT-L) to reflect the potential low bias.

5.6.4 Method Blanks, Calibration Blanks, and Rinsate Blanks

Method/ Calibration Blanks

Target analytes were not detected in the method or calibration blanks.

Rinsate Blanks

A rinsate blank sample was not reported in this data package. Detections in rinsate blanks are discussed in Section 6.

5.6.5 Duplicate Sample Analysis

Method duplicate results are discussed in Section 6.

5.6.6 Matrix Spike Analysis

Matrix spike and matrix spike duplicate results are discussed in Section 6.

5.6.7 Serial Dilution

A serial dilution is required for Method 6010B for all sample delivery groups, but is only pertinent to analytes present at greater than 50x the detection limit. A serial dilution was conducted on sample STS-PCUG-2011-10. The applicable percent differences were within ±10% for the 1:5 dilution of the sample. Data qualification was not necessary.

5.6.8 Post Digestion Spike

For Method 6010B, a post digestion spike is required when the matrix spike recovery is outside of the acceptance limits of 75-125%. As the matrix spike recoveries were within the QAP acceptance limits of 75-125%, a post digestion spike was not necessary.

5.6.9 Field Duplicate

A field duplicate pair was not reported in this data package. Field duplicate results are discussed in Section 6.

5.6.10 Internal Standards (ICP-MS Methods 6020 or 200.8)

The samples in this data package were not analyzed for metals by Methods 6020 or 200.8. Further action was not necessary.

5.6.11 ICP Interference Check Standards (ICS)

The ICS AB solutions were analyzed at the proper frequency. The target analytes were recovered within the acceptance range of 80-120% in the ICS AB solution. Interferent elements (e.g. aluminum, calcium, and iron) were present in some or all of the samples in this data package at concentrations approaching the interfering element concentrations for the ICSAB solution. As the laboratory did not analyze the ICSA solution, those samples with interferent elements present could not be evaluated for positive and negative biases suggested by the ICSA.

5.7 ACZ Data Package L91355

Data package L91355 contained the analytical results for fourteen soil samples and six field duplicate soil samples. The table below lists the laboratory IDs, corresponding field IDs, and QC designations.

Laboratory ID	Field ID	Analyses	QC Designation	Depth
L91355-01	STS-PCUG-2011-21	Total Copper, pH, percent solids	MS/MSD - Total Copper MD – Percent Solids, pH	-
L91355-02	STS-PCUG-2011-22			-
L91355-03	STS-PCUG-2011-23			-
L91355-04	STS-PCUG-2011-24			-
L91355-05	STS-PCUG-2011-25			-
L91355-06	DUP1		FD to STS-PCUG-2011-19	-
L91355-07	DUP2		SD – Total Copper FD to STS-PCUG-2011-29	-
L91355-08	STS-PCUG-2011-28			-
L91355-09	STS-PCUG-2011-29			-
L91355-10	STS-PCUG-2011-30			-
L91355-11	DUP7	Total Copper, percent solids	FD to STS-CG-2011-43	-
L91355-12	STS-CG-2011-42			-
L91355-13	STS-CG-2011-43			-
L91355-14	DUP8		FD to STS-CG-2011-10	-
L91355-15	STS-CG-2011-45			-
L91355-16	STS-CG-2011-46			-
L91355-17	DUP9		FD to STS-CG-2011-42	-
L91355-18	DUP3		FD to STS-PCUG-2011-14	-
L91355-19	STS-CG-2011-49			-
L91355-20	STS-CG-2011-50			-

FD – Field Duplicate
ID – Identification
MD – Method Duplicate
- no depth given
MS/MSD – Matrix Spike/ Matrix Spike Duplicate
QC – Quality Control
SD – Serial Dilution

5.7.1 Overall Assessment

The data are considered usable for meeting project objectives with the qualifications noted in the following narrative. The data qualifiers and associated bias codes were hand-entered on the sample reporting forms. The sample reporting forms are included in Appendix A.

5.7.2 COC and Sample Receipt Documentation

The samples were shipped to ACZ under COC. The laboratory sample custodian noted that all samples were received intact.

The cooler temperatures upon receipt ranged from 9.2°C – 13.6°C above the required ≤6°C temperature criterion. As the samples were air-dried and sieved upon receipt; the elevated cooler temperatures are not considered to affect the usability of the results to meet projects. Data qualification was not considered necessary.

5.7.3 Holding Times

With the exceptions below, the samples were prepared and analyzed within the required holding time limits.

The holding time criterion of 2 days for pH analysis was exceeded for all samples in this data package. The pH results for these samples were qualified as estimated (J HT-L) to reflect the potential low bias.

5.7.4 Method Blanks, Calibration Blanks, and Rinsate Blanks

Method/ Calibration Blanks

Target analytes were not detected in the method and calibration blanks.

Rinsate Blanks

A rinsate blank sample was not reported in this data package. Detections in rinsate blanks are discussed in Section 6.

5.7.5 Duplicate Sample Analysis

Method duplicate results are discussed in Section 6.

5.7.6 Matrix Spike Analysis

Matrix spike and matrix spike duplicate results are discussed in Section 6.

5.7.7 Serial Dilution

A serial dilution is required for Method 6010B for all sample delivery groups, but is only pertinent to analytes present at greater than 50x the detection limit. A serial dilution was conducted on sample DUP2. The applicable percent differences were within ±10% for the 1:5 dilution of the sample. Data qualification was not necessary.

5.7.8 Post Digestion Spike

For Method 6010B, a post digestion spike is required when the matrix spike recovery is outside of the acceptance limits of 75-125%. As the matrix spike recoveries were within the QAP acceptance limits of 75-125%, a post digestion spike was not necessary.

5.7.9 Field Duplicate

A field duplicate pair was not reported in this data package. Field duplicate results are discussed in Section 6.

5.7.10 Internal Standards (ICP-MS Methods 6020 or 200.8)

The samples in this data package were not analyzed for metals by Methods 6020 or 200.8. Further action was not necessary.

5.7.11 ICP Interference Check Standards (ICS)

The ICS AB solutions were analyzed at the proper frequency. The target analytes were recovered within the acceptance range of 80-120% in the ICS AB solution. Interferent elements (e.g. aluminum, calcium, and iron) were present in some or all of the samples in this data package at concentrations approaching the interfering element concentrations for the ICSAB solution. As the laboratory did not analyze the ICSA solution, those samples with interferent elements present could not be evaluated for positive and negative biases suggested by the ICSA.

5.8 ACZ Data Package L91220

Data package L91220 contained the analytical results for twenty soil samples. The table below lists the laboratory IDs, corresponding field IDs, and QC designations.

Laboratory ID	Field ID	Analyses	QC Designation	Depth (Inches)
L91220-01	STS-AMD-2011-W1 0-6	Total Calcium, Copper (SPLP), Total Copper, Total Potassium, TC, TOC, pH, Percent Solids, Nitrate as N, Nitrate/Nitrite as N, Nitrite as N,	MD – TC, TOC, Nitrate/ Nitrite as N, Nitrite as N, pH MS/MSD – Copper (SPLP)	0-6
L91220-02	STS-AMD-2011-W2 0-6		MS - Nitrate/ Nitrite as N, Nitrite as N	0-6
L91220-03	STS-AMD-2011-W3 0-6			6-12
L91220-04	STS-AMD-2011-W1 6-12			6-12
L91220-05	STS-AMD-2011-W2 12-18			12-18

Laboratory ID	Field ID	Analyses	QC Designation	Depth (Inches)
L91220-06	STS-AMD-2011-W3 12-18	Ammonia as N*, Total Kjeldahl Nitrogen*		12-18
L91220-07	STS-AMD-2011-N1 0-6		SD – Copper (SPLP)	0-6
L91220-08	STS-AMD-2011-N2 0-6			0-6
L91220-09	STS-AMD-2011-N3 0-6			0-6
L91220-10	STS-AMD-2011-N1 18-24		SD – Total Calcium, Total Copper, Total Potassium	18-24
L91220-11	STS-AMD-2011-N2 18-24			18-24
L91220-12	STS-AMD-2011-N3 18-24			18-24
L91220-13	STS-AMD-2011-NE1 0-6			0-6
L91220-14	STS-AMD-2011-NE2 0-6			0-6
L91220-15	STS-AMD-2011-NE3 0-6			0-6
L91220-16	STS-AMD-2011-NE1 18-24			18-24
L91220-17	STS-AMD-2011-NE2 18-24			18-24
L91220-18	STS-AMD-2011-NE3 18-24		SD – Total Calcium, Total Copper	18-24
L91220-19	STS-AMD-2011-E1 0-6			0-6
L91220-20	STS-AMD-2011-E2 0-6		MS/MSD – Total Calcium, Total Copper, Total Potassium MD – Copper (SPLP), Percent Solids	0-6

ID – Identification
MS/MSD – Matrix Spike/ Matrix Spike Duplicate
SD – Serial Dilution
TOC – Total Organic Carbon
MD – Method Duplicate
QC – Quality Control
TC – Total Carbon
SPLP – Synthetic Precipitation Leaching Procedure

* Ammonia as nitrogen and total Kjeldahl nitrogen were requested on the COC, but not reported in this data package. The ammonia as nitrogen and total Kjeldahl nitrogen results for all samples are reported in SDG L92223.

5.8.1 Overall Assessment

Data are considered usable for meeting project objectives with the qualifications noted in the following narrative. The data qualifiers and associated bias codes were hand-entered on the sample reporting forms. The sample reporting forms are included in Appendix A.

5.8.2 COC and Sample Receipt Documentation

The samples were shipped to ACZ under COC. The laboratory sample custodian noted that all samples were received intact.

The cooler temperatures upon receipt ranged from 11.6°C – 13.0°C above the required ≤6°C temperature criterion. As the samples were air-dried and sieved upon receipt; the elevated cooler temperatures are not considered to affect the usability of the results to meet projects. Data qualification was not considered necessary.

Ammonia as nitrogen and total Kjeldahl nitrogen were requested on the COC, but not reported in this data package. The ammonia as nitrogen and total Kjeldahl nitrogen results for all samples are reported in SDG L92223. Further action was not necessary.

5.8.3 Holding Times

With the exceptions below, the samples were prepared and analyzed within the required holding time limits.

The total carbon and total organic carbon results for all samples were analyzed 6-8 days outside of the 28 day holding time requirement. The total carbon and total organic carbon results for all samples were qualified as estimated (J HT-L) to reflect the potential low bias.

The nitrite as N results for all samples were analyzed >2x the 48 hour holding time requirement. The detected nitrite as N results for all samples were qualified as estimated (J HT-L) to reflect the potential low bias. No nitrite as N results were reported as non-detect.

The nitrite/ nitrate as N results for all samples were analyzed 6-9 days outside of the 28 day holding time requirement. The nitrite/ nitrate as N results for all samples were qualified as estimated (J HT-L) to reflect the potential low bias.

As the nitrate as N results were calculated from the nitrite as N and nitrate/ nitrite as N results, the detected nitrate as N results for all samples were qualified as estimated (J HT-L) to reflect the potential low bias.

The holding time criterion of 2 days for pH analysis was exceeded for all samples in this data package. The pH results for these samples were qualified as estimated (J HT-L) to reflect the potential low bias.

5.8.4 Method Blanks, Calibration Blanks, and Rinsate Blanks

Method/ Calibration Blanks

With the exceptions noted below, target analytes were not detected in the method or calibration blanks.

Blank	Analyte	Concentration*	Data Qualification
WG313324			
CCB01	Total Calcium	0.34 mg/L*	None. The associated sample listed analytical results were reported at concentrations >5x the blank contamination.
CCB01	Total Copper	0.035 mg/L*	
CCB02		0.052 mg/L*	
CCB03		0.046 mg/L*	
CCB01	Total Potassium	0.42 mg/L*	

> – Greater Than
CCB – Continuing Calibration Blank
mg/L – Milligrams per Liter
* The CCB concentration was converted from mg/L to mg/Kg by multiplying by 100.

Rinsate Blanks

A rinsate blank sample was not reported in this data package. Detections in rinsate blanks are discussed in Section 6.

5.8.5 Duplicate Sample Analysis

Method duplicate results are discussed in Section 6.

5.8.6 Matrix Spike Analysis

Matrix spike and matrix spike duplicate results are discussed in Section 6.

5.8.7 Serial Dilution

A serial dilution is required for Method 6010B for all sample delivery groups, but is only pertinent to analytes present at greater than 50x the detection limit. Serial dilutions were conducted on samples STS-AMD-2011-N1 0-6 (SPLP copper), STS-AMD-2011-N1 18-24 (total calcium, total copper, and total potassium), and STS-AMD-2011-NE3 18-24 (total calcium and total copper). With the exceptions listed in the table below, the applicable percent differences were within ±10% for the 1:5 dilution of the sample.

Associated Sample	Analyte	%D	Qualification
STS-AMD-2011-NE3 18-24			
Batch WG313367 Sample STS-AMD-2011-W2 12-18	Total Calcium	17.2	None. The total calcium result for the sample that the serial dilution was conducted on was not reported from this batch; therefore, data qualification was not considered necessary.
STS-AMD-2011-N1 0-6			
Batch WG313042 All Samples	Copper (SPLP)	10.6	The detected results for the listed analytes in the associated samples were qualified as estimated (J SD-L) to reflect the potential low bias. The bias is considered to be low as the native sample concentration is less than the diluted result.

%D – Percent Difference   L – Low Bias
J – Estimated   SD – Serial Dilution

5.8.8 Post Digestion Spike

For Method 6010B, a post digestion spike is required when the matrix spike recovery is outside of the acceptance limits of 75-125%. As the matrix spike recoveries were within the QAP acceptance limits of 75-125%, a post digestion spike was not necessary.

5.8.9 Field Duplicate

A field duplicate pair was not reported in this data package. Field duplicate results are discussed in Section 6.

5.8.10 Internal Standards (ICP-MS Methods 6020 or 200.8)

The samples in this data package were not analyzed for metals by Methods 6020 or 200.8. Further action was not necessary.

5.8.11 ICP Interference Check Standards (ICS)

The ICS AB solutions were analyzed at the proper frequency. The target analytes were recovered within the acceptance range of 80-120% in the ICS AB solution. Interferent elements (e.g. aluminum, calcium, and iron) were present in some or all of the samples in this data package at concentrations approaching the interfering element concentrations for the ICSAB solution. As the laboratory did not analyze the ICSA solution, those samples with interferent elements present could not be evaluated for positive and negative biases suggested by the ICSA.

5.9 ACZ Data Package L91393

Data package L91393 contained the analytical results for eight rinsate blanks. The table below lists the laboratory IDs, corresponding field IDs, and QC designations.

Laboratory ID	Field ID	Analyses	QC Designation	Depth
L91393-01	RINSATE3	Total Copper	RB	NA
L91393-02	RINSATE4		RB	NA
L91393-03	RINSATE1		RB	NA
L91393-04	RINSATE5		RB	NA
L91393-05	RINSATE7		RB	NA
L91393-06	RINSATE8		RB	NA
L91393-07	RINSATE2		RB	NA
L91393-08	RINSATE6		RB	NA

ID – Identification
NA – Not applicable
QC – Quality Control
RB – Rinsate Blank

5.9.1 Overall Assessment

The data are considered usable for meeting project objectives with the qualifications noted in the following narrative. The data qualifiers and associated bias codes were hand-entered on the sample reporting forms. The sample reporting forms are included in Appendix A.

5.9.2 COC and Sample Receipt Documentation

The samples were shipped to ACZ under COC. The laboratory sample custodian noted that all samples were received intact.

The cooler temperatures upon receipt were within the required ≤6°C temperature criterion. Data qualification was not considered necessary.

It was noted in the case narrative that the copper (SPLP), total calcium, total potassium and total organic carbon analyses requested on the COC for all samples could not be performed due to insufficient volume submitted to the laboratory. Further action was not necessary.

5.9.3 Holding Times

The samples were prepared and analyzed within the required holding time limits. Data qualification was not necessary.

5.9.4 Method Blanks, Calibration Blanks, and Rinsate Blanks

Method/ Calibration Blanks

Target analytes were not detected in the method or calibration blanks.

Rinsate Blanks

Eight rinsate blank samples were reported in this data package. Detections in rinsate blanks are discussed in Section 6.

5.9.5 Duplicate Sample Analysis

Method duplicate results are discussed in Section 6.

5.9.6 Matrix Spike Analysis

Matrix spike and matrix spike duplicate results are discussed in Section 6.

5.9.7 Serial Dilution

A serial dilution is not required for Method 200.8. Further action was not necessary.

5.9.8 Post Digestion Spike

A post digestion spike is not required for Method 200.8. Further action was not necessary.

5.9.9 Field Duplicate

A field duplicate pair was not reported in this data package. Field duplicate results are discussed in Section 6.

5.9.10 Internal Standards (ICP-MS Method 200.8)

All internal standard recoveries were within the acceptance limits. Data qualification was not necessary.

5.9.11 ICP Interference Check Standards (ICS)

Method 200.8 does not require that an ICSA be analyzed. No further action was necessary.

5.9.12 Tune (ICPMS)

Method 200.8 does not require that an ICSA be analyzed. No further action was necessary.

5.10 ACZ Data Package L91526

Data package L91526 contained the analytical results for eighteen soil samples and two field duplicate soil samples. The table below lists the laboratory IDs, corresponding field IDs, and QC designations.

Laboratory ID	Field ID	Analyses	QC Designation	Depth (Inches)
L91526-01	STS-PCUG-2011-27	Total Copper, pH, Percent Solids	MS/MSD – Total Copper MD - pH	-
L91526-02	STS-PCUG-2011-31			-
L91526-03	DUP4		FD to STS-PCUG-2011-31	-
L91526-04	STS-PCUG-2011-5		SD – Total Copper	-
L91526-05	STS-PCUG-2011-6			-
L91526-06	STS-PCUG-2011-8			-
L91526-07	STS-PCUG-2011-9			-
L91526-08	STS-PCUG-2011-15			-
L91526-09	STS-PH-2011-FID106	Total Copper, ABA Parameters	MD – Neutralization Potential as $CaCO_3$, pH, Percent Solids, Sulfur Organic Residual, Sulfur Pyritic Sulfide, Sulfur Sulfate, Total Sulfur, Total Sulfur minus Sulfate	-
L91526-10	STS-PCUG-2011-32	Total Copper, pH, Percent Solids		-
L91526-11	STS-PCUG-2011-34			-
L91526-12	STS-PCUG-2011-35			-
L91526-13	STS-PCUG-2011-36			-
L91526-14	STS-PCUG-2011-37			-
L91526-15	DUP10		FD to STS-CG-2011-1	-
L91526-16	STS-CG-2011-44			-
L91526-17	STS-CG-2011-47			-
L91526-18	STS-CG-2011-48			-

Laboratory ID	Field ID	Analyses	QC Designation	Depth (Inches)
L91526-19	STS-CG-2011-16			-
L91526-20	STS-CG-2011-7		MD – Percent Solids	-

ABA – Acid Base Accounting Overburden Analysis
ID – Identification
MS/MSD – Matrix Spike/ Matrix Spike Duplicate
SD – Serial Dilution
FD – Field Duplicate
MD – Method Duplicate
QC – Quality Control
- no depth given

ABA parameters include: Acid Generation, Acid Neutralization, Acid-Base Potential, Neutralization Potential as $CaCO_3$, pH, Percent Solids, Sulfur HCL Residue, Sulfur HNO_3 Residue, Organic Sulfur, Sulfur Pyritic Sulfide, Sulfur Sulfate, Total Sulfur, and Total Sulfur minus Sulfate.

5.10.1 Overall Assessment

Data are considered usable for meeting project objectives with the qualifications noted in the following narrative. The data qualifiers and associated bias codes were hand-entered on the sample reporting forms. The sample reporting forms are included in Appendix A.

5.10.2 COC and Sample Receipt Documentation

The samples were shipped to ACZ under COC. The laboratory sample custodian noted that all samples were received intact.

The cooler temperatures upon receipt ranged from 6.4°C – 8.4°C above the required ≤6°C temperature criterion. As the samples were air-dried and sieved upon receipt; the elevated cooler temperatures are not considered to affect the usability of the results to meet projects. Data qualification was not considered necessary.

5.10.3 Holding Times

With the exceptions noted below, the samples were prepared and analyzed within the required holding time limits.

The holding time criterion of 2 days for pH analysis was exceeded for all samples in this data package. The pH results for these samples were qualified as estimated (J HT-L) to reflect the potential low bias.

5.10.4 Method Blanks, Calibration Blanks, and Rinsate Blanks

Method/ Calibration Blanks

With the exception noted below, target analytes were not detected in the method or calibration blanks.

Blank	Analyte	Concentration*	Data Qualification
WG314273			
CCB03	Total Copper	0.023 mg/L*	None. The associated listed analytical sample results were reported at concentrations >5x the blank contamination.

> – Greater Than
CCB – Continuing Calibration Blank
mg/L – Milligrams per Liter
* The CCB concentration was converted from mg/L to mg/Kg by multiplying by 100.

Rinsate Blanks

A rinsate blank sample was not reported in this data package. Detections in rinsate blanks are discussed in Section 6.

5.10.5 Duplicate Sample Analysis

Method duplicate results are discussed in Section 6.

5.10.6 Matrix Spike Analysis

Matrix spike and matrix spike duplicate results are discussed in Section 6.

5.10.7 Serial Dilution

A serial dilution is required for Method 6010B for all sample delivery groups, but is only pertinent to analytes present at greater than 50x the detection limit. A serial dilution was conducted on sample STS-PCUG-2011-5. The applicable percent differences were within ±10% for the 1:5 dilution of the sample. Data qualification was not necessary.

5.10.8 Post Digestion Spike

For Method 6010B, a post digestion spike is required when the matrix spike recovery is outside of the acceptance limits of 75-125%. As the matrix spike recoveries were within the QAP acceptance limits of 75-125%, a post digestion spike was not necessary.

5.10.9 Field Duplicate

Two field duplicates, DUP4 and DUP10, were reported in this data package. Field duplicate results are discussed in Section 6.

5.10.10 Internal Standards (ICP-MS Methods 6020 or 200.8)

The samples in this data package were not analyzed for metals by Methods 6020 or 200.8. Further action was not necessary.

5.10.11 ICP Interference Check Standards (ICS)

The ICS AB solutions were analyzed at the proper frequency. The target analytes were recovered within the acceptance range of 80-120% in the ICS AB solution. Interferent elements (e.g. aluminum, calcium, and iron) were present in some or all of the samples in this data package at concentrations approaching the interfering element concentrations for the ICSAB solution. As the laboratory did not analyze the ICSA solution, those samples with interferent elements present could not be evaluated for positive and negative biases suggested by the ICSA.

5.11 ACZ Data Package L91527

Data package L91527 contained the analytical results for twenty soil samples. The table below lists the laboratory IDs, corresponding field IDs, and QC designations.

Laboratory ID	Field ID	Analyses	QC Designation	Depth
L91527-01	STS-CG-2011-51	Total Copper, percent solids	MS/MSD - Total Copper	-
L91527-02	STS-CG-2011-52			-
L91527-03	STS-CG-2011-53			-
L91527-04	STS-CG-2011-54		SD – Total Copper	-
L91527-05	STS-CG-2011-55			-
L91527-06	STS-CG-2011-56			-
L91527-07	STS-CG-2011-57			-
L91527-08	STS-CG-2011-32			-
L91527-09	STS-CG-2011-37			-
L91527-10	STS-CG-2011-41			-
L91527-11	STS-CG-2011-1			-

Laboratory ID	Field ID	Analyses	QC Designation	Depth
L91527-12	STS-CG-2011-2			-
L91527-13	STS-CG-2011-3			-
L91527-14	STS-CG-2011-4			-
L91527-15	STS-CG-2011-5			-
L91527-16	STS-CG-2011-6			-
L91527-17	STS-CG-2011-18			-
L91527-18	STS-CG-2011-8			-
L91527-19	STS-CG-2011-22			-
L91527-20	STS-CG-2011-23		MD – percent solids	-

ID – Identification
MS/MSD – Matrix Spike/ Matrix Spike Duplicate
SD – Serial Dilution
MD – Method Duplicate
QC – Quality Control
- no depth given

5.11.1 Overall Assessment

The data are considered usable for meeting project objectives with the qualifications noted in the following narrative. The data qualifiers and associated bias codes were hand-entered on the sample reporting forms. The sample reporting forms are included in Appendix A.

5.11.2 COC and Sample Receipt Documentation

The samples were shipped to ACZ under COC. The laboratory sample custodian noted that all samples were received intact.

The cooler temperatures upon receipt ranged from 6.4°C – 7.5°C above the required ≤6°C temperature criterion. As the samples were air-dried and sieved upon receipt; the elevated cooler temperatures are not considered to affect the usability of the results to meet projects. Data qualification was not considered necessary.

5.11.3 Holding Times

The samples were prepared and analyzed within the required holding time limits. Data qualification was not necessary.

5.11.4 Method Blanks, Calibration Blanks, and Rinsate Blanks

Method/ Calibration Blanks

With the exceptions noted below, target analytes were not detected in the method or calibration blanks.

Blank	Analyte	Concentration*	Data Qualification
WG314276			
CCB02	Total Copper	0.013 mg/L*	None. The associated total copper sample results were reported at concentrations >5x the blank contamination.
CCB03		0.027 mg/L*	

> – Greater Than
CCB – Continuing Calibration Blank
mg/L – Milligrams per Liter
* The CCB concentration was converted from mg/L to mg/Kg by multiplying by 100.

Rinsate Blanks

A rinsate blank sample was not reported in this data package. Detections in rinsate blanks are discussed in Section 6.

5.11.5 Duplicate Sample Analysis

Method duplicate results are discussed in Section 6.

5.11.6 Matrix Spike Analysis

Matrix spike and matrix spike duplicate results are discussed in Section 6.

5.11.7 Serial Dilution

A serial dilution is required for Method 6010B for all sample delivery groups, but is only pertinent to analytes present at greater than 50x the detection limit. A serial dilution was conducted on sample STS-CG-2011-54. The applicable percent differences were within ±10% for the 1:5 dilution of the sample. Data qualification was not necessary.

5.11.8 Post Digestion Spike

For Method 6010B, a post digestion spike is required when the matrix spike recovery is outside of the acceptance limits of 75-125%. As the matrix spike recoveries were within the QAP acceptance limits of 75-125%, a post digestion spike was not necessary.

5.11.9 Field Duplicate

A field duplicate pair was not reported in this data package. Field duplicate results are discussed in Section 6.

5.11.10 Internal Standards (ICP-MS Methods 6020 or 200.8)

The samples in this data package were not analyzed for metals by Methods 6020 or 200.8. Further action was not necessary.

5.11.11 ICP Interference Check Standards (ICS)

The ICS AB solutions were analyzed at the proper frequency. The target analytes were recovered within the acceptance range of 80-120% in the ICS AB solution. Interferent elements (e.g. aluminum, calcium, and iron) were present in some or all of the samples in this data package at concentrations approaching the interfering element concentrations for the ICSAB solution. As the laboratory did not analyze the ICSA solution, those samples with interferent elements present could not be evaluated for positive and negative biases suggested by the ICSA.

5.12 ACZ Data Package L91528

Data package L91528 contained the analytical results for four soil samples. The table below lists the laboratory IDs, corresponding field IDs, and QC designations.

Laboratory ID	Field ID	Analyses	QC Designation	Depth (Inches)
L91528-01	STS-PH-2011-FID102	Total Copper, ABA Parameters	MS/MSD – Total Copper	-
L91528-02	STS-PH-2011-FID7			-
L91528-03	STS-PH-2011-FID8			-
L91528-04	STS-PH-2011-FID28		SD – Total Copper	-

ABA – Acid Base Accounting Overburden Analysis
ID – Identification
MS/MSD – Matrix Spike/ Matrix Spike Duplicate
QC – Quality Control
SD – Serial Dilution
- no depth given
ABA parameters include: Acid Generation, Acid Neutralization, Acid-Base Potential, Neutralization Potential as $CaCO_3$, pH, Percent Solids, Sulfur HCL Residue, Sulfur HNO_3 Residue, Organic Sulfur, Sulfur Pyritic Sulfide, Sulfur Sulfate, Total Sulfur, and Total Sulfur minus Sulfate.

5.12.1 Overall Assessment

Data are considered usable for meeting project objectives with the qualifications noted in the following narrative. The data qualifiers and associated bias codes were hand-entered on the sample reporting forms. The sample reporting forms are included in Appendix A.

5.12.2 COC and Sample Receipt Documentation

The samples were shipped to ACZ under COC. The laboratory sample custodian noted that all samples were received intact.

The cooler temperatures upon receipt ranged from 8.4°C – 8.5°C above the required ≤6°C temperature criterion. As the samples were air-dried and sieved upon receipt; the elevated cooler temperatures are not considered to affect the usability of the results to meet projects. Data qualification was not considered necessary.

5.12.3 Holding Times

With the exceptions below, the samples were prepared and analyzed within the required holding time limits.

The holding time criterion of 2 days for pH analysis was exceeded for all samples in this data package. The pH results for these samples were qualified as estimated (J HT-L) to reflect the potential low bias.

5.12.4 Method Blanks, Calibration Blanks, and Rinsate Blanks

Method/ Calibration Blanks

Target analytes were not detected in the method or calibration blanks.

Rinsate Blanks

A rinsate blank sample was not reported in this data package. Detections in rinsate blanks are discussed in Section 6.

5.12.5 Duplicate Sample Analysis

Method duplicate results are discussed in Section 6.

5.12.6 Matrix Spike Analysis

Matrix spike and matrix spike duplicate results are discussed in Section 6.

5.12.7 Serial Dilution

A serial dilution is required for Method 6010B for all sample delivery groups, but is only pertinent to analytes present at greater than 50x the detection limit. A serial dilution was conducted on sample STS-PH-2011-FID28 (Total Copper). With the exceptions listed in the table below, the applicable percent differences were within ±10% for the 1:5 dilution of the sample.

Associated Sample	Analyte	%D	Qualification
STS-PH-2011-FID28			
All Samples	Total Copper	11.8	The detected results for total copper in the associated samples were qualified as estimated (J SD-L) to reflect the potential low bias. The bias is considered to be low as the native sample concentration is less than the diluted result.

%D – Percent Difference
L – Low Bias
J – Estimated
SD – Serial Dilution

5.12.8 Post Digestion Spike

For Method 6010B, a post digestion spike is required when the matrix spike recovery is outside of the acceptance limits of 75-125%. As the matrix spike recoveries were within the QAP acceptance limits of 75-125%, a post digestion spike was not necessary.

5.12.9 Field Duplicate

A field duplicate pair was not reported in this data package. Field duplicate results are discussed in Section 6.

5.12.10 Internal Standards (ICP-MS Methods 6020 or 200.8)

The samples in this data package were not analyzed for metals by Methods 6020 or 200.8. Further action was not necessary.

5.12.11 ICP Interference Check Standards (ICS)

The ICS AB solutions were analyzed at the proper frequency. The target analytes were recovered within the acceptance range of 80-120% in the ICS AB solution. Interferent elements (e.g. aluminum, calcium, and iron) were present in some or all of the samples in this data package at concentrations approaching the interfering element concentrations for the ICSAB solution. As the laboratory did not analyze the ICSA solution, those samples with interferent elements present could not be evaluated for positive and negative biases suggested by the ICSA.

5.13 ACZ Data Package L92172

Data package L92172 contained the analytical results for eighteen soil samples. The table below lists the laboratory IDs, corresponding field IDs, and QC designations.

Laboratory ID	Field ID	Analyses	QC Designation	Depth (Inches)
L92172-01	STS-PH-2011-FID37	Sulfur HCL Residue, Sulfur HNO_3 Residue, Organic Sulfur, Sulfur Pyritic Sulfide, Sulfur Sulfate, Total Sulfur, Total Sulfur minus Sulfate	MD – Sulfur Organic Residual Mod, Sulfur Pyritic Sulfide, Sulfur Sulfate, Total Sulfur, Total Sulfur minus Sulfate	-
L92172-02	STS-PH-2011-FID101			-
L92172-03	STS-PH-2011-REFPLOT3			-
L92172-04	STS-PH-2011-REFPLOT4			-
L92172-05	STS-PH-2011-FID105			-
L92172-06	STS-PH-2011-REFPLOT1			-
L92172-07	STS-PH-2011-REFPLOT2			-
L92172-08	STS-PH-2011-FID22			-
L92172-09	STS-PH-2011-FID10			-
L92172-10	STS-PH-2011-FID15			-
L92172-11	STS-PH-2011-FID16			-
L92172-12	STS-PH-2011-FID17			-
L92172-13	STS-PH-2011-FID18			-
L92172-14	STS-PH-2011-FID106			-
L92172-15	STS-PH-2011-FID102			-
L92172-16	STS-PH-2011-FID7			-
L92172-17	STS-PH-2011-FID8			-
L92172-18	STS-PH-2011-FID28			-

ID – Identification
MD – Method Duplicate
QC – Quality Control
- no depth given

5.13.1 Overall Assessment

Data are considered usable for meeting project objectives with the qualifications noted in the following narrative. The data qualifiers and associated bias codes were hand-entered on the sample reporting forms. The sample reporting forms are included in Appendix A.

5.13.2 COC and Sample Receipt Documentation

The samples were shipped to ACZ under COC. The laboratory sample custodian noted that all samples were received intact.

The cooler temperatures upon receipt ranged from 9.2°C – 13.6°C above the required ≤6°C temperature criterion. As the samples were air-dried and sieved upon receipt; the elevated cooler temperatures are not considered to affect the usability of the results to meet projects. Data qualification was not considered necessary.

5.13.3 Holding Times

The samples were prepared and analyzed within the required holding time limits. Data qualification was not necessary.

5.13.4 Method Blanks, Calibration Blanks, and Rinsate Blanks

Method Blanks

Target analytes were not detected in the method blanks.

Rinsate Blanks

A rinsate blank sample was not reported in this data package. Detections in rinsate blanks are discussed in Section 6.

5.13.5 Duplicate Sample Analysis

Method duplicate results are discussed in Section 6.

5.13.6 Matrix Spike Analysis

Matrix spike and matrix spike duplicate results are discussed in Section 6.

5.13.7 Serial Dilution

A serial dilution is not applicable for the methods analyzed in this data package. Further action was not necessary.

5.13.8 Post Digestion Spike

A post digestion spike is not applicable for the methods analyzed in this data package. Further action was not necessary.

5.13.9 Field Duplicate

A field duplicate pair was not reported in this data package. Field duplicate results are discussed in Section 6.

5.13.10 Internal Standards (ICP-MS Methods 6020 or 200.8)

The samples in this data package were not analyzed for metals by Methods 6020 or 200.8. Further action was not necessary.

5.13.11 ICP Interference Check Standards (ICS)

Not applicable.

5.14 ACZ Data Package L92223

Data package L92223 contained the analytical results for twenty soil samples. The table below lists the laboratory IDs, corresponding field IDs, and QC designations.

Laboratory ID	Field ID	Analyses	QC Designation	Depth (Inches)
L92223-01	STS-AMD-2011-W1 0-6	Ammonia as Nitrogen, Total Kjelddahl Nitrogen, Total Calcium, Copper (SPLP), Total Copper, Total Potassium, Total Carbon, Total Organic Carbon, pH, Percent Solids, Nitrate as N, Nitrate/ Nitrite as N, and Nitrite as N*		0-6
L92223-02	STS-AMD-2011-W2 0-6			0-6
L92223-03	STS-AMD-2011-W3 0-6			0-6
L92223-04	STS-AMD-2011-W1 6-12			6-12
L92223-05	STS-AMD-2011-W2 12-18			12-18
L92223-06	STS-AMD-2011-W3 12-18			12-18
L92223-07	STS-AMD-2011-N1 0-6		MS – Total Kjeldahl Nitrogen	0-6
L92223-08	STS-AMD-2011-N2 0-6		MS – Ammonia Nitrogen MD – Ammonia Nitrogen, Total Kjeldahl Nitrogen	0-6
L92223-09	STS-AMD-2011-N3 0-6			0-6
L92223-10	STS-AMD-2011-N1 18-24			18-24
L92223-11	STS-AMD-2011-N2 18-24			18-24
L92223-12	STS-AMD-2011-N3 18-24			18-24
L92223-13	STS-AMD-2011-NE1 0-6			0-6
L92223-14	STS-AMD-2011-NE2 0-6			0-6
L92223-15	STS-AMD-2011-NE3 0-6			0-6
L92223-16	STS-AMD-2011-NE1 18-24			18-24
L92223-17	STS-AMD-2011-NE2 18-24			18-24
L92223-18	STS-AMD-2011-NE3 18-24			18-24
L92223-19	STS-AMD-2011-E1 0-6			0-6

Laboratory ID	Field ID	Analyses	QC Designation	Depth (Inches)
L92223-20	STS-AMD-2011-E2 0-6			0-6

ID – Identification
MD – Method Duplicate
MS/MSD – Matrix Spike/ Matrix Spike Duplicate
QC – Quality Control

*The total calcium, copper (SPLP), total copper, total potassium, total carbon, total organic carbon, pH, percent solids, nitrate as N, nitrate/ nitrite as N, and nitrite as N analyses were reported in data package L91220.

5.14.1 Overall Assessment

With several exceptions, data are considered usable for meeting project objectives with the qualifications noted in the following narrative. The non-detect ammonia as nitrogen results for samples STS-AMD-2011-W1 0-6, STS-AMD-2011-W2 0-6, STS-AMD-2011-W3 0-6, STS-AMD-2011-W1 6-12, STS-AMD-2011-W2 12-18, STS-AMD-2011-W3 12-18, STS-AMD-2011-N1 18-24, STS-AMD-2011-N2 18-24, STS-AMD-2011-NE1 18-24, STS-AMD-2011-NE2 18-24 and STS-AMD-2011-E1 0-6 were analyzed >2x the 28 day holding time criterion. These non-detect results were qualified as unusable due to holding time exceedances (R). The data qualifiers and associated bias codes were hand-entered on the sample reporting forms. The sample reporting forms are included in Appendix A.

5.14.2 COC and Sample Receipt Documentation

The samples were shipped to ACZ under COC. The laboratory sample custodian noted that all samples were received intact.

The cooler temperatures upon receipt ranged from 11.6°C – 14.6°C above the required ≤6°C temperature criterion. As the samples were air-dried and sieved upon receipt; the elevated cooler temperatures are not considered to affect the usability of the results to meet projects. Data qualification was not considered necessary.

The total copper, copper (SPLP), pH, total calcium, total potassium, total organic carbon, total carbon, nitrate as N, nitrite as N, and nitrite/nitrate as N analyses for all samples were reported in data package L91220.

The field IDs for numerous samples were truncated on the data sheets due to laboratory software limitations. The datasheets were updated to include the depths and reflect the proper nomenclature. Further action was not necessary.

5.14.3 Holding Times

With the exceptions below, the samples were prepared and analyzed within the required holding time limits. The ammonia as nitrogen and total Kjeldahl nitrogen results were analyzed >2x the 28 day holding time requirement. Detected ammonia as nitrogen and total Kjeldahl nitrogen results were qualified as estimated (J HT-L) and non-detect ammonia as nitrogen results were qualified as unusable (R).

5.14.4 Method Blanks, Calibration Blanks, and Rinsate Blanks

Method/ Calibration Blanks

Target analytes were not detected in the method or calibration blanks.

Rinsate Blanks

A rinsate blank sample was not reported in this data package. Detections in rinsate blanks are discussed in Section 6.

5.14.5 Duplicate Sample Analysis

Method duplicate results are discussed in Section 6.

5.14.6 Matrix Spike Analysis

Matrix spike and matrix spike duplicate results are discussed in Section 6.

5.14.7 Serial Dilution

A serial dilution is not applicable for the methods analyzed in this data package. Further action was not necessary.

5.14.8 Post Digestion Spike

A post digestion spike is not applicable for the methods analyzed in this data package. Further action was not necessary.

5.14.9 Field Duplicate

A field duplicate pair was not reported in this data package. Field duplicate results are discussed in Section 6.

5.14.10 Internal Standards (ICP-MS Methods 6020 or 200.8)

The samples in this data package were not analyzed for metals by Methods 6020 or 200.8. Further action was not necessary.

5.14.11 ICP Interference Check Standards (ICS)

Not applicable.

5.15 ACZ Data Package L92224

Data package L92224 contained the analytical results for twenty soil samples. The table below lists the laboratory IDs, corresponding field IDs, and QC designations.

Laboratory ID	Field ID	Analyses	QC Designation	Depth (Inches)
L92224-01	STS-AMD-2011-E3 0-6	Ammonia Nitrogen, Total Kjelddahl Nitrogen, Total Calcium, Copper (SPLP), Total Copper, Total Potassium, Total Carbon, Total Organic Carbon, pH, Percent Solids, Nitrate as N, Nitrate/ Nitrite as N, and Nitrite as N*	MD – Ammonia Nitrogen, Total Kjeldahl Nitrogen MS – Ammonia Nitrogen	0-6
L92224-02	STS-AMD-2011-E1 6-12		MS – Total Kjeldahl Nitrogen	6-12
L92224-03	STS-AMD-2011-E2 6-12			6-12
L92224-04	STS-AMD-2011-E3 6-12			6-12
L92224-05	STS-AMD-2011-WREF1 0-6			0-6
L92224-06	STS-AMD-2011-WREF2 0-6			0-6
L92224-07	STS-AMD-2011-WREF1 12-18			12-18
L92224-08	STS-AMD-2011-WREF2 18-24			18-24
L92224-09	STS-AMD-2011-NREF1 0-6			0-6
L92224-10	STS-AMD-2011-NREF2 0-6			0-6
L92224-11	STS-AMD-2011-NREF1 18-24			18-24
L92224-12	STS-AMD-2011-NREF2 18-24			18-24
L92224-13	STS-AMD-2011-NEREF1 0-6			0-6
L92224-14	STS-AMD-2011-NEREF2 0-6			0-6
L92224-15	STS-AMD-2011-NEREF1 18-24			18-24
L92224-16	STS-AMD-2011-NEREF2 12-18			12-18
L92224-17	STS-AMD-2011-EREF1 0-6			0-6
L92224-18	STS-AMD-2011-EREF2 0-6			0-6
L92223-19	STS-AMD-2011-EREF1 6-12			6-12
L92223-20	STS-AMD-2011-EREF2 6-12			6-12

ID – Identification
MD – Method Duplicate
MS/MSD – Matrix Spike/ Matrix Spike Duplicate
QC – Quality Control
*The total calcium, copper (SPLP), total copper, total potassium, total carbon, total organic carbon, pH, percent solids, nitrate as N, nitrate/ nitrite as N, and nitrite as N analyses were reported in data package L91218.

5.15.1 Overall Assessment

With several exceptions, data are considered usable for meeting project objectives with the qualifications noted in the following narrative. The non-detect ammonia as nitrogen results for samples STS-AMD-2011-E1 6-12, STS-AMD-2011-E3 6-12, STS-AMD-2011-WREF1 0-6, STS-AMD-2011-WREF2 0-6, STS-AMD-2011-WREF1 12-18, STS-AMD-2011-WREF2 18-24, STS-AMD-2011-NREF1 18-24, STS-AMD-2011-NREF2 18-24, STS-AMD-2011-NEREF1 18-24, STS-AMD-2011-NEREF2 12-18, STS-AMD-2011-EREF1 6-12 and STS-AMD-2011-EREF2 6-12 were analyzed >2x the 28 day holding time criterion and were therefore qualified as unusable (R) due to holding time exceedance. The data qualifiers and associated bias codes were hand-entered on the sample reporting forms. The sample reporting forms are included in Appendix A.

5.15.2 COC and Sample Receipt Documentation

The samples were shipped to ACZ under COC. The laboratory sample custodian noted that all samples were received intact.

The cooler temperatures upon receipt ranged from 10.0°C – 12.2°C above the required ≤6°C temperature criterion. As the samples were air-dried and sieved upon receipt; the elevated cooler temperatures are not considered to affect the usability of the results to meet projects. Data qualification was not considered necessary.

The total copper, copper (SPLP), pH, total calcium, total potassium, total organic carbon, total carbon, nitrate as N, nitrite as N, and nitrite/nitrate as N analyses for all samples were reported in data package L91218.

The field IDs for numerous samples were truncated on the data sheets due to laboratory software limitations. The datasheets were updated to include the depths and reflect the proper nomenclature. Further action was not necessary.

5.15.3 Holding Times

With the exceptions noted below, the samples were prepared and analyzed within the required holding time limits. The ammonia as nitrogen and total Kjeldahl nitrogen results were analyzed >2x the 28 day holding time requirement. Detected ammonia as nitrogen and total Kjeldahl nitrogen results were qualified as estimated

(J HT-L) and non-detect ammonia as nitrogen results were qualified as unusable (R).

5.15.4 Method Blanks, Calibration Blanks, and Rinsate Blanks

Method/ Calibration Blanks

Target analytes were not detected in the method or calibration blanks.

Rinsate Blanks

A rinsate blank sample was not reported in this data package. Detections in rinsate blanks are discussed in Section 6.

5.15.5 Duplicate Sample Analysis

Method duplicate results are discussed in Section 6.

5.15.6 Matrix Spike Analysis

Matrix spike and matrix spike duplicate results are discussed in Section 6.

5.15.7 Serial Dilution

A serial dilution is not applicable for the methods analyzed in this data package. Further action was not necessary.

5.15.8 Post Digestion Spike

A post digestion spike is not applicable for the methods analyzed in this data package. Further action was not necessary.

5.15.9 Field Duplicate

A field duplicate pair was not reported in this data package. Field duplicate results are discussed in Section 6.

5.15.10 Internal Standards (ICP-MS Methods 6020 or 200.8)

The samples in this data package were not analyzed for metals by Methods 6020 or 200.8. Further action was not necessary.

5.15.11 ICP Interference Check Standards (ICS)

Not applicable.

5.16 ACZ Data Package L91359

Data package L91359 contained the analytical results for seventeen soil samples. The table below lists the laboratory IDs, corresponding field IDs, and QC designations.

Laboratory ID	Field ID	Analyses	QC Designation	Depth
L91359-01	STS-CG-2011-11	Total Copper, Percent Solids	MS/MSD – Total Copper MD - pH	-
L91359-02	STS-CG-2011-12			-
L91359-03	STS-CG-2011-13			-
L91359-04	STS-CG-2011-14			-
L91359-05	STS-CG-2011-15			-
L91359-06	STS-CG-2011-17			-
L91359-07	STS-CG-2011-19			-
L91359-08	STS-CG-2011-20		SD – Total Copper	-
L91359-09	STS-PCUG-2011-1	Total Copper, Percent Solids, pH		-
L91359-10	STS-PCUG-2011-2			-
L91359-11	STS-PCUG-2011-3			-
L91359-12	STS-PCUG-2011-4			-
L91359-13	STS-PCUG-2011-33			-
L91359-14	STS-PCUG-2011-7		MD – Percent Solids	-
L91359-15	STS-PCUG-2011-38			-
L91359-16	STS-PCUG-2011-39			-
L91359-17	STS-PCUG-2011-10			-

ID – Identification
MD – Method Duplicate
MS/MSD – Matrix Spike/ Matrix Spike Duplicate
QC – Quality Control
SD – Serial Dilution
- no depth given

5.16.1 Overall Assessment

The data are considered usable for meeting project objectives with the qualifications noted in the following narrative. The data qualifiers and associated bias codes were hand-entered on the sample reporting forms. The sample reporting forms are included in Appendix A.

5.16.2 COC and Sample Receipt Documentation

The samples were shipped to ACZ under COC. The laboratory sample custodian noted that all samples were received intact.

The cooler temperatures upon receipt ranged from 9.2°C – 17.6°C above the required ≤6°C temperature criterion. As the samples were air-dried and sieved upon receipt; the elevated cooler temperatures are not considered to affect the usability of the results to meet projects. Data qualification was not considered necessary.

5.16.3 Holding Times

With the exceptions below, the samples were prepared and analyzed within the required holding time limits.

The holding time criterion of 2 days for pH analysis was exceeded for all samples in this data package. The pH results for these samples were qualified as estimated (J HT-L) to reflect the potential low bias.

5.16.4 Method Blanks, Calibration Blanks, and Rinsate Blanks

Method/ Calibration Blanks

With the exceptions noted below, target analytes were not detected in the method or calibration blanks.

Blank	Analyte	Concentration*	Data Qualification
WG313608			
CCB01	Total Copper	0.013 mg/L*	None. The associated sample listed analytical results were reported at concentrations >5x the blank contamination.

> – Greater Than
CCB – Continuing Calibration Blank
mg/L – Milligrams per Liter
* The CCB concentration was converted from mg/L to mg/Kg by multiplying by 100.

Rinsate Blanks

A rinsate blank sample was not reported in this data package. Detections in rinsate blanks are discussed in Section 6.

5.16.5 Duplicate Sample Analysis

Method duplicate results are discussed in Section 6.

5.16.6 Matrix Spike Analysis

Matrix spike and matrix spike duplicate results are discussed in Section 6.

5.16.7 Serial Dilution

A serial dilution is required for Method 6010B for all sample delivery groups, but is only pertinent to analytes present at greater than 50x the detection limit. A serial dilution was conducted on sample STS-CG-2011-20. The applicable percent differences were within ±10% for the 1:5 dilution of the sample. Data qualification was not necessary.

5.16.8 Post Digestion Spike

For Method 6010B, a post digestion spike is required when the matrix spike recovery is outside of the acceptance limits of 75-125%. As the matrix spike recoveries were within the QAP acceptance limits of 75-125%, a post digestion spike was not necessary.

5.16.9 Field Duplicate

A field duplicate pair was not reported in this data package. Field duplicate results are discussed in Section 6.

5.16.10 Internal Standards (ICP-MS Methods 6020 or 200.8)

The samples in this data package were not analyzed for metals by Methods 6020 or 200.8. Further action was not necessary.

5.16.11 ICP Interference Check Standards (ICS)

The ICS AB solutions were analyzed at the proper frequency. The target analytes were recovered within the acceptance range of 80-120% in the ICS AB solution. Interferent elements (e.g. aluminum, calcium, and iron) were present in some or all of the samples in this data package at concentrations approaching the interfering element concentrations for the ICSAB solution. As the laboratory did not analyze the ICSA solution, those samples with interferent elements present could not be evaluated for positive and negative biases suggested by the ICSA.

5.17 ACZ Data Package L90609

Data package L90609 contained the analytical results for one rinsate blank sample. The table below lists the laboratory ID, corresponding field ID, and QC designations.

Laboratory ID	Field ID	Analyses	QC Designation	Depth
L90609-01	RINSATE BLANK #1	Total Copper	RB	-

ID – Identification
QC – Quality Control
RB – Rinsate Blank
- no depth given

5.17.1 Overall Assessment

The data are considered usable for meeting project objectives with the qualifications noted in the following narrative. The data qualifiers and associated bias codes were hand-entered on the sample reporting forms. The sample reporting forms are included in Appendix A.

5.17.2 COC and Sample Receipt Documentation

The sample was shipped to ACZ under COC. The laboratory sample custodian noted that the sample was received intact. The cooler was received at a temperature of 21.8 °C, above the temperature criterion of ≤6°C. Based on the stability of total copper, data qualification was not considered necessary for these analytes.

5.17.3 Holding Times

The samples were prepared and analyzed within the required holding time limits. Data qualification was not necessary.

5.17.4 Method Blanks, Calibration Blanks, and Rinsate Blanks

Method/ Calibration Blanks

Target analytes were not detected in the method or calibration blanks.

Rinsate Blanks

One rinsate blank sample was reported in this data package. Detections in rinsate blanks are discussed in Section 6.

5.17.5 Duplicate Sample Analysis

Method duplicate results are discussed in Section 6.

5.17.6 Matrix Spike Analysis

Matrix spike and matrix spike duplicate results are discussed in Section 6.

5.17.7 Serial Dilution

A serial dilution is not required for Method 200.8. Further action was not necessary.

5.17.8 Post Digestion Spike

A post digestion spike is not required for Method 200.8. Further action was not necessary.

5.17.9 Field Duplicate

A field duplicate pair was not reported in this data package. Field duplicate results are discussed in Section 6.

5.17.10 Internal Standards (ICP-MS Methods 6020 or 200.8)

The samples in this data package were not analyzed for metals by Methods 6020 or 200.8. Further action was not necessary.

5.17.11 ICP Interference Check Standards (ICS)

An ICS is not required for Method 200.8. Further action was not necessary.

6. METHOD & FIELD QUALITY PARAMETERS

The results obtained for the method and field quality control samples are discussed in the sections below.

When quality control issues accounted for less than 35% of the quality control analyses conducted, applicable data qualification was limited to parent samples. When quality control issues accounted for more than 35% of the quality control analyses conducted, applicable data qualification was extended to qualification of all samples.

6.1 Method Quality Parameters

Method Duplicate

The table below lists the sample for which a method duplicate was performed. This number of method duplicate samples met the QAP required frequency of one set per twenty site samples per matrix.

Sample	Analyses
Data Package L90608	
STS-BWC-2011-3	pH
Data Package L91218	
STS-AMD-2011-E3 0-6	TC, TOC, Nitrate/Nitrite as N, Nitrite as N, pH
STS-AMD-2011-EREF2 6-12	Copper (SPLP), Percent Solids
Data Package L91360	
STS-CG-2011-31	Percent Solids
Data Package L91219	
DUP13	TC, TOC, Copper (SPLP), Nitrite/ Nitrate as N, Nitrite as N, pH
DUP16	Percent Solids
Data Package L91358	
STS-PH-2011-FID37	Sulfur Organic Residual, Sulfur Pyritic Sulfide, Sulfur Sulfate, Total Sulfur, Total Sulfur minus Sulfate
STS-PH-2011-FID15	Percent Solids
Data Package L91357	
STS-PCUG-2011-30	Percent Solids

Sample	Analyses
Data Package L91355	
STS-PCUG-2011-21	Percent Solids, pH
Data Package L91220	
STS-AMD-2011-W1 0-6	TC, TOC, Nitrate/ Nitrite as N, Nitrite as N, pH
STS-AMD-2011-E2 0-6	Copper (SPLP), Percent Solids
Data Package L91526	
STS-PH-2011-FID106	Neutralization Potential as CaCO3, Sulfur Organic Residual, Sulfur Pyritic Sulfide, Sulfur Sulfate, Total Sulfur, Total Sulfur minus Sulfate
STS-PCUG-2011-27	pH
STS-CG-2011-7	Percent Solids
Data Package L91526	
STS-CG-2011-23	Percent Solids
Data Package L92172	
STS-PH-2011-FID37	Sulfur Organic Residual Mod, Sulfur Pyritic Sulfide, Sulfur Sulfate, Total Sulfur, Total Sulfur minus Sulfate
Data Package L92223	
STS-AMD-2011-N2 0-6	Ammonia Nitrogen, Total Kjeldahl Nitrogen
Data Package L92224	
STS-AMD-2011-E3 0-6	Ammonia Nitrogen, Total Kjeldahl Nitrogen
Data Package L91359	
STS-CG-2011-11	pH
STS-PCUG-2011-7	Percent Solids

$CaCO_3$ – Calcium Carbonate	TC – Total Carbon
SPLP – Synthetic Precipitation Leaching Procedure	TOC – Total Organic Carbon

The concentration – dependent evaluation criteria listed in Table 3-1 were met for all analytes. Further action was not necessary.

Matrix Spike and Matrix Spike Duplicate

The table below lists the samples for which matrix spike and/or matrix spike duplicates were performed. This number of MS/MSD samples met the QAP required frequency of one set per twenty site samples per matrix.

Samples	Analyses
Data Package L90608	
STS-BWC-2011-3	MS/MSD - Total Copper
Data Package L91218	
STS-AMD-2011-E3 0-6	MS/MSD - Copper (SPLP)
STS-AMD-2011-E1 6-12	MS – Nitrate/ Nitrite as N, Nitrite as N
STS-AMD-2011-NREF2 0-6	MS/MSD - Total Calcium, Total Copper, Total Potassium
Data Package L91360	
STS-CG-2011-31	MS/MSD – Total Copper
Data Package L91219	
DUP13	MS/MSD - Total Calcium, Total Copper, Total Potassium
DUP14	MS - Nitrate/ Nitrite as N, Nitrite as N
DUP16	MS/MSD – Copper (SPLP)
Data Package L91358	
STS-PH-2011-FID37	MS/MSD – Total Copper
Data Package L91357	
STS-PCUG-2011-11	MS/MSD - Total Copper
Data Package L91355	
STS-PCUG-2011-21	MS/MSD - Total Copper
Data Package L91220	
STS-AMD-2011-W1 0-6	MS/MSD – Copper (SPLP)
STS-AMD-2011-W2 0-6	MS - Nitrate/ Nitrite as N, Nitrite as N
STS-AMD-2011-E2 0-6	MS/MSD – Total Calcium, Total Copper, Total Potassium
Data Package L91526	
STS-PCUG-2011-27	MS/MSD – Total Copper
Data Package L91527	
STS-CG-2011-51	MS/MSD – Total Copper
Data Package L91528	
STS-PH-2011-FID102	MS/MSD – Total Copper
Data Package L92223	
STS-AMD-2011-N2 0-6	MS - Total Kjeldahl Nitrogen
STS-AMD-2011-N1 0-6	MS - Ammonia Nitrogen

Samples	Analyses
Data Package L92224	
STS-AMD-2011-E3 0-6	MS - Ammonia Nitrogen
STS-AMD-2011-E1 6-12	MS - Total Kjeldahl Nitrogen
Data Package L91359	
STS-CG-2011-11	MS/MSD – Total Copper

MS/MSD – Matrix Spike/ Matrix Spike Duplicate
TOC – Total Organic Carbon

All applicable matrix spike and matrix spike duplicate recoveries were within the QAP acceptance range of 75-125%. Data qualification was not necessary.

MS/MSD recoveries could not be evaluated for results in the native sample that were greater than four times the concentration of the spike added during sample preparation. Since the sample concentrations are so much greater than the spike amount added to these samples, the MS/MSD recoveries are not considered to be a representative measure of accuracy and precision.

6.2 Field Quality Parameters

Rinsate Blanks

Eight rinsate blank samples were collected during this sampling event are listed in the table below. This number of rinsate blank samples met the QAP required frequency of one set per twenty site samples per matrix.

Rinsate Blank	Associated Sample
Data Package L91393	
RINSATE3	STS-CG-2011-40
RINSATE4	STS-CG-2011-43
RINSATE1	STS-PCUG-2011-22
RINSATE5	STS-CG-2011-34
RINSATE7	STS-AMD-2011-NE2 18-24
RINSATE8	STS-AMD-2011-NEREF2 0-6
RINSATE2	STS-PCUG-2011-4
RINSATE6	STS-PH-2011-FID101
RINSATE BLANK #1	STS-PCUG-2011-22

The table below presents detections in rinsate blanks collected for this sampling event.

Rinsate Blank	Parent Sample	Analyte	Concentration (mg/L)*	Data Qualification
Data Package L91393				
RINSATE6	STS-PH-2011-FID101	Total Copper	0.0007	As <35% (two in eight rinsate blanks) of the rinsate blanks had a total copper detection, data qualification was not necessary.
Data Package L90609				
RINSATE BLANK #1	STS-PCUG-2011-22	Total Copper	0.0048	As <35% (two in eight rinsate blanks) of the rinsate blanks had a total copper detection, data qualification was not necessary.

> – Greater than
mg/L – Milligrams per Liter
* The CCB concentration was converted from mg/L to mg/Kg by multiplying by 100.

Field Blank

As organic parameters were not collected in association with the Smelter/Tailings Soils Investigational Unit sampling event, a field blank was not applicable. Further action was not necessary.

Field Duplicate Agreement

The field duplicate sample pairs collected during this sampling event are listed in the table below. This number of field duplicate samples met the QAP required frequency of one set per ten site samples per matrix.

Field Duplicates
DUP5/ STS-CG-2011-28
DUP6/ STS-PCUG-2011-7
DUP13/ STS-AMD-2011-W3 0-6
DUP14/ STS-AMD-2011-NREF1 0-6
DUP15/ STS-AND-2011-E1 0-6
DUP16/ STS-AMD-2011-NE1 0-6
DUP11/ STS-PH-2011-FID101
DUP12/ STS-PH-2011-FID22
DUP1/ STS-PCUG-2011-19
DUP2/ STS-PCUG-2011-29
DUP7/ STS-CG-2011-43
DUP8/ STS-CG-2011-10

Field Duplicates
DUP9/ STS-CG-2011-42
DUP3/ STS-PCUG-2011-14
DUP4/ STS-PCUG-2011-31
DUP10/ STS-CG-2011-1

Field duplicate results satisfied the applicable evaluation criterion in Table 3-1. This indicates an acceptable level of overall sampling and analysis precision.

7. OVERALL ASSESSMENT

The sample data are considered to be acceptable for use in reconciliation with project objectives as qualified. A general overall assessment of each of the QAP's data quality assurance objectives is provided below.

7.1 Reporting Limits

Reporting limits (RLs/ PQLs) are established by the analytical laboratory based on the method detection limits (MDLs/ IDLs), historical data, and comparison to EPA limits for the respective methods. With the exceptions noted in the table below, the reporting limits (or PQLs) satisfied the reporting limit requirements specified in the Quality Assurance Plan (QAP) prepared by Chino Mines Company and Steffen, Robertson and Kirsten (U.S.), Inc. (March 1997).

Analyte	Affected Samples	Reported MDL	Reported PQL	QAP RL	Result D or ND
Metals (mg/L)					
Copper (SPLP)	STS-AMD-2011-E3 0-6	0.01	0.05	0.025	D
	STS-AMD-2011-E1 6-12	0.01	0.05	0.025	ND
	STS-AMD-2011-E2 6-12	0.01	0.05	0.025	D
	STS-AMD-2011-E3 6-12	0.01	0.05	0.025	D
	STS-AMD-2011-WREF1 0-6	0.01	0.05	0.025	D
	STS-AMD-2011-WREF2 0-6	0.01	0.05	0.025	D
	STS-AMD-2011-WREF1 12-18	0.01	0.05	0.025	ND
	STS-AMD-2011-WREF2 18-24	0.01	0.05	0.025	ND
	STS-AMD-2011-NREF1 0-6	0.01	0.05	0.025	D
	STS-AMD-2011-NREF2 0-6	0.01	0.05	0.025	D
	STS-AMD-2011-NREF1 18-24	0.01	0.05	0.025	ND
	STS-AMD-2011-NREF2 18-24	0.01	0.05	0.025	D
	STS-AMD-2011-NEREF1 0-6	0.01	0.05	0.025	D
	STS-AMD-2011-NEREF2 0-6	0.01	0.05	0.025	D
	STS-AMD-2011-NEREF1 18-24	0.01	0.05	0.025	D
	STS-AMD-2011-NEREF2 12-18	0.01	0.05	0.025	D
	STS-AMD-2011-EREF1 0-6	0.01	0.05	0.025	D
	STS-AMD-2011-EREF2 0-6	0.01	0.05	0.025	D
	STS-AMD-2011-EREF1 6-12	0.01	0.05	0.025	ND
	STS-AMD-2011-EREF2 6-12	0.01	0.05	0.025	D
	DUP13	0.01	0.05	0.025	D
	DUP14	0.01	0.05	0.025	D
	DUP15	0.01	0.05	0.025	D

Analyte	Affected Samples	Reported MDL	Reported PQL	QAP RL	Result D or ND
	DUP16	0.01	0.05	0.025	D
	STS-AMD-2011-W1 0-6	0.01	0.05	0.025	D
	STS-AMD-2011-W2 0-6	0.01	0.05	0.025	D
	STS-AMD-2011-W3 0-6	0.01	0.05	0.025	D
	STS-AMD-2011-W1 6-12	0.01	0.05	0.025	D
	STS-AMD-2011-W2 12-18	0.01	0.05	0.025	D
	STS-AMD-2011-W3 12-18	0.01	0.05	0.025	D
	STS-AMD-2011-N1 0-6	0.01	0.05	0.025	D
	STS-AMD-2011-N2 0-6	0.01	0.05	0.025	D
	STS-AMD-2011-N3 0-6	0.01	0.05	0.025	D
	STS-AMD-2011-N1 18-24	0.01	0.05	0.025	D
	STS-AMD-2011-N2 18-24	0.01	0.05	0.025	D
	STS-AMD-2011-N3 18-24	0.01	0.05	0.025	D
	STS-AMD-2011-NE1 0-6	0.01	0.05	0.025	D
	STS-AMD-2011-NE2 0-6	0.01	0.05	0.025	D
	STS-AMD-2011-NE3 0-6	0.01	0.05	0.025	D
	STS-AMD-2011-NE1 18-24	0.01	0.05	0.025	D
	STS-AMD-2011-NE2 18-24	0.01	0.05	0.025	D
	STS-AMD-2011-NE3 18-24	0.01	0.05	0.025	ND
	STS-AMD-2011-E1 0-6	0.01	0.05	0.025	D
	STS-AMD-2011-E2 0-6	0.01	0.05	0.025	D
Inorganics (mg/Kg)					
Nitrate as N	STS-AMD-2011-N1 0-6	0.4	2	1	D
	STS-AMD-2011-NE3 0-6	0.3	2	1	D
	STS-AMD-2011-E2 0-6	0.4	2	1	D

D – Detected	ND – Non-detect
MDL- Method Detection Limit	PQL – Practical Quantitation Limit
mg/Kg – Milligrams per Kilogram	QAP – Quality Assurance Plan
mg/L – Milligram per Liter	RL – Reporting Limit

The copper (SPLP) PQL was 0.05 mg/L for all samples, exceeding the required QAP RL of 0.025 mg/L. As the copper (SPLP) MDLs were below the QAP RLs, there is no effect to the usability of the data.

The nitrate as N PQL was 2 mg/Kg for samples STS-AMD-2011-N1 0-6, STS-AMD-2011-NE3 0-6 and STS-AMD-2011-E2 0-6, exceeding the required QAP RL of 1 mg/Kg. As the nitrate as N results were reported as detected, the elevated PQL does not affect the usability of the data.

7.2 Accuracy

Accuracy is defined as the degree of agreement of a measurement to an accepted reference or true value. Accuracy was measured as the percent recovery (%R) of an analyte in a reference standard or spiked sample.

All laboratory control samples, matrix spike and matrix spike duplicate recoveries, and all calibration standards were within acceptance limits demonstrating acceptable overall accuracy of the analytical system. As such, acceptable accuracy with respect to the analytical method and site-specific sample matric was acceptable.

7.3 Precision

Precision is defined as the agreement between a set of replicate measurements without assumption or knowledge of the true value. Precision of laboratory measurements was evaluated by the comparison of sample/sample duplicate results.

All of the laboratory duplicate results satisfied the applicable evaluation criteria. Therefore, the overall level of precision demonstrated by the analyses is considered to be acceptable

Precision of field sampling and laboratory analysis was evaluated by the comparison of field duplicate sample results. The agreement shown by all of the field duplicate results is indicative of an acceptable level of overall sampling and analysis precision.

7.4 Completeness

With the exception of some nitrite as N results and ammonia as nitrogen results that were qualified as unusable (R) due to holding time exceedances, the results are considered usable as qualified. As such, the analytical completeness for the sampling, defined as the ratio of the number of valid analytical results (valid analytical results include estimated values) to the total number of analytical results requested on samples submitted for analysis, is 97% which satisfies the QAP requirement of 80%. All valid results are considered acceptable for use in meeting project objectives.

7.5 Representativeness

Representativeness is the degree to which data accurately and precisely represent a characteristic of a population, parameter variations at a sampling point, or an environmental condition. Representativeness was maintained during sampling efforts by completing sampling in compliance with the FSP, and relevant SOPs.

Consistent, uniform sample collection protocols, including such tasks as storage, preservation and transportation, were used to assure that the representativeness of the samples gathered during the AOC met project objectives. Proper documentation in the field and laboratory verified that protocols were followed and that sample identification as well as integrity was preserved.

7.6 Comparability

Comparability expresses the confidence with which one data set can be compared to another. Comparability can be related to accuracy and precision because these quantities are measures of data reliability. Data are comparable if collection techniques, measurement procedures, method, and reporting limits are equivalent for the samples within a sample set. As the samples in this set were analyzed in accordance with appropriate methods and quality control measures described in the methods, and acceptable levels of overall accuracy and precision were attained, the data within this set are considered to be comparable to each other.

APPENDIX A

DATA REPORTING FORMS

Freeport-McMoRan - Chino Mines Company

Project ID: ZN000000J8
Sample ID: STS-BWC-2011-3

ACZ Sample ID: ***L90608-01***
Date Sampled: *09/14/11 14:00*
Date Received: *09/20/11*
Sample Matrix: *Soil*

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010B ICP	622		*	mg/Kg	1	5	10/07/11 10:57	jjc

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
pH, Saturated Paste	USDA No. 60 (21A) J HT→I L	5.4		*	units	0.1	0.1	10/19/11 10:32	zsh
Solids, Percent	CLPSOW390, PART F, D-98	87.6		*	%	0.1	0.5	10/19/11 16:35	ndj

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							10/04/11 11:30	cra
Digestion - Hot Plate	M3050B ICP							10/06/11 13:52	mss2/nd
Saturated Paste Extraction	USDA No. 60 (2)							10/17/11 13:15	zsh
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							10/06/11 11:45	thf
Sieve-250 um (60 mesh)	ASA No.9, 15-4.2.2							10/06/11 11:45	thf

EB 03/29/12

Freeport-McMoRan - Chino Mines Company
Project ID: ZN000000J8
Sample ID: STS-BWC-2011-4

ACZ Sample ID: *L90608-02*
Date Sampled: *09/16/11 10:00*
Date Received: *09/20/11*
Sample Matrix: *Soil*

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010B ICP	521		*	mg/Kg	1	5	10/07/11 11:07	jjc

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
pH, Saturated Paste	USDA No. 60 (21A) J HT-ZL	4.9		*	units	0.1	0.1	10/19/11 10:36	zsh
Solids, Percent	CLPSOW390, PART F, D-98	86.9		*	%	0.1	0.5	10/19/11 17:52	ndj

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							10/04/11 11:32	cra
Digestion - Hot Plate	M3050B ICP							10/06/11 14:45	mss2/nd
Saturated Paste Extraction	USDA No. 60 (2)							10/17/11 13:21	zsh
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							10/06/11 11:52	thf
Sieve-250 um (60 mesh)	ASA No.9, 15-4.2.2							10/06/11 11:52	thf

EB 03/29/12

Freeport-McMoRan - Chino Mines Company

Project ID:	ZN000000J8	ACZ Sample ID:	***L90608-03***
Sample ID:	STS-BWC-2011-5	Date Sampled:	*09/16/11 13:00*
		Date Received:	*09/20/11*
		Sample Matrix:	*Soil*

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010B ICP	975		*	mg/Kg	1	5	10/07/11 11:10	jjc

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
pH, Saturated Paste	USDA No. 60 (21A) J HT-IL	4.9		*	units	0.1	0.1	10/19/11 10:37	zsh
Solids, Percent	CLPSOW390, PART F, D-98	82.7		*	%	0.1	0.5	10/19/11 19:09	ndj

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							10/04/11 11:34	cra
Digestion - Hot Plate	M3050B ICP							10/06/11 15:02	mss2/nd
Saturated Paste Extraction	USDA No. 60 (2)							10/17/11 13:25	zsh
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							10/06/11 11:59	thf
Sieve-250 um (60 mesh)	ASA No.9, 15-4.2.2							10/06/11 11:59	thf

EB 03/29/12

Freeport-McMoRan - Chino Mines Company
Project ID: ZN000000J8
Sample ID: STS-BWC-2011-6

ACZ Sample ID: ***L90608-04***
Date Sampled: *09/14/11 14:45*
Date Received: *09/20/11*
Sample Matrix: *Soil*

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010B ICP	426		*	mg/Kg	1	5	10/07/11 11:13	jjc

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
pH, Saturated Paste	USDA No. 60 (21A) J HT-ZL	5.6		*	units	0.1	0.1	10/19/11 10:39	zsh
Solids, Percent	CLPSOW390, PART F, D-98	93.5		*	%	0.1	0.5	10/19/11 20:27	ndj

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							10/04/11 11:36	cra
Digestion - Hot Plate	M3050B ICP							10/06/11 15:20	mss2/nd
Saturated Paste Extraction	USDA No. 60 (2)							10/17/11 13:28	zsh
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							10/06/11 12:06	thf
Sieve-250 um (60 mesh)	ASA No.9, 15-4.2.2							10/06/11 12:06	thf

EB 03/29/12

** Please refer to Qualifier Reports for details.*

Freeport-McMoRan - Chino Mines Company
Project ID: ZN000000J8
Sample ID: STS-BWC-2011-7

ACZ Sample ID: ***L90608-05***
Date Sampled: *09/15/11 09:10*
Date Received: *09/20/11*
Sample Matrix: *Soil*

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010B ICP	2110		*	mg/Kg	1	5	10/07/11 11:25	jjc

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
pH, Saturated Paste	USDA No. 60 (21A) J HT-ZL	5.5		*	units	0.1	0.1	10/19/11 10:41	zsh
Solids, Percent	CLPSOW390, PART F, D-98	82.4		*	%	0.1	0.5	10/19/11 21:44	ndj

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							10/04/11 11:38	cra
Digestion - Hot Plate	M3050B ICP							10/06/11 15:37	mss2/nd
Saturated Paste Extraction	USDA No. 60 (2)							10/17/11 13:32	zsh
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							10/06/11 12:13	thf
Sieve-250 um (60 mesh)	ASA No.9, 15-4.2.2							10/06/11 12:13	thf

EB 03/29/12

** Please refer to Qualifier Reports for details.*

Freeport-McMoRan - Chino Mines Company
Project ID: ZN000000J8
Sample ID: STS-BWC-2011-8

ACZ Sample ID: ***L90608-06***
Date Sampled: *09/16/11 11:00*
Date Received: *09/20/11*
Sample Matrix: *Soil*

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010B ICP	691		*	mg/Kg	1	5	10/07/11 11:29	jjc

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
pH, Saturated Paste	USDA No. 60 (21A) J HT-ZL	4.5		*	units	0.1	0.1	10/19/11 10:43	zsh
Solids, Percent	CLPSOW390, PART F, D-98	87.8		*	%	0.1	0.5	10/19/11 23:01	ndj

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							10/04/11 11:41	cra
Digestion - Hot Plate	M3050B ICP							10/06/11 15:55	mss2/nd
Saturated Paste Extraction	USDA No. 60 (2)							10/17/11 13:35	zsh
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							10/06/11 12:20	thf
Sieve-250 um (60 mesh)	ASA No.9, 15-4.2.2							10/06/11 12:20	thf

EB 03/29/12

** Please refer to Qualifier Reports for details.*

Freeport-McMoRan - Chino Mines Company		ACZ Sample ID:	***L90608-07***
Project ID:	ZN000000J8	Date Sampled:	*09/15/11 10:45*
Sample ID:	STS-BWC-2011-9	Date Received:	*09/20/11*
		Sample Matrix:	*Soil*

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010B ICP	610		*	mg/Kg	1	5	10/07/11 11:32	jjc

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
pH, Saturated Paste	USDA No. 60 (21A) J HT-ZL	4.8		*	units	0.1	0.1	10/19/11 10:45	zsh
Solids, Percent	CLPSOW390, PART F, D-98	93.9		*	%	0.1	0.5	10/20/11 0:18	ndj

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							10/04/11 11:43	cra
Digestion - Hot Plate	M3050B ICP							10/06/11 16:12	mss2/nd
Saturated Paste Extraction	USDA No. 60 (2)							10/17/11 13:39	zsh
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							10/06/11 12:27	thf
Sieve-250 um (60 mesh)	ASA No.9, 15-4.2.2							10/06/11 12:27	thf

EB 03/29/12

** Please refer to Qualifier Reports for details.*

Inorganic Analytical Results

Freeport-McMoRan - Chino Mines Company

Project ID: ZN000000J8
Sample ID: STS-BWC-2011-10

ACZ Sample ID: ***L90608-08***
Date Sampled: *09/15/11 08:00*
Date Received: *09/20/11*
Sample Matrix: *Soil*

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010B ICP	972		*	mg/Kg	1	5	10/07/11 11:35	jjc

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
pH, Saturated Paste	USDA No. 60 (21A) J HT-ZL	5.6		*	units	0.1	0.1	10/19/11 10:47	zsh
Solids, Percent	CLPSOW390, PART F, D-98	89.8		*	%	0.1	0.5	10/20/11 1:36	ndj

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							10/04/11 11:45	cra
Digestion - Hot Plate	M3050B ICP							10/06/11 16:30	mss2/nd
Saturated Paste Extraction	USDA No. 60 (2)							10/17/11 13:42	zsh
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							10/06/11 12:34	thf
Sieve-250 um (60 mesh)	ASA No.9, 15-4.2.2							10/06/11 12:34	thf

EB 03/29/12

** Please refer to Qualifier Reports for details.*

Inorganic Analytical Results

Freeport-McMoRan - Chino Mines Company

Project ID:	ZN000000J8	ACZ Sample ID:	***L90608-09***
Sample ID:	STS-BWC-2011-11	Date Sampled:	*09/16/11 12:00*
		Date Received:	*09/20/11*
		Sample Matrix:	*Soil*

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010B ICP	1590		*	mg/Kg	1	5	10/07/11 11:38	jjc

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
pH, Saturated Paste	USDA No. 60 (21A) J HT-ZL	4.6		*	units	0.1	0.1	10/19/11 10:49	zsh
Solids, Percent	CLPSOW390, PART F, D-98	84.4		*	%	0.1	0.5	10/20/11 2:53	ndj

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							10/04/11 11:47	cra
Digestion - Hot Plate	M3050B ICP							10/06/11 16:47	mss2/nd
Saturated Paste Extraction	USDA No. 60 (2)							10/17/11 13:46	zsh
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							10/06/11 12:41	thf
Sieve-250 um (60 mesh)	ASA No.9, 15-4.2.2							10/06/11 12:41	thf

EB 03/29/12

** Please refer to Qualifier Reports for details.*

Inorganic Analytical Results

Freeport-McMoRan - Chino Mines Company

Project ID:	ZN000000J8	ACZ Sample ID:	***L90608-10***
Sample ID:	STS-BWC-2011-12	Date Sampled:	*09/15/11 10:15*
		Date Received:	*09/20/11*
		Sample Matrix:	*Soil*

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010B ICP	709		*	mg/Kg	1	5	10/07/11 11:41	jjc

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
pH, Saturated Paste	USDA No. 60 (21A) JHT-ZL	5.2		*	units	0.1	0.1	10/19/11 10:52	zsh
Solids, Percent	CLPSOW390, PART F, D-98	94.6		*	%	0.1	0.5	10/20/11 4:10	ndj

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							10/04/11 11:50	cra
Digestion - Hot Plate	M3050B ICP							10/06/11 17:05	mss2/nd
Saturated Paste Extraction	USDA No. 60 (2)							10/17/11 13:49	zsh
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							10/06/11 12:48	thf
Sieve-250 um (60 mesh)	ASA No.9, 15-4.2.2							10/06/11 12:48	thf

EB 03/29/12

** Please refer to Qualifier Reports for details.*

Inorganic Analytical Results

Freeport-McMoRan - Chino Mines Company
Project ID: ZN000000J8
Sample ID: STS-BWC-2011-1

ACZ Sample ID: ***L90608-11***
Date Sampled: *09/14/11 11:20*
Date Received: *09/20/11*
Sample Matrix: *Soil*

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010B ICP	766		*	mg/Kg	1	5	10/07/11 11:44	jjc

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
pH, Saturated Paste	USDA No. 60 (21A) J HT-ZL	5.2		*	units	0.1	0.1	10/19/11 10:54	zsh
Solids, Percent	CLPSOW390, PART F, D-98	90.9		*	%	0.1	0.5	10/20/11 5:28	ndj

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							10/04/11 14:00	cra
Digestion - Hot Plate	M3050B ICP							10/06/11 17:22	mss2/nd
Saturated Paste Extraction	USDA No. 60 (2)							10/17/11 13:53	zsh
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							10/06/11 12:55	thf
Sieve-250 um (60 mesh)	ASA No.9, 15-4.2.2							10/06/11 12:55	thf

EB 03/29/12

** Please refer to Qualifier Reports for details.*

Freeport-McMoRan - Chino Mines Company
Project ID: ZN000000J8
Sample ID: STS-BWC-2011-2

ACZ Sample ID: ***L90608-12***
Date Sampled: *09/14/11 12:50*
Date Received: *09/20/11*
Sample Matrix: *Soil*

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010B ICP	667		*	mg/Kg	1	5	10/07/11 11:47	jjc

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
pH, Saturated Paste	USDA No. 60 (21A) J HT-ZL	6.0		*	units	0.1	0.1	10/19/11 10:56	zsh
Solids, Percent	CLPSOW390, PART F, D-98	90.9		*	%	0.1	0.5	10/20/11 6:45	ndj

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							10/04/11 14:01	cra
Digestion - Hot Plate	M3050B ICP							10/06/11 17:40	mss2/nd
Saturated Paste Extraction	USDA No. 60 (2)							10/17/11 13:56	zsh
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							10/06/11 13:02	thf
Sieve-250 um (60 mesh)	ASA No.9, 15-4.2.2							10/06/11 13:02	thf

EB 03/29/12

** Please refer to Qualifier Reports for details.*

Inorganic Analytical Results

Freeport-McMoRan - Chino Mines Company
Project ID: ZN000000J8
Sample ID: DUPLICATE#1STS-BWC-2

ACZ Sample ID: ***L90608-13***
Date Sampled: *09/14/11 14:45*
Date Received: *09/20/11*
Sample Matrix: *Soil*

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010B ICP	363		*	mg/Kg	1	5	10/07/11 11:50	jjc

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
pH, Saturated Paste	USDA No. 60 (21A) JHT-ZL	5.8		*	units	0.1	0.1	10/19/11 10:58	zsh
Solids, Percent	CLPSOW390, PART F, D-98	93.9		*	%	0.1	0.5	10/20/11 8:02	ndj

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							10/04/11 14:02	cra
Digestion - Hot Plate	M3050B ICP							10/06/11 17:57	mss2/nd
Saturated Paste Extraction	USDA No. 60 (2)							10/17/11 14:00	zsh
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							10/06/11 13:10	thf
Sieve-250 um (60 mesh)	ASA No.9, 15-4.2.2							10/06/11 13:10	thf

EB 03/29/12

ACZ Laboratories, Inc.
2773 Downhill Drive Steamboat Springs, CO 80487 (800) 334-5493

Inorganic Analytical Results

Freeport-McMoRan - Chino Mines Company

Project ID:	ZN000000J8	ACZ Sample ID:	*L91218-01*
Sample ID:	STS-AMD-2011-E3 0-6	Date Sampled:	*10/06/11 09:55*
		Date Received:	*10/12/11*
		Sample Matrix:	*Soil*

Inorganic Prep

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Total Hot Plate Digestion	M3010A ICP							11/04/11 10:13	jjc

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Calcium, total (3050)	M6010B ICP	2700			mg/Kg	20	100	11/10/11 11:31	aeb
Copper (1312)	M6010B ICP	0.12		*	mg/L	0.01	0.05	11/07/11 14:01	jjc
Copper, total (3050)	M6010B ICP	1080		*	mg/Kg	1	5	11/10/11 11:31	aeb
Potassium, total (3050)	M6010B ICP	2600			mg/Kg	30	200	11/10/11 11:31	aeb

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Carbon, total (TC)	ASA No.9 29-2.2.4 Combustion/IR	0.8 J HT-L	H	*	%	0.1	0.5	11/08/11 16:30	bsu
Carbon, total organic (TOC)	ASA No.9 29-2.2.4 Combustion/IR	1.1 ↓		*	%	0.1	0.5	11/08/11 16:30	bsu
pH, Saturated Paste	USDA No. 60 (21A)	5.0 J HT-L		*	units	0.1	0.1	11/09/11 15:51	ndj
Solids, Percent	CLPSOW390, PART F, D-98	88.0		*	%	0.1	0.5	11/01/11 17:31	lwt

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/01/11 11:00	lwt
Digestion - Hot Plate	M3050B ICP							11/09/11 7:03	lwt
Saturated Paste Extraction	USDA No. 60 (2)							11/09/11 10:00	ndj
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/07/11 15:49	thf/ndj
Sieve-250 um (60 mesh)	ASA No.9, 15-4.2.2							11/07/11 15:49	thf/ndj
Synthetic Precip. Leaching Procedure	M1312							11/02/11 12:06	lwt/brd
Water Extraction	ASA No. 9 10-2.3.2							11/09/11 11:41	ndj

Wet Chemistry

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Nitrate as N, soluble (Water)	Calculation: NO3NO2 minus NO2	4.8 J HT-L			mg/Kg	0.1	0.5	11/14/11 12:25	calc
Nitrate/Nitrite as N, soluble (Water)	M353.2 - Automated Cadmium Reduction J HT-L	5.0		*	mg/Kg	0.1	0.5	11/09/11 21:57	pjb
Nitrite as N, soluble (Water)	M353.2 - Automated Cadmium Reduction J HT, SQL-~~Z~~ L	0.13	B	*	mg/Kg	0.05	0.3	11/09/11 21:57	pjb

EB 03/30/12

* Please refer to Qualifier Reports for details.

Freeport-McMoRan - Chino Mines Company		ACZ Sample ID:	***L91218-02***
Project ID:	ZN000000J8	Date Sampled:	*10/06/11 09:40*
Sample ID:	STS-AMD-2011-E1 6-12	Date Received:	*10/12/11*
		Sample Matrix:	*Soil*

Inorganic Prep

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Total Hot Plate Digestion	M3010A ICP							11/04/11 10:55	jjc

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Calcium, total (3050)	M6010B ICP	6770			mg/Kg	20	100	11/10/11 11:35	aeb
Copper (1312)	M6010B ICP		U	*	mg/L	0.01	0.05	11/07/11 14:10	jjc
Copper, total (3050)	M6010B ICP	113		*	mg/Kg	1	5	11/10/11 11:35	aeb
Potassium, total (3050)	M6010B ICP	6600			mg/Kg	30	200	11/10/11 11:35	aeb

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Carbon, total (TC)	ASA No.9 29-2.2.4 Combustion/IR	1.4	J HT-L H	*	%	0.1	0.5	11/08/11 18:30	bsu
Carbon, total organic (TOC)	ASA No.9 29-2.2.4 Combustion/IR	1.3	↓	*	%	0.1	0.5	11/08/11 18:30	bsu
pH, Saturated Paste	USDA No. 60 (21A)	6.9	J HT-L	*	units	0.1	0.1	11/09/11 15:55	ndj
Solids, Percent	CLPSOW390, PART F, D-98	81.8		*	%	0.1	0.5	11/01/11 17:32	lwt

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/01/11 11:04	lwt
Digestion - Hot Plate	M3050B ICP							11/09/11 7:04	lwt
Saturated Paste Extraction	USDA No. 60 (2)							11/09/11 10:03	ndj
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/07/11 15:52	thf/ndj
Sieve-250 um (60 mesh)	ASA No.9, 15-4.2.2							11/07/11 15:52	thf/ndj
Synthetic Precip. Leaching Procedure	M1312							11/02/11 12:09	lwt/brd
Water Extraction	ASA No. 9 10-2.3.2							11/09/11 12:04	ndj

Wet Chemistry

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Nitrate as N, soluble (Water)	Calculation: NO3NO2 minus NO2	1.3	J HT-L		mg/Kg	0.1	0.5	11/14/11 12:25	calc
Nitrate/Nitrite as N, soluble (Water)	M353.2 - Automated Cadmium Reduction J HT-L	1.5		*	mg/Kg	0.1	0.5	11/09/11 22:00	pjb
Nitrite as N, soluble (Water)	M353.2 - Automated Cadmium Reduction J HT, SQL-~~I~~ L	0.18	B	*	mg/Kg	0.05	0.3	11/09/11 22:00	pjb

EB 03/30/12

ACZ Laboratories, Inc.
2773 Downhill Drive Steamboat Springs, CO 80487 (800) 334-5493

Inorganic Analytical Results

Freeport-McMoRan - Chino Mines Company

Project ID:	ZN000000J8
Sample ID:	STS-AMD-2011-E2 6-12
ACZ Sample ID:	***L91218-03***
Date Sampled:	*10/06/11 09:35*
Date Received:	*10/12/11*
Sample Matrix:	*Soil*

Inorganic Prep

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Total Hot Plate Digestion	M3010A ICP							11/04/11 11:09	jjc

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Calcium, total (3050)	M6010B ICP	3860			mg/Kg	20	100	11/10/11 11:38	aeb
Copper (1312)	M6010B ICP	0.06		*	mg/L	0.01	0.05	11/07/11 14:14	jjc
Copper, total (3050)	M6010B ICP	868		*	mg/Kg	1	5	11/10/11 11:38	aeb
Potassium, total (3050)	M6010B ICP	3780			mg/Kg	30	200	11/10/11 11:38	aeb

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Carbon, total (TC)	ASA No.9 29-2.2.4 Combustion/IR	1.2 J HT-L	H	*	%	0.1	0.5	11/08/11 19:30	bsu
Carbon, total organic (TOC)	ASA No.9 29-2.2.4 Combustion/IR	1.1 ↓		*	%	0.1	0.5	11/08/11 19:30	bsu
pH, Saturated Paste	USDA No. 60 (21A)	5.8 J HT-L		*	units	0.1	0.1	11/09/11 15:56	ndj
Solids, Percent	CLPSOW390, PART F, D-98	91.1		*	%	0.1	0.5	11/01/11 17:34	lwt

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/01/11 11:08	lwt
Digestion - Hot Plate	M3050B ICP							11/09/11 7:05	lwt
Saturated Paste Extraction	USDA No. 60 (2)							11/09/11 10:04	ndj
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/07/11 15:55	thf/ndj
Sieve-250 um (60 mesh)	ASA No.9, 15-4.2.2							11/07/11 15:55	thf/ndj
Synthetic Precip. Leaching Procedure	M1312							11/02/11 12:10	lwt/brd
Water Extraction	ASA No. 9 10-2.3.2							11/09/11 12:15	ndj

Wet Chemistry

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Nitrate as N, soluble (Water)	Calculation: NO3NO2 minus NO2	12.3 J HT-L			mg/Kg	0.1	0.5	11/14/11 12:25	calc
Nitrate/Nitrite as N, soluble (Water)	M353.2 - Automated Cadmium Reduction J HT-L	12.4		*	mg/Kg	0.1	0.5	11/09/11 22:02	pjb
Nitrite as N, soluble (Water)	M353.2 - Automated Cadmium Reduction J HT, SQL-~~Z~~ L	0.11	B	*	mg/Kg	0.05	0.3	11/09/11 22:02	pjb

EB 03/30/12

** Please refer to Qualifier Reports for details.*

Freeport-McMoRan - Chino Mines Company
Project ID: ZN000000J8
Sample ID: STS-AMD-2011-E3 6-12

ACZ Sample ID: ***L91218-04***
Date Sampled: *10/06/11 10:15*
Date Received: *10/12/11*
Sample Matrix: *Soil*

Inorganic Prep

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Total Hot Plate Digestion	M3010A ICP							11/04/11 11:23	jjc

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Calcium, total (3050)	M6010B ICP	3190			mg/Kg	20	100	11/10/11 11:41	aeb
Copper (1312)	M6010B ICP	0.06		*	mg/L	0.01	0.05	11/07/11 14:17	jjc
Copper, total (3050)	M6010B ICP	630		*	mg/Kg	1	5	11/10/11 11:41	aeb
Potassium, total (3050)	M6010B ICP	3110			mg/Kg	30	200	11/10/11 11:41	aeb

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Carbon, total (TC)	ASA No.9 29-2.2.4 Combustion/IR	1.1 J HT-L	H	*	%	0.1	0.5	11/08/11 20:30	bsu
Carbon, total organic (TOC)	ASA No.9 29-2.2.4 Combustion/IR	1.1 ↓		*	%	0.1	0.5	11/08/11 20:30	bsu
pH, Saturated Paste	USDA No. 60 (21A)	5.2 J HT-L		*	units	0.1	0.1	11/09/11 15:58	ndj
Solids, Percent	CLPSOW390, PART F, D-98	88.3		*	%	0.1	0.5	11/01/11 17:35	lwt

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/01/11 11:12	lwt
Digestion - Hot Plate	M3050B ICP							11/09/11 7:06	lwt
Saturated Paste Extraction	USDA No. 60 (2)							11/09/11 10:06	ndj
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/07/11 15:58	thf/ndj
Sieve-250 um (60 mesh)	ASA No.9, 15-4.2.2							11/07/11 15:58	thf/ndj
Synthetic Precip. Leaching Procedure	M1312							11/02/11 12:11	lwt/brd
Water Extraction	ASA No. 9 10-2.3.2							11/09/11 12:27	ndj

Wet Chemistry

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Nitrate as N, soluble (Water)	Calculation: NO3NO2 minus NO2	3.4 J HT-L			mg/Kg	0.1	0.5	11/14/11 12:25	calc
Nitrate/Nitrite as N, soluble (Water)	M353.2 - Automated Cadmium Reduction J HT-L	3.7		*	mg/Kg	0.1	0.5	11/09/11 22:03	pjb
Nitrite as N, soluble (Water)	M353.2 - Automated Cadmium Reduction J HT, SQL-~~Z~~ L	0.21	B	*	mg/Kg	0.05	0.3	11/09/11 22:03	pjb

EB 03/30/12

Freeport-McMoRan - Chino Mines Company
Project ID: ZN000000J8
Sample ID: STS-AMD-2011-WREF1 0

ACZ Sample ID: ***L91218-05***
Date Sampled: *10/04/11 09:30*
Date Received: *10/12/11*
Sample Matrix: *Soil*

Inorganic Prep

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Total Hot Plate Digestion	M3010A ICP							11/04/11 11:37	jjc

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Calcium, total (3050)	M6010B ICP	13500			mg/Kg	20	100	11/10/11 11:44	aeb
Copper (1312)	M6010B ICP J SQL:I	0.02	B	*	mg/L	0.01	0.05	11/07/11 14:20	jjc
Copper, total (3050)	M6010B ICP	731		*	mg/Kg	1	5	11/10/11 11:44	aeb
Potassium, total (3050)	M6010B ICP	3670			mg/Kg	30	200	11/10/11 11:44	aeb

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Carbon, total (TC)	ASA No.9 29-2.2.4 Combustion/IR	1.7 J HT-L	H	*	%	0.1	0.5	11/08/11 21:30	bsu
Carbon, total organic (TOC)	ASA No.9 29-2.2.4 Combustion/IR	1.3 ↓		*	%	0.1	0.5	11/08/11 21:30	bsu
pH, Saturated Paste	USDA No. 60 (21A)	7.8 J HT-L		*	units	0.1	0.1	11/09/11 16:00	ndj
Solids, Percent	CLPSOW390, PART F, D-98	92.6		*	%	0.1	0.5	11/01/11 17:37	lwt

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/01/11 11:16	lwt
Digestion - Hot Plate	M3050B ICP							11/09/11 7:07	lwt
Saturated Paste Extraction	USDA No. 60 (2)							11/09/11 10:07	ndj
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/07/11 16:01	thf/ndj
Sieve-250 um (60 mesh)	ASA No.9, 15-4.2.2							11/07/11 16:01	thf/ndj
Synthetic Precip. Leaching Procedure	M1312							11/02/11 12:12	lwt/brd
Water Extraction	ASA No. 9 10-2.3.2							11/09/11 12:38	ndj

Wet Chemistry

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Nitrate as N, soluble (Water)	Calculation: NO3NO2 minus NO2	1.3 J HT-L			mg/Kg	0.1	0.5	11/14/11 12:25	calc
Nitrate/Nitrite as N, soluble (Water)	M353.2 - Automated Cadmium Reduction J HT-L	1.7		*	mg/Kg	0.1	0.5	11/09/11 22:04	pjb
Nitrite as N, soluble (Water)	M353.2 - Automated Cadmium Reduction J HT-~~I~~ L	0.34		*	mg/Kg	0.05	0.3	11/09/11 22:04	pjb

EB 03/30/12

** Please refer to Qualifier Reports for details.*

Inorganic Analytical Results

Freeport-McMoRan - Chino Mines Company		ACZ Sample ID:	***L91218-06***
Project ID:	ZN000000J8	Date Sampled:	*10/04/11 09:55*
Sample ID:	STS-AMD-2011-WREF2 0	Date Received:	*10/12/11*
		Sample Matrix:	*Soil*

Inorganic Prep

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Total Hot Plate Digestion	M3010A ICP							11/04/11 11:51	jjc

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Calcium, total (3050)	M6010B ICP	28200			mg/Kg	20	100	11/10/11 11:47	aeb
Copper (1312)	M6010B ICP J SQL-I	0.03	B	*	mg/L	0.01	0.05	11/07/11 14:23	jjc
Copper, total (3050)	M6010B ICP	690		*	mg/Kg	1	5	11/10/11 11:47	aeb
Potassium, total (3050)	M6010B ICP	3740			mg/Kg	30	200	11/10/11 11:47	aeb

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Carbon, total (TC)	ASA No.9 29-2.2.4 Combustion/IR	2.6 J HT-L	H	*	%	0.1	0.5	11/08/11 22:30	bsu
Carbon, total organic (TOC)	ASA No.9 29-2.2.4 Combustion/IR	1.8 ↓		*	%	0.1	0.5	11/08/11 22:30	bsu
pH, Saturated Paste	USDA No. 60 (21A)	7.8 J HT-L		*	units	0.1	0.1	11/09/11 16:01	ndj
Solids, Percent	CLPSOW390, PART F, D-98	91.8		*	%	0.1	0.5	11/01/11 17:38	lwt

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/01/11 11:20	lwt
Digestion - Hot Plate	M3050B ICP							11/09/11 7:08	lwt
Saturated Paste Extraction	USDA No. 60 (2)							11/09/11 10:09	ndj
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/07/11 16:04	thf/ndj
Sieve-250 um (60 mesh)	ASA No.9, 15-4.2.2							11/07/11 16:04	thf/ndj
Synthetic Precip. Leaching Procedure	M1312							11/02/11 12:13	lwt/brd
Water Extraction	ASA No. 9 10-2.3.2							11/09/11 12:50	ndj

Wet Chemistry

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Nitrate as N, soluble (Water)	Calculation: NO3NO2 minus NO2	2.0 J HT-L			mg/Kg	0.1	0.5	11/14/11 12:25	calc
Nitrate/Nitrite as N, soluble (Water)	M353.2 - Automated Cadmium Reduction J HT-L	2.3		*	mg/Kg	0.1	0.5	11/09/11 22:06	pjb
Nitrite as N, soluble (Water)	M353.2 - Automated Cadmium Reduction J HT, SQL-~~I~~ L	0.26	B	*	mg/Kg	0.05	0.3	11/09/11 22:06	pjb

EB 03/30/12

** Please refer to Qualifier Reports for details.*

ACZ Laboratories, Inc.
2773 Downhill Drive Steamboat Springs, CO 80487 (800) 334-5493

Inorganic Analytical Results

Freeport-McMoRan - Chino Mines Company

Project ID: ZN000000J8
Sample ID: STS-AMD-2011-WREF1 1

ACZ Sample ID: ***L91218-07***
Date Sampled: *10/04/11 10:26*
Date Received: *10/12/11*
Sample Matrix: *Soil*

Inorganic Prep

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Total Hot Plate Digestion	M3010A ICP							11/04/11 12:05	jjc

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Calcium, total (3050)	M6010B ICP	49900			mg/Kg	20	100	11/10/11 11:59	aeb
Copper (1312)	M6010B ICP		U	*	mg/L	0.01	0.05	11/07/11 14:32	jjc
Copper, total (3050)	M6010B ICP	316		*	mg/Kg	1	5	11/11/11 0:31	jjc
Potassium, total (3050)	M6010B ICP	4180			mg/Kg	30	200	11/10/11 11:59	aeb

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Carbon, total (TC)	ASA No.9 29-2.2.4 Combustion/IR	3.4 J HT-L	H	*	%	0.1	0.5	11/08/11 23:30	bsu
Carbon, total organic (TOC)	ASA No.9 29-2.2.4 Combustion/IR	1.3 ↓		*	%	0.1	0.5	11/08/11 23:30	bsu
pH, Saturated Paste	USDA No. 60 (21A)	7.9 J HT-L		*	units	0.1	0.1	11/09/11 16:03	ndj
Solids, Percent	CLPSOW390, PART F, D-98	90.1		*	%	0.1	0.5	11/01/11 17:40	lwt

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/01/11 11:25	lwt
Digestion - Hot Plate	M3050B ICP							11/09/11 7:09	lwt
Saturated Paste Extraction	USDA No. 60 (2)							11/09/11 10:10	ndj
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/07/11 16:07	thf/ndj
Sieve-250 um (60 mesh)	ASA No.9, 15-4.2.2							11/07/11 16:07	thf/ndj
Synthetic Precip. Leaching Procedure	M1312							11/02/11 12:15	lwt/brd
Water Extraction	ASA No. 9 10-2.3.2							11/09/11 13:01	ndj

Wet Chemistry

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Nitrate as N, soluble (Water)	Calculation: NO3NO2 minus NO2	1.5 J HT-L			mg/Kg	0.1	0.5	11/14/11 12:25	calc
Nitrate/Nitrite as N, soluble (Water)	M353.2 - Automated Cadmium Reduction J HT-L	1.7		*	mg/Kg	0.1	0.5	11/09/11 22:09	pjb
Nitrite as N, soluble (Water)	M353.2 - Automated Cadmium Reduction J HT, SQL-Z L	0.18	B	*	mg/Kg	0.05	0.3	11/09/11 22:09	pjb

EB 03/30/12

** Please refer to Qualifier Reports for details.*

ACZ Laboratories, Inc.
2773 Downhill Drive Steamboat Springs, CO 80487 (800) 334-5493

Inorganic Analytical Results

Freeport-McMoRan - Chino Mines Company

Project ID:	ZN000000J8	ACZ Sample ID:	***L91218-08***
Sample ID:	STS-AMD-2011-WREF2 1	Date Sampled:	*10/04/11 10:40*
		Date Received:	*10/12/11*
		Sample Matrix:	*Soil*

Inorganic Prep

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Total Hot Plate Digestion	M3010A ICP							11/04/11 12:19	jjc

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Calcium, total (3050)	M6010B ICP	77800			mg/Kg	20	100	11/10/11 12:02	aeb
Copper (1312)	M6010B ICP		U	*	mg/L	0.01	0.05	11/07/11 14:35	jjc
Copper, total (3050)	M6010B ICP	267		*	mg/Kg	1	5	11/11/11 0:37	jjc
Potassium, total (3050)	M6010B ICP	4060			mg/Kg	30	200	11/10/11 12:02	aeb

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Carbon, total (TC)	ASA No.9 29-2.2.4 Combustion/IR	4.4	J HT-L H	*	%	0.1	0.5	11/09/11 0:30	bsu
Carbon, total organic (TOC)	ASA No.9 29-2.2.4 Combustion/IR	1.8	↓	*	%	0.1	0.5	11/09/11 0:30	bsu
pH, Saturated Paste	USDA No. 60 (21A)	7.9	J HT-L	*	units	0.1	0.1	11/09/11 16:05	ndj
Solids, Percent	CLPSOW390, PART F, D-98	90.2		*	%	0.1	0.5	11/01/11 17:41	lwt

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/01/11 11:29	lwt
Digestion - Hot Plate	M3050B ICP							11/09/11 7:10	lwt
Saturated Paste Extraction	USDA No. 60 (2)							11/09/11 10:12	ndj
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/07/11 16:10	thf/ndj
Sieve-250 um (60 mesh)	ASA No.9, 15-4.2.2							11/07/11 16:10	thf/ndj
Synthetic Precip. Leaching Procedure	M1312							11/02/11 12:16	lwt/brd
Water Extraction	ASA No. 9 10-2.3.2							11/09/11 13:12	ndj

Wet Chemistry

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Nitrate as N, soluble (Water)	Calculation: NO3NO2 minus NO2	0.8	J HT-L		mg/Kg	0.1	0.5	11/14/11 12:25	calc
Nitrate/Nitrite as N, soluble (Water)	M353.2 - Automated Cadmium Reduction J HT-L	1.1		*	mg/Kg	0.1	0.5	11/09/11 22:10	pjb
Nitrite as N, soluble (Water)	M353.2 - Automated Cadmium Reduction J HT, SQL-~~I~~ L	0.21	B	*	mg/Kg	0.05	0.3	11/09/11 22:10	pjb

EB 03/30/12

** Please refer to Qualifier Reports for details.*

Freeport-McMoRan - Chino Mines Company
Project ID: ZN000000J8
Sample ID: STS-AMD-2011-NREF1 0

ACZ Sample ID: ***L91218-09***
Date Sampled: *10/05/11 10:00*
Date Received: *10/12/11*
Sample Matrix: *Soil*

Inorganic Prep

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Total Hot Plate Digestion	M3010A ICP							11/04/11 12:33	jjc

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Calcium, total (3050)	M6010B ICP	6510			mg/Kg	20	100	11/10/11 12:05	aeb
Copper (1312)	M6010B ICP	0.08		*	mg/L	0.01	0.05	11/07/11 14:38	jjc
Copper, total (3050)	M6010B ICP	821		*	mg/Kg	1	5	11/11/11 0:41	jjc
Potassium, total (3050)	M6010B ICP	4040			mg/Kg	30	200	11/10/11 12:05	aeb

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Carbon, total (TC)	ASA No.9 29-2.2.4 Combustion/IR	1.4 J HT-L	H	*	%	0.1	0.5	11/09/11 1:30	bsu
Carbon, total organic (TOC)	ASA No.9 29-2.2.4 Combustion/IR	1.3 ↓		*	%	0.1	0.5	11/09/11 1:30	bsu
pH, Saturated Paste	USDA No. 60 (21A)	6.4 J HT-L		*	units	0.1	0.1	11/09/11 16:06	ndj
Solids, Percent	CLPSOW390, PART F, D-98	93.4		*	%	0.1	0.5	11/01/11 17:42	lwt

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/01/11 11:33	lwt
Digestion - Hot Plate	M3050B ICP							11/09/11 7:11	lwt
Saturated Paste Extraction	USDA No. 60 (2)							11/09/11 10:13	ndj
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/07/11 16:13	thf/ndj
Sieve-250 um (60 mesh)	ASA No.9, 15-4.2.2							11/07/11 16:13	thf/ndj
Synthetic Precip. Leaching Procedure	M1312							11/02/11 12:17	lwt/brd
Water Extraction	ASA No. 9 10-2.3.2							11/09/11 13:24	ndj

Wet Chemistry

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Nitrate as N, soluble (Water)	Calculation: NO3NO2 minus NO2	17.8 J HT-L			mg/Kg	0.1	0.5	11/14/11 12:25	calc
Nitrate/Nitrite as N, soluble (Water)	M353.2 - Automated Cadmium Reduction J HT-L	18.0		*	mg/Kg	0.1	0.5	11/09/11 22:12	pjb
Nitrite as N, soluble (Water)	M353.2 - Automated Cadmium Reduction J HT, SQL-~~Z~~ L	0.16	B	*	mg/Kg	0.05	0.3	11/09/11 22:12	pjb

EB 03/30/12

** Please refer to Qualifier Reports for details.*

Inorganic Analytical Results

Freeport-McMoRan - Chino Mines Company

Project ID: ZN000000J8
Sample ID: STS-AMD-2011-NREF2 0

ACZ Sample ID: ***L91218-10***
Date Sampled: *10/05/11 10:50*
Date Received: *10/12/11*
Sample Matrix: *Soil*

Inorganic Prep

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Total Hot Plate Digestion	M3010A ICP							11/04/11 12:47	jjc

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Calcium, total (3050)	M6010B ICP	4680			mg/Kg	20	100	11/10/11 12:08	aeb
Copper (1312)	M6010B ICP	0.06		*	mg/L	0.01	0.05	11/07/11 14:42	jjc
Copper, total (3050)	M6010B ICP	901		*	mg/Kg	1	5	11/11/11 0:44	jjc
Potassium, total (3050)	M6010B ICP	3200			mg/Kg	30	200	11/10/11 12:08	aeb

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Carbon, total (TC)	ASA No.9 29-2.2.4 Combustion/IR	1.2 J HT-L	H	*	%	0.1	0.5	11/09/11 2:30	bsu
Carbon, total organic (TOC)	ASA No.9 29-2.2.4 Combustion/IR	1.2 ↓		*	%	0.1	0.5	11/09/11 2:30	bsu
pH, Saturated Paste	USDA No. 60 (21A)	5.1 J HT-L		*	units	0.1	0.1	11/09/11 16:10	ndj
Solids, Percent	CLPSOW390, PART F, D-98	93.6		*	%	0.1	0.5	11/01/11 17:44	lwt

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/01/11 11:37	lwt
Digestion - Hot Plate	M3050B ICP							11/09/11 7:12	lwt
Saturated Paste Extraction	USDA No. 60 (2)							11/09/11 10:15	ndj
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/07/11 16:16	thf/ndj
Sieve-250 um (60 mesh)	ASA No.9, 15-4.2.2							11/07/11 16:16	thf/ndj
Synthetic Precip. Leaching Procedure	M1312							11/02/11 12:18	lwt/brd
Water Extraction	ASA No. 9 10-2.3.2							11/09/11 13:35	ndj

Wet Chemistry

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Nitrate as N, soluble (Water)	Calculation: NO3NO2 minus NO2	2.9 J HT-L			mg/Kg	0.1	0.5	11/14/11 12:25	calc
Nitrate/Nitrite as N, soluble (Water)	M353.2 - Automated Cadmium Reduction J HT-L	3.1		*	mg/Kg	0.1	0.5	11/09/11 22:13	pjb
Nitrite as N, soluble (Water)	M353.2 - Automated Cadmium Reduction J HT, SQL-Z L	0.11	B	*	mg/Kg	0.05	0.3	11/09/11 22:13	pjb

EB 03/30/12

** Please refer to Qualifier Reports for details.*

Freeport-McMoRan - Chino Mines Company
Project ID: ZN000000J8
Sample ID: STS-AMD-2011-NREF1 1

ACZ Sample ID: ***L91218-11***
Date Sampled: *10/05/11 10:50*
Date Received: *10/12/11*
Sample Matrix: *Soil*

Inorganic Prep

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Total Hot Plate Digestion	M3010A ICP							11/04/11 13:01	jjc

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Calcium, total (3050)	M6010B ICP	51200			mg/Kg	20	100	11/10/11 12:17	aeb
Copper (1312)	M6010B ICP		U	*	mg/L	0.01	0.05	11/07/11 14:48	jjc
Copper, total (3050)	M6010B ICP	128		*	mg/Kg	1	5	11/11/11 1:01	jjc
Potassium, total (3050)	M6010B ICP	3900			mg/Kg	30	200	11/10/11 12:17	aeb

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Carbon, total (TC)	ASA No.9 29-2.2.4 Combustion/IR	1.7 J HT-L	H	*	%	0.1	0.5	11/09/11 3:30	bsu
Carbon, total organic (TOC)	ASA No.9 29-2.2.4 Combustion/IR	0.5 ↓		*	%	0.1	0.5	11/09/11 3:30	bsu
pH, Saturated Paste	USDA No. 60 (21A)	7.6 J HT-L		*	units	0.1	0.1	11/09/11 16:11	ndj
Solids, Percent	CLPSOW390, PART F, D-98	89.5		*	%	0.1	0.5	11/01/11 17:45	lwt

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/01/11 11:41	lwt
Digestion - Hot Plate	M3050B ICP							11/09/11 7:15	lwt
Saturated Paste Extraction	USDA No. 60 (2)							11/09/11 10:16	ndj
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/07/11 16:20	thf/ndj
Sieve-250 um (60 mesh)	ASA No.9, 15-4.2.2							11/07/11 16:20	thf/ndj
Synthetic Precip. Leaching Procedure	M1312							11/02/11 12:19	lwt/brd
Water Extraction	ASA No. 9 10-2.3.2							11/09/11 13:47	ndj

Wet Chemistry

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Nitrate as N, soluble (Water)	Calculation: NO3NO2 minus NO2	2.6 J HT-L			mg/Kg	0.1	0.5	11/14/11 12:25	calc
Nitrate/Nitrite as N, soluble (Water)	M353.2 - Automated Cadmium Reduction J HT-L	2.8		*	mg/Kg	0.1	0.5	11/09/11 22:14	pjb
Nitrite as N, soluble (Water)	M353.2 - Automated Cadmium Reduction J HT, SQL-Z L	0.15	B	*	mg/Kg	0.05	0.3	11/09/11 22:14	pjb

EB 03/30/12

** Please refer to Qualifier Reports for details.*

Freeport-McMoRan - Chino Mines Company

Project ID:	ZN000000J8	ACZ Sample ID:	***L91218-12***
Sample ID:	STS-AMD-2011-NREF2 1	Date Sampled:	*10/05/11 11:20*
		Date Received:	*10/12/11*
		Sample Matrix:	*Soil*

Inorganic Prep

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Total Hot Plate Digestion	M3010A ICP							11/04/11 13:15	jjc

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Calcium, total (3050)	M6010B ICP	9470			mg/Kg	20	100	11/10/11 12:20	aeb
Copper (1312)	M6010B ICP J SQL-I	0.02	B	*	mg/L	0.01	0.05	11/07/11 14:51	jjc
Copper, total (3050)	M6010B ICP	98		*	mg/Kg	1	5	11/11/11 1:04	jjc
Potassium, total (3050)	M6010B ICP	4650			mg/Kg	30	200	11/10/11 12:20	aeb

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Carbon, total (TC)	ASA No.9 29-2.2.4 Combustion/IR	1.0 J HT-L	H	*	%	0.1	0.5	11/09/11 4:30	bsu
Carbon, total organic (TOC)	ASA No.9 29-2.2.4 Combustion/IR	0.9 ↓		*	%	0.1	0.5	11/09/11 4:30	bsu
pH, Saturated Paste	USDA No. 60 (21A)	7.5 J HT-L		*	units	0.1	0.1	11/09/11 16:13	ndj
Solids, Percent	CLPSOW390, PART F, D-98	88.0		*	%	0.1	0.5	11/01/11 17:47	lwt

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/01/11 11:46	lwt
Digestion - Hot Plate	M3050B ICP							11/09/11 7:16	lwt
Saturated Paste Extraction	USDA No. 60 (2)							11/09/11 10:18	ndj
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/07/11 16:23	thf/ndj
Sieve-250 um (60 mesh)	ASA No.9, 15-4.2.2							11/07/11 16:23	thf/ndj
Synthetic Precip. Leaching Procedure	M1312							11/02/11 12:20	lwt/brd
Water Extraction	ASA No. 9 10-2.3.2							11/09/11 13:58	ndj

Wet Chemistry

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Nitrate as N, soluble (Water)	Calculation: NO3NO2 minus NO2	1.6 J HT-L			mg/Kg	0.1	0.5	11/14/11 12:25	calc
Nitrate/Nitrite as N, soluble (Water)	M353.2 - Automated Cadmium Reduction J HT-L	1.8		*	mg/Kg	0.1	0.5	11/09/11 22:15	pjb
Nitrite as N, soluble (Water)	M353.2 - Automated Cadmium Reduction J HT,SQL-~~I~~ L	0.15	B	*	mg/Kg	0.05	0.3	11/09/11 22:15	pjb

EB 03/30/12

** Please refer to Qualifier Reports for details.*

Freeport-McMoRan - Chino Mines Company		ACZ Sample ID:	***L91218-13***
Project ID:	ZN000000J8	Date Sampled:	*10/07/11 10:20*
Sample ID:	STS-AMD-2011-NEREF1	Date Received:	*10/12/11*
		Sample Matrix:	*Soil*

Inorganic Prep

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Total Hot Plate Digestion	M3010A ICP							11/04/11 13:29	jjc

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Calcium, total (3050)	M6010B ICP	4130			mg/Kg	20	100	11/10/11 12:23	aeb
Copper (1312)	M6010B ICP	6.29		*	mg/L	0.01	0.05	11/07/11 14:54	jjc
Copper, total (3050)	M6010B ICP	4050		*	mg/Kg	1	5	11/11/11 1:07	jjc
Potassium, total (3050)	M6010B ICP	3590			mg/Kg	30	200	11/10/11 12:23	aeb

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Carbon, total (TC)	ASA No.9 29-2.2.4 Combustion/IR	1.3	J HT-L H	*	%	0.1	0.5	11/09/11 5:30	bsu
Carbon, total organic (TOC)	ASA No.9 29-2.2.4 Combustion/IR	1.3	↓	*	%	0.1	0.5	11/09/11 5:30	bsu
pH, Saturated Paste	USDA No. 60 (21A)	4.2	J HT-L	*	units	0.1	0.1	11/09/11 16:15	ndj
Solids, Percent	CLPSOW390, PART F, D-98	92.3		*	%	0.1	0.5	11/01/11 17:48	lwt

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/01/11 11:50	lwt
Digestion - Hot Plate	M3050B ICP							11/09/11 7:17	lwt
Saturated Paste Extraction	USDA No. 60 (2)							11/09/11 10:19	ndj
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/07/11 16:26	thf/ndj
Sieve-250 um (60 mesh)	ASA No.9, 15-4.2.2							11/07/11 16:26	thf/ndj
Synthetic Precip. Leaching Procedure	M1312							11/02/11 12:21	lwt/brd
Water Extraction	ASA No. 9 10-2.3.2							11/09/11 14:10	ndj

Wet Chemistry

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Nitrate as N, soluble (Water)	Calculation: NO3NO2 minus NO2	17.1	J HT-L		mg/Kg	0.1	0.5	11/14/11 12:26	calc
Nitrate/Nitrite as N, soluble (Water)	M353.2 - Automated Cadmium Reduction J HT-L	17.2		*	mg/Kg	0.1	0.5	11/09/11 22:16	pjb
Nitrite as N, soluble (Water)	M353.2 - Automated Cadmium Reduction J HT, SQL-L	0.08	B	*	mg/Kg	0.05	0.3	11/09/11 22:16	pjb

EB 03/30/12

Inorganic Analytical Results

Freeport-McMoRan - Chino Mines Company		ACZ Sample ID:	***L91218-14***
Project ID:	ZN000000J8	Date Sampled:	*10/07/11 10:05*
Sample ID:	STS-AMD-2011-NEREF2	Date Received:	*10/12/11*
		Sample Matrix:	*Soil*

Inorganic Prep

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Total Hot Plate Digestion	M3010A ICP							11/04/11 13:43	jjc

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Calcium, total (3050)	M6010B ICP	5330			mg/Kg	20	100	11/10/11 12:26	aeb
Copper (1312)	M6010B ICP	0.21		*	mg/L	0.01	0.05	11/07/11 14:57	jjc
Copper, total (3050)	M6010B ICP	2420		*	mg/Kg	1	5	11/11/11 1:11	jjc
Potassium, total (3050)	M6010B ICP	4590			mg/Kg	30	200	11/10/11 12:26	aeb

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Carbon, total (TC)	ASA No.9 29-2.2.4 Combustion/IR	1.4	J HT-L H	*	%	0.1	0.5	11/09/11 6:30	bsu
Carbon, total organic (TOC)	ASA No.9 29-2.2.4 Combustion/IR	1.3	↓	*	%	0.1	0.5	11/09/11 6:30	bsu
pH, Saturated Paste	USDA No. 60 (21A)	5.0	J HT-L	*	units	0.1	0.1	11/09/11 16:16	ndj
Solids, Percent	CLPSOW390, PART F, D-98	90.6		*	%	0.1	0.5	11/01/11 17:50	lwt

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/01/11 11:54	lwt
Digestion - Hot Plate	M3050B ICP							11/09/11 7:18	lwt
Saturated Paste Extraction	USDA No. 60 (2)							11/09/11 10:21	ndj
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/07/11 16:29	thf/ndj
Sieve-250 um (60 mesh)	ASA No.9, 15-4.2.2							11/07/11 16:29	thf/ndj
Synthetic Precip. Leaching Procedure	M1312							11/02/11 12:22	lwt/brd
Water Extraction	ASA No. 9 10-2.3.2							11/09/11 14:21	ndj

Wet Chemistry

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Nitrate as N, soluble (Water)	Calculation: NO3NO2 minus NO2	7.0	J HT-L		mg/Kg	0.1	0.5	11/14/11 12:26	calc
Nitrate/Nitrite as N, soluble (Water)	M353.2 - Automated Cadmium Reduction J HT-L	7.1		*	mg/Kg	0.1	0.5	11/09/11 22:18	pjb
Nitrite as N, soluble (Water)	M353.2 - Automated Cadmium Reduction J HT, SQL-L	0.06	B	*	mg/Kg	0.05	0.3	11/09/11 22:18	pjb

EB 03/30/12

** Please refer to Qualifier Reports for details.*

ACZ Laboratories, Inc.

2773 Downhill Drive Steamboat Springs, CO 80487 (800) 334-5493

Inorganic Analytical Results

Freeport-McMoRan - Chino Mines Company

Project ID: ZN000000J8

Sample ID: STS-AMD-2011-NEREF1

ACZ Sample ID: ***L91218-15***

Date Sampled: *10/07/11 11:05*

Date Received: *10/12/11*

Sample Matrix: *Soil*

Inorganic Prep

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Total Hot Plate Digestion	M3010A ICP							11/04/11 13:57	jjc

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Calcium, total (3050)	M6010B ICP	41800			mg/Kg	20	100	11/10/11 12:35	aeb
Copper (1312)	M6010B ICP J SQL: I	0.02	B	*	mg/L	0.01	0.05	11/07/11 15:00	jjc
Copper, total (3050)	M6010B ICP	136		*	mg/Kg	1	5	11/11/11 1:14	jjc
Potassium, total (3050)	M6010B ICP	5090			mg/Kg	30	200	11/10/11 12:35	aeb

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Carbon, total (TC)	ASA No.9 29-2.2.4 Combustion/IR	2.2 J HT-L	H	*	%	0.1	0.5	11/09/11 7:30	bsu
Carbon, total organic (TOC)	ASA No.9 29-2.2.4 Combustion/IR	1.0 ↓		*	%	0.1	0.5	11/09/11 7:30	bsu
pH, Saturated Paste	USDA No. 60 (21A)	7.5 J HT-L		*	units	0.1	0.1	11/09/11 16:18	ndj
Solids, Percent	CLPSOW390, PART F, D-98	84.0		*	%	0.1	0.5	11/01/11 17:51	lwt

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/01/11 11:58	lwt
Digestion - Hot Plate	M3050B ICP							11/09/11 7:19	lwt
Saturated Paste Extraction	USDA No. 60 (2)							11/09/11 10:22	ndj
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/07/11 16:32	thf/ndj
Sieve-250 um (60 mesh)	ASA No.9, 15-4.2.2							11/07/11 16:32	thf/ndj
Synthetic Precip. Leaching Procedure	M1312							11/02/11 12:23	lwt/brd
Water Extraction	ASA No. 9 10-2.3.2							11/09/11 14:32	ndj

Wet Chemistry

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Nitrate as N, soluble (Water)	Calculation: NO3NO2 minus NO2	3.0 J HT-L			mg/Kg	0.1	0.5	11/14/11 12:26	calc
Nitrate/Nitrite as N, soluble (Water)	M353.2 - Automated Cadmium Reduction J HT-L	3.5		*	mg/Kg	0.1	0.5	11/09/11 22:19	pjb
Nitrite as N, soluble (Water)	M353.2 - Automated Cadmium Reduction J HT-L	0.45		*	mg/Kg	0.05	0.3	11/09/11 22:19	pjb

EB 03/30/12

** Please refer to Qualifier Reports for details.*

Inorganic Analytical Results

Freeport-McMoRan - Chino Mines Company		ACZ Sample ID:	***L91218-16***
Project ID:	ZN000000J8	Date Sampled:	*10/07/11 10:45*
Sample ID:	STS-AMD-2011-NEREF2	Date Received:	*10/12/11*
		Sample Matrix:	*Soil*

Inorganic Prep

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Total Hot Plate Digestion	M3010A ICP							11/04/11 14:11	jjc

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Calcium, total (3050)	M6010B ICP	8350			mg/Kg	20	100	11/10/11 12:38	aeb
Copper (1312)	M6010B ICP J SQL-I	0.01	B	*	mg/L	0.01	0.05	11/07/11 15:10	jjc
Copper, total (3050)	M6010B ICP	168		*	mg/Kg	1	5	11/11/11 1:17	jjc
Potassium, total (3050)	M6010B ICP	4980			mg/Kg	30	200	11/10/11 12:38	aeb

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Carbon, total (TC)	ASA No.9 29-2.2.4 Combustion/IR	1.6	J HT-L H	*	%	0.1	0.5	11/09/11 8:30	bsu
Carbon, total organic (TOC)	ASA No.9 29-2.2.4 Combustion/IR	1.4	↓	*	%	0.1	0.5	11/09/11 8:30	bsu
pH, Saturated Paste	USDA No. 60 (21A)	6.9	J HT-L	*	units	0.1	0.1	11/09/11 16:20	ndj
Solids, Percent	CLPSOW390, PART F, D-98	82.1		*	%	0.1	0.5	11/01/11 17:52	lwt

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/01/11 12:02	lwt
Digestion - Hot Plate	M3050B ICP							11/09/11 7:20	lwt
Saturated Paste Extraction	USDA No. 60 (2)							11/09/11 10:24	ndj
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/07/11 16:35	thf/ndj
Sieve-250 um (60 mesh)	ASA No.9, 15-4.2.2							11/07/11 16:35	thf/ndj
Synthetic Precip. Leaching Procedure	M1312							11/02/11 12:24	lwt/brd
Water Extraction	ASA No. 9 10-2.3.2							11/09/11 14:44	ndj

Wet Chemistry

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Nitrate as N, soluble (Water)	Calculation: NO3NO2 minus NO2	1.3	J HT-L		mg/Kg	0.1	0.5	11/14/11 12:26	calc
Nitrate/Nitrite as N, soluble (Water)	M353.2 - Automated Cadmium Reduction J HT-L	1.5		*	mg/Kg	0.1	0.5	11/09/11 22:20	pjb
Nitrite as N, soluble (Water)	M353.2 - Automated Cadmium Reduction J HT, SQL-L	0.20	B	*	mg/Kg	0.05	0.3	11/09/11 22:20	pjb

EB 03/30/12

** Please refer to Qualifier Reports for details.*

Inorganic Analytical Results

Freeport-McMoRan - Chino Mines Company
Project ID: ZN000000J8
Sample ID: STS-AMD-2011-EREF1 0

ACZ Sample ID: ***L91218-17***
Date Sampled: *10/06/11 08:55*
Date Received: *10/12/11*
Sample Matrix: *Soil*

Inorganic Prep

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Total Hot Plate Digestion	M3010A ICP							11/04/11 14:25	jjc

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Calcium, total (3050)	M6010B ICP	3710			mg/Kg	20	100	11/10/11 12:41	aeb
Copper (1312)	M6010B ICP	0.07		*	mg/L	0.01	0.05	11/07/11 15:13	jjc
Copper, total (3050)	M6010B ICP	1240		*	mg/Kg	1	5	11/11/11 1:21	jjc
Potassium, total (3050)	M6010B ICP	5390			mg/Kg	30	200	11/10/11 12:41	aeb

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Carbon, total (TC)	ASA No.9 29-2.2.4 Combustion/IR	0.8	J HT-L H	*	%	0.1	0.5	11/09/11 9:30	bsu
Carbon, total organic (TOC)	ASA No.9 29-2.2.4 Combustion/IR	0.8	↓	*	%	0.1	0.5	11/09/11 9:30	bsu
pH, Saturated Paste	USDA No. 60 (21A)	4.7	J HT-L	*	units	0.1	0.1	11/09/11 16:21	ndj
Solids, Percent	CLPSOW390, PART F, D-98	84.1		*	%	0.1	0.5	11/01/11 17:54	lwt

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/01/11 12:06	lwt
Digestion - Hot Plate	M3050B ICP							11/09/11 7:21	lwt
Saturated Paste Extraction	USDA No. 60 (2)							11/09/11 10:25	ndj
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/07/11 16:38	thf/ndj
Sieve-250 um (60 mesh)	ASA No.9, 15-4.2.2							11/07/11 16:38	thf/ndj
Synthetic Precip. Leaching Procedure	M1312							11/02/11 12:26	lwt/brd
Water Extraction	ASA No. 9 10-2.3.2							11/09/11 14:55	ndj

Wet Chemistry

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Nitrate as N, soluble (Water)	Calculation: NO3NO2 minus NO2	2.9	J HT-L		mg/Kg	0.1	0.5	11/14/11 12:26	calc
Nitrate/Nitrite as N, soluble (Water)	M353.2 - Automated Cadmium Reduction J HT-L	3.1		*	mg/Kg	0.1	0.5	11/09/11 22:24	pjb
Nitrite as N, soluble (Water)	M353.2 - Automated Cadmium Reduction J HT,SQL-L	0.11	B	*	mg/Kg	0.05	0.3	11/09/11 22:24	pjb

EB 03/30/12

* *Please refer to Qualifier Reports for details.*

Freeport-McMoRan - Chino Mines Company
Project ID: ZN000000J8
Sample ID: STS-AMD-2011-EREF2 0

ACZ Sample ID: ***L91218-18***
Date Sampled: *10/06/11 08:50*
Date Received: *10/12/11*
Sample Matrix: *Soil*

Inorganic Prep

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Total Hot Plate Digestion	M3010A ICP							11/04/11 14:39	jjc

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Calcium, total (3050)	M6010B ICP	2550			mg/Kg	20	100	11/10/11 12:44	aeb
Copper (1312)	M6010B ICP	0.39		*	mg/L	0.01	0.05	11/07/11 15:16	jjc
Copper, total (3050)	M6010B ICP	1400		*	mg/Kg	1	5	11/11/11 1:24	jjc
Potassium, total (3050)	M6010B ICP	2720			mg/Kg	30	200	11/10/11 12:44	aeb

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Carbon, total (TC)	ASA No.9 29-2.2.4 Combustion/IR	0.5	J HT-L H	*	%	0.1	0.5	11/09/11 10:30	bsu
Carbon, total organic (TOC)	ASA No.9 29-2.2.4 Combustion/IR	0.5	↓	*	%	0.1	0.5	11/09/11 10:30	bsu
pH, Saturated Paste	USDA No. 60 (21A)	4.7	J HT-L	*	units	0.1	0.1	11/09/11 16:23	ndj
Solids, Percent	CLPSOW390, PART F, D-98	92.1		*	%	0.1	0.5	11/01/11 17:55	lwt

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/01/11 12:11	lwt
Digestion - Hot Plate	M3050B ICP							11/09/11 7:22	lwt
Saturated Paste Extraction	USDA No. 60 (2)							11/09/11 10:27	ndj
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/07/11 16:41	thf/ndj
Sieve-250 um (60 mesh)	ASA No.9, 15-4.2.2							11/07/11 16:41	thf/ndj
Synthetic Precip. Leaching Procedure	M1312							11/02/11 12:27	lwt/brd
Water Extraction	ASA No. 9 10-2.3.2							11/09/11 15:07	ndj

Wet Chemistry

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Nitrate as N, soluble (Water)	Calculation: NO3NO2 minus NO2	2.6	J HT-L		mg/Kg	0.1	0.5	11/14/11 12:26	calc
Nitrate/Nitrite as N, soluble (Water)	M353.2 - Automated Cadmium Reduction	2.6	J HT-L	*	mg/Kg	0.1	0.5	11/09/11 22:25	pjb
Nitrite as N, soluble (Water)	M353.2 - Automated Cadmium Reduction	R	~~U~~	~~*~~	~~mg/Kg~~	~~0.05~~	~~0.3~~	~~11/09/11 22:25~~	~~pjb~~

EB 03/30/12

** Please refer to Qualifier Reports for details.*

Freeport-McMoRan - Chino Mines Company

Project ID:	ZN000000J8	ACZ Sample ID:	***L91218-19***
Sample ID:	STS-AMD-2011-EREF1 6	Date Sampled:	*10/06/11 09:05*
		Date Received:	*10/12/11*
		Sample Matrix:	*Soil*

Inorganic Prep

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Total Hot Plate Digestion	M3010A ICP							11/04/11 14:53	jjc

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Calcium, total (3050)	M6010B ICP	7020			mg/Kg	20	100	11/10/11 12:47	aeb
Copper (1312)	M6010B ICP		U	*	mg/L	0.01	0.05	11/07/11 15:19	jjc
Copper, total (3050)	M6010B ICP	116		*	mg/Kg	1	5	11/11/11 1:27	jjc
Potassium, total (3050)	M6010B ICP	7320			mg/Kg	30	200	11/10/11 12:47	aeb

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Carbon, total (TC)	ASA No.9 29-2.2.4 Combustion/IR	0.8 J HT-L	H	*	%	0.1	0.5	11/09/11 11:30	bsu
Carbon, total organic (TOC)	ASA No.9 29-2.2.4 Combustion/IR	0.8 ↓		*	%	0.1	0.5	11/09/11 11:30	bsu
pH, Saturated Paste	USDA No. 60 (21A)	6.8 J HT-L		*	units	0.1	0.1	11/09/11 16:25	ndj
Solids, Percent	CLPSOW390, PART F, D-98	85.9		*	%	0.1	0.5	11/01/11 17:57	lwt

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/01/11 12:15	lwt
Digestion - Hot Plate	M3050B ICP							11/09/11 7:23	lwt
Saturated Paste Extraction	USDA No. 60 (2)							11/09/11 10:28	ndj
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/07/11 16:44	thf/ndj
Sieve-250 um (60 mesh)	ASA No.9, 15-4.2.2							11/07/11 16:44	thf/ndj
Synthetic Precip. Leaching Procedure	M1312							11/02/11 12:28	lwt/brd
Water Extraction	ASA No. 9 10-2.3.2							11/09/11 15:18	ndj

Wet Chemistry

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Nitrate as N, soluble (Water)	Calculation: NO3NO2 minus NO2	4.5 J HT-L			mg/Kg	0.1	0.5	11/14/11 12:26	calc
Nitrate/Nitrite as N, soluble (Water)	M353.2 - Automated Cadmium Reduction J HT-L	4.8		*	mg/Kg	0.1	0.5	11/09/11 22:26	pjb
Nitrite as N, soluble (Water)	M353.2 - Automated Cadmium Reduction J HT,SQL·L	0.27	B	*	mg/Kg	0.05	0.3	11/09/11 22:26	pjb

EB 03/30/12

** Please refer to Qualifier Reports for details.*

Freeport-McMoRan - Chino Mines Company
Project ID: ZN000000J8
Sample ID: STS-AMD-2011-EREF2 6

ACZ Sample ID: ***L91218-20***
Date Sampled: *10/06/11 09:00*
Date Received: *10/12/11*
Sample Matrix: *Soil*

Inorganic Prep

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Total Hot Plate Digestion	M3010A ICP							11/04/11 15:07	jjc

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Calcium, total (3050)	M6010B ICP	2240			mg/Kg	20	100	11/10/11 12:50	aeb
Copper (1312)	M6010B ICP	0.34		*	mg/L	0.01	0.05	11/07/11 15:22	jjc
Copper, total (3050)	M6010B ICP	964		*	mg/Kg	1	5	11/11/11 1:31	jjc
Potassium, total (3050)	M6010B ICP	3430			mg/Kg	30	200	11/10/11 12:50	aeb

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Carbon, total (TC)	ASA No.9 29-2.2.4 Combustion/IR	0.9 J HT-L	H	*	%	0.1	0.5	11/09/11 12:30	bsu
Carbon, total organic (TOC)	ASA No.9 29-2.2.4 Combustion/IR	0.9 ↓		*	%	0.1	0.5	11/09/11 12:30	bsu
pH, Saturated Paste	USDA No. 60 (21A)	4.5 J HT-L		*	units	0.1	0.1	11/09/11 16:28	ndj
Solids, Percent	CLPSOW390, PART F, D-98	90.1		*	%	0.1	0.5	11/01/11 17:58	lwt

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/01/11 12:19	lwt
Digestion - Hot Plate	M3050B ICP							11/09/11 7:24	lwt
Saturated Paste Extraction	USDA No. 60 (2)							11/09/11 10:30	ndj
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/07/11 16:47	thf/ndj
Sieve-250 um (60 mesh)	ASA No.9, 15-4.2.2							11/07/11 16:47	thf/ndj
Synthetic Precip. Leaching Procedure	M1312							11/02/11 12:29	lwt/brd
Water Extraction	ASA No. 9 10-2.3.2							11/09/11 15:30	ndj

Wet Chemistry

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Nitrate as N, soluble (Water)	Calculation: NO3NO2 minus NO2	6.9 J HT-L			mg/Kg	0.1	0.5	11/14/11 12:26	calc
Nitrate/Nitrite as N, soluble (Water)	M353.2 - Automated Cadmium Reduction J HT-L	6.9		*	mg/Kg	0.1	0.5	11/09/11 22:27	pjb
Nitrite as N, soluble (Water)	M353.2 - Automated Cadmium Reduction	R	~~U~~	~~*~~	~~mg/Kg~~	~~0.05~~	~~0.3~~	~~11/09/11 22:27~~	~~pjb~~

EB 03/30/12

Freeport-McMoRan - Chino Mines Company
Project ID: ZN000000J8
Sample ID: DUP13

ACZ Sample ID: ***L91219-01***
Date Sampled: *10/04/11 00:00*
Date Received: *10/12/11*
Sample Matrix: *Soil*

Inorganic Prep

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Total Hot Plate Digestion	M3010A ICP							11/14/11 16:48	aeb

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Calcium, total (3050)	M6010B ICP J SD-L	6050		*	mg/Kg	20	100	11/11/11 12:53	jjc
Copper (1312)	M6010B ICP J SQL-I	0.03	B	*	mg/L	0.01	0.05	11/15/11 11:01	aeb
Copper, total (3050)	M6010B ICP J SD-L	842		*	mg/Kg	1	5	11/11/11 12:53	jjc
Potassium, total (3050)	M6010B ICP ↓	3210		*	mg/Kg	30	200	11/11/11 12:53	jjc

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Carbon, total (TC)	ASA No.9 29-2.2.4 Combustion/IR	1.5 J HT-L	H	*	%	0.1	0.5	11/10/11 15:22	bsu
Carbon, total organic (TOC)	ASA No.9 29-2.2.4 Combustion/IR	1.5 ↓		*	%	0.1	0.5	11/10/11 15:22	bsu
pH, Saturated Paste	USDA No. 60 (21A)	7.7 J HT-L		*	units	0.1	0.1	11/10/11 8:43	ndj
Solids, Percent	CLPSOW390, PART F, D-98	90.7		*	%	0.1	0.5	11/01/11 17:01	lwt

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/01/11 12:23	lwt
Digestion - Hot Plate	M3050B ICP							11/10/11 13:30	mss2
Saturated Paste Extraction	USDA No. 60 (2)							11/09/11 11:00	ndj
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/08/11 7:00	lwt
Sieve-250 um (60 mesh)	ASA No.9, 15-4.2.2							11/08/11 7:00	lwt
Synthetic Precip. Leaching Procedure	M1312							11/11/11 3:36	brd
Water Extraction	ASA No. 9 10-2.3.2							11/11/11 8:36	ndj

Wet Chemistry

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Nitrate as N, soluble (Water)	Calculation: NO3NO2 minus NO2 J HT-L	0.7			mg/Kg	0.1	0.5	11/16/11 9:36	calc
Nitrate/Nitrite as N, soluble (Water)	M353.2 - Automated Cadmium Reduction J HT-L	0.8		*	mg/Kg	0.1	0.5	11/11/11 22:06	pjb
Nitrite as N, soluble (Water)	M353.2 - Automated Cadmium Reduction J HT, SQL-L	0.08	B	*	mg/Kg	0.05	0.3	11/11/11 22:06	pjb

EB 03/30/12

** Please refer to Qualifier Reports for details.*

Freeport-McMoRan - Chino Mines Company
Project ID: ZN000000J8
Sample ID: DUP14

ACZ Sample ID: ***L91219-02***
Date Sampled: *10/05/11 00:00*
Date Received: *10/12/11*
Sample Matrix: *Soil*

Inorganic Prep

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Total Hot Plate Digestion	M3010A ICP							11/14/11 18:12	aeb

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Calcium, total (3050)	M6010B ICP J SD-L	4430		*	mg/Kg	20	100	11/11/11 13:02	jjc
Copper (1312)	M6010B ICP J SQL-I	0.04	B	*	mg/L	0.01	0.05	11/15/11 11:07	aeb
Copper, total (3050)	M6010B ICP J SD-L	639		*	mg/Kg	1	5	11/11/11 13:02	jjc
Potassium, total (3050)	M6010B ICP ↓	2850		*	mg/Kg	30	200	11/11/11 13:02	jjc

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Carbon, total (TC)	ASA No.9 29-2.2.4 Combustion/IR	1.4 J HT-L	H	*	%	0.1	0.5	11/10/11 16:11	bsu
Carbon, total organic (TOC)	ASA No.9 29-2.2.4 Combustion/IR	1.3 ↓		*	%	0.1	0.5	11/10/11 16:11	bsu
pH, Saturated Paste	USDA No. 60 (21A)	6.3 J HT-L		*	units	0.1	0.1	11/10/11 8:50	ndj
Solids, Percent	CLPSOW390, PART F, D-98	89.3		*	%	0.1	0.5	11/01/11 17:02	lwt

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/01/11 12:27	lwt
Digestion - Hot Plate	M3050B ICP							11/10/11 14:33	mss2
Saturated Paste Extraction	USDA No. 60 (2)							11/09/11 11:30	ndj
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/08/11 7:12	lwt
Sieve-250 um (60 mesh)	ASA No.9, 15-4.2.2							11/08/11 7:12	lwt
Synthetic Precip. Leaching Procedure	M1312							11/11/11 7:09	brd
Water Extraction	ASA No. 9 10-2.3.2							11/11/11 9:48	ndj

Wet Chemistry

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Nitrate as N, soluble (Water)	Calculation: NO3NO2 minus NO2	J HT-L 15.0			mg/Kg	0.3	2	11/16/11 9:36	calc
Nitrate/Nitrite as N, soluble (Water)	M353.2 - Automated Cadmium Reduction	J HT-L 15.0		*	mg/Kg	0.3	2	11/11/11 22:17	pjb
Nitrite as N, soluble (Water)	M353.2 - Automated Cadmium Reduction R		~~U~~	~~*~~	~~mg/Kg~~	~~0.05~~	~~0.3~~	~~11/11/11 22:09~~	~~pjb~~

EB 03/30/12

** Please refer to Qualifier Reports for details.*

ACZ Laboratories, Inc.
2773 Downhill Drive Steamboat Springs, CO 80487 (800) 334-5493

Inorganic Analytical Results

Freeport-McMoRan - Chino Mines Company		ACZ Sample ID:	***L91219-03***
Project ID:	ZN000000J8	Date Sampled:	*10/06/11 00:00*
Sample ID:	DUP15	Date Received:	*10/12/11*
		Sample Matrix:	*Soil*

Inorganic Prep

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Total Hot Plate Digestion	M3010A ICP							11/14/11 18:54	aeb

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Calcium, total (3050)	M6010B ICP J SD-L	5060		*	mg/Kg	20	100	11/11/11 13:05	jjc
Copper (1312)	M6010B ICP J SQL-I	0.02	B	*	mg/L	0.01	0.05	11/15/11 11:13	aeb
Copper, total (3050)	M6010B ICP J SD-L	481		*	mg/Kg	1	5	11/11/11 13:05	jjc
Potassium, total (3050)	M6010B ICP ↓	3830		*	mg/Kg	30	200	11/11/11 13:05	jjc

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Carbon, total (TC)	ASA No.9 29-2.2.4 Combustion/IR	1.3 JHT-L	H	*	%	0.1	0.5	11/10/11 16:35	bsu
Carbon, total organic (TOC)	ASA No.9 29-2.2.4 Combustion/IR	1.2 ↓		*	%	0.1	0.5	11/10/11 16:35	bsu
pH, Saturated Paste	USDA No. 60 (21A)	7.1 JHT-L		*	units	0.1	0.1	11/10/11 8:53	ndj
Solids, Percent	CLPSOW390, PART F, D-98	82.5		*	%	0.1	0.5	11/01/11 17:03	lwt

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/01/11 12:32	lwt
Digestion - Hot Plate	M3050B ICP							11/10/11 14:54	mss2
Saturated Paste Extraction	USDA No. 60 (2)							11/09/11 11:45	ndj
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/08/11 7:24	lwt
Sieve-250 um (60 mesh)	ASA No.9, 15-4.2.2							11/08/11 7:24	lwt
Synthetic Precip. Leaching Procedure	M1312							11/11/11 8:55	brd
Water Extraction	ASA No. 9 10-2.3.2							11/11/11 10:24	ndj

Wet Chemistry

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Nitrate as N, soluble (Water)	Calculation: NO3NO2 minus NO2 JHT-L	3.8			mg/Kg	0.1	0.5	11/16/11 9:36	calc
Nitrate/Nitrite as N, soluble (Water)	M353.2 - Automated Cadmium Reduction JHT-L	3.9		*	mg/Kg	0.1	0.5	11/11/11 22:11	pjb
Nitrite as N, soluble (Water)	M353.2 - Automated Cadmium Reduction J HT, SQL-L	0.06	B	*	mg/Kg	0.05	0.3	11/11/11 22:11	pjb

EB 03/30/12

** Please refer to Qualifier Reports for details.*

Freeport-McMoRan - Chino Mines Company

Project ID:	ZN000000J8	ACZ Sample ID:	*L91219-04*
Sample ID:	DUP16	Date Sampled:	*10/07/11 00:00*
		Date Received:	*10/12/11*
		Sample Matrix:	*Soil*

Inorganic Prep

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Total Hot Plate Digestion	M3010A ICP							11/14/11 19:36	aeb

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Calcium, total (3050)	M6010B ICP	J SD-L 5640		*	mg/Kg	20	100	11/11/11 13:09	jjc
Copper (1312)	M6010B ICP	0.45		*	mg/L	0.01	0.05	11/15/11 11:17	aeb
Copper, total (3050)	M6010B ICP	J SD-L 3010		*	mg/Kg	1	5	11/11/11 13:09	jjc
Potassium, total (3050)	M6010B ICP	↓ 3480		*	mg/Kg	30	200	11/11/11 13:09	jjc

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Carbon, total (TC)	ASA No.9 29-2.2.4 Combustion/IR	2.5 J HT-L	H	*	%	0.1	0.5	11/10/11 16:59	bsu
Carbon, total organic (TOC)	ASA No.9 29-2.2.4 Combustion/IR	2.2 ↓		*	%	0.1	0.5	11/10/11 16:59	bsu
pH, Saturated Paste	USDA No. 60 (21A)	5.3 J HT-L		*	units	0.1	0.1	11/10/11 8:56	ndj
Solids, Percent	CLPSOW390, PART F, D-98	87.2		*	%	0.1	0.5	11/01/11 17:04	lwt

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/01/11 12:36	lwt
Digestion - Hot Plate	M3050B ICP							11/10/11 15:15	mss2
Saturated Paste Extraction	USDA No. 60 (2)							11/09/11 12:00	ndj
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/08/11 7:37	lwt
Sieve-250 um (60 mesh)	ASA No.9, 15-4.2.2							11/08/11 7:37	lwt
Synthetic Precip. Leaching Procedure	M1312							11/11/11 10:41	brd
Water Extraction	ASA No. 9 10-2.3.2							11/11/11 11:00	ndj

Wet Chemistry

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Nitrate as N, soluble (Water)	Calculation: NO3NO2 minus NO2	J HT-L 15.4			mg/Kg	0.1	0.5	11/16/11 9:36	calc
Nitrate/Nitrite as N, soluble (Water)	M353.2 - Automated Cadmium Reduction	J HT-L 15.4		*	mg/Kg	0.1	0.5	11/11/11 22:12	pjb
Nitrite as N, soluble (Water)	M353.2 - Automated Cadmium Reduction	R	U	*	mg/Kg	0.05	0.3	11/11/11 22:12	pjb

EB 03/30/12

** Please refer to Qualifier Reports for details.*

Inorganic Analytical Results

Freeport-McMoRan - Chino Mines Company		ACZ Sample ID:	***L91220-01***
Project ID:	ZN000000J8	Date Sampled:	*10/04/11 08:20*
Sample ID:	STS-AMD-2011-W1 0-6	Date Received:	*10/12/11*
		Sample Matrix:	*Soil*

Inorganic Prep

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Total Hot Plate Digestion	M3010A ICP							11/04/11 15:55	aeb

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Calcium, total (3050)	M6010B ICP	8620			mg/Kg	20	100	11/10/11 13:50	aeb
Copper (1312)	M6010B ICP J SQ4ZSD-L	0.03	B	*	mg/L	0.01	0.05	11/07/11 18:39	aeb
Copper, total (3050)	M6010B ICP ~~J S~~	880		*	mg/Kg	1	5	11/10/11 13:50	aeb
Potassium, total (3050)	M6010B ICP	4380			mg/Kg	30	200	11/10/11 13:50	aeb

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Carbon, total (TC)	ASA No.9 29-2.2.4 Combustion/IR	1.6	J HT-L H	*	%	0.1	0.5	11/09/11 14:35	bsu
Carbon, total organic (TOC)	ASA No.9 29-2.2.4 Combustion/IR	1.6	↓	*	%	0.1	0.5	11/09/11 14:35	bsu
pH, Saturated Paste	USDA No. 60 (21A) J HT-L	7.8		*	units	0.1	0.1	11/10/11 8:43	ndj
Solids, Percent	CLPSOW390, PART F, D-98	91.1		*	%	0.1	0.5	11/01/11 17:01	lwt

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/01/11 12:40	lwt
Digestion - Hot Plate	M3050B ICP							11/09/11 7:03	lwt
Saturated Paste Extraction	USDA No. 60 (2)							11/09/11 11:00	ndj
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/08/11 7:49	lwt
Sieve-250 um (60 mesh)	ASA No.9, 15-4.2.2							11/08/11 7:49	lwt
Synthetic Precip. Leaching Procedure	M1312							11/03/11 13:38	lwt/ndj
Water Extraction	ASA No. 9 10-2.3.2							11/10/11 11:00	ndj

Wet Chemistry

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Nitrate as N, soluble (Water)	Calculation: NO3NO2 minus NO2	0.5	J HT-L		mg/Kg	0.1	0.5	11/14/11 12:34	calc
Nitrate/Nitrite as N, soluble (Water)	M353.2 - Automated Cadmium Reduction	0.8	↓	*	mg/Kg	0.1	0.5	11/10/11 22:28	pjb
Nitrite as N, soluble (Water)	M353.2 - Automated Cadmium Reduction J HT, SQL-L	0.21	B	*	mg/Kg	0.05	0.3	11/10/11 22:28	pjb

EB 03/30/12

** Please refer to Qualifier Reports for details.*

Freeport-McMoRan - Chino Mines Company		ACZ Sample ID:	***L91220-02***
Project ID:	ZN000000J8	Date Sampled:	*10/04/11 09:23*
Sample ID:	STS-AMD-2011-W2 0-6	Date Received:	*10/12/11*
		Sample Matrix:	*Soil*

Inorganic Prep

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Total Hot Plate Digestion	M3010A ICP							11/04/11 16:33	aeb

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Calcium, total (3050)	M6010B ICP	8500			mg/Kg	20	100	11/10/11 13:53	aeb
Copper (1312)	M6010B ICP J SD-L	0.06		*	mg/L	0.01	0.05	11/07/11 18:48	aeb
Copper, total (3050)	M6010B ICP	2440		*	mg/Kg	1	5	11/10/11 13:53	aeb
Potassium, total (3050)	M6010B ICP	3470			mg/Kg	30	200	11/10/11 13:53	aeb

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Carbon, total (TC)	ASA No.9 29-2.2.4 Combustion/IR	2.0	JHT-L H	*	%	0.1	0.5	11/09/11 16:40	bsu
Carbon, total organic (TOC)	ASA No.9 29-2.2.4 Combustion/IR	1.8	↓	*	%	0.1	0.5	11/09/11 16:40	bsu
pH, Saturated Paste	USDA No. 60 (21A) J HT-L	7.7		*	units	0.1	0.1	11/10/11 8:50	ndj
Solids, Percent	CLPSOW390, PART F, D-98	93.2		*	%	0.1	0.5	11/01/11 17:03	lwt

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/01/11 12:44	lwt
Digestion - Hot Plate	M3050B ICP							11/09/11 7:04	lwt
Saturated Paste Extraction	USDA No. 60 (2)							11/09/11 11:18	ndj
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/08/11 8:02	lwt
Sieve-250 um (60 mesh)	ASA No.9, 15-4.2.2							11/08/11 8:02	lwt
Synthetic Precip. Leaching Procedure	M1312							11/03/11 13:43	lwt/ndj
Water Extraction	ASA No. 9 10-2.3.2							11/10/11 11:00	ndj

Wet Chemistry

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Nitrate as N, soluble (Water)	Calculation: NO3NO2 minus NO2	1.4	J HT-L		mg/Kg	0.1	0.5	11/14/11 12:35	calc
Nitrate/Nitrite as N, soluble (Water)	M353.2 - Automated Cadmium Reduction	1.7	↓	*	mg/Kg	0.1	0.5	11/10/11 22:30	pjb
Nitrite as N, soluble (Water)	M353.2 - Automated Cadmium Reduction J HT, SQL-L	0.21	B	*	mg/Kg	0.05	0.3	11/10/11 22:30	pjb

EB 03/30/12

** Please refer to Qualifier Reports for details.*

Freeport-McMoRan - Chino Mines Company
Project ID: ZN000000J8
Sample ID: STS-AMD-2011-W3 0-6

ACZ Sample ID: ***L91220-03***
Date Sampled: *10/04/11 09:05*
Date Received: *10/12/11*
Sample Matrix: *Soil*

Inorganic Prep

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Total Hot Plate Digestion	M3010A ICP							11/04/11 16:46	aeb

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Calcium, total (3050)	M6010B ICP	8160			mg/Kg	20	100	11/10/11 13:56	aeb
Copper (1312)	M6010B ICP J SQL, ZSD-L	0.03	B	*	mg/L	0.01	0.05	11/07/11 18:52	aeb
Copper, total (3050)	M6010B ICP	761		*	mg/Kg	1	5	11/10/11 13:56	aeb
Potassium, total (3050)	M6010B ICP	4110			mg/Kg	30	200	11/10/11 13:56	aeb

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Carbon, total (TC)	ASA No.9 29-2.2.4 Combustion/IR	1.5	JHT-L H	*	%	0.1	0.5	11/09/11 17:43	bsu
Carbon, total organic (TOC)	ASA No.9 29-2.2.4 Combustion/IR	1.4	↓	*	%	0.1	0.5	11/09/11 17:43	bsu
pH, Saturated Paste	USDA No. 60 (21A) J HT-L	7.8		*	units	0.1	0.1	11/10/11 8:53	ndj
Solids, Percent	CLPSOW390, PART F, D-98	90.3		*	%	0.1	0.5	11/01/11 17:05	lwt

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/01/11 12:48	lwt
Digestion - Hot Plate	M3050B ICP							11/09/11 7:05	lwt
Saturated Paste Extraction	USDA No. 60 (2)							11/09/11 11:27	ndj
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/08/11 8:14	lwt
Sieve-250 um (60 mesh)	ASA No.9, 15-4.2.2							11/08/11 8:14	lwt
Synthetic Precip. Leaching Procedure	M1312							11/03/11 13:44	lwt/ndj
Water Extraction	ASA No. 9 10-2.3.2							11/10/11 11:00	ndj

Wet Chemistry

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Nitrate as N, soluble (Water)	Calculation: NO3NO2 minus NO2	0.8	J HT-L		mg/Kg	0.1	0.5	11/14/11 12:35	calc
Nitrate/Nitrite as N, soluble (Water)	M353.2 - Automated Cadmium Reduction	1.0	↓	*	mg/Kg	0.1	0.5	11/10/11 22:33	pjb
Nitrite as N, soluble (Water)	M353.2 - Automated Cadmium Reduction J HT, SQL-L	0.20	B	*	mg/Kg	0.05	0.3	11/10/11 22:33	pjb

EB 03/30/12

** Please refer to Qualifier Reports for details.*

Freeport-McMoRan - Chino Mines Company		ACZ Sample ID:	***L91220-04***
Project ID:	ZN000000J8	Date Sampled:	*10/04/11 08:30*
Sample ID:	STS-AMD-2011-W1 6-12	Date Received:	*10/12/11*
		Sample Matrix:	*Soil*

Inorganic Prep

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Total Hot Plate Digestion	M3010A ICP							11/04/11 16:58	aeb

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Calcium, total (3050)	M6010B ICP	33900			mg/Kg	20	100	11/10/11 13:59	aeb
Copper (1312)	M6010B ICP J SQL, ZSD-L	0.01	B	*	mg/L	0.01	0.05	11/07/11 18:55	aeb
Copper, total (3050)	M6010B ICP	249		*	mg/Kg	1	5	11/10/11 13:59	aeb
Potassium, total (3050)	M6010B ICP	5230			mg/Kg	30	200	11/10/11 13:59	aeb

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Carbon, total (TC)	ASA No.9 29-2.2.4 Combustion/IR	3.7	J HT-L H	*	%	0.1	0.5	11/09/11 18:46	bsu
Carbon, total organic (TOC)	ASA No.9 29-2.2.4 Combustion/IR	2.2	↓	*	%	0.1	0.5	11/09/11 18:46	bsu
pH, Saturated Paste	USDA No. 60 (21A) J HT-L	7.8		*	units	0.1	0.1	11/10/11 8:56	ndj
Solids, Percent	CLPSOW390, PART F, D-98	89.9		*	%	0.1	0.5	11/01/11 17:07	lwt

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/01/11 12:52	lwt
Digestion - Hot Plate	M3050B ICP							11/09/11 7:06	lwt
Saturated Paste Extraction	USDA No. 60 (2)							11/09/11 11:36	ndj
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/08/11 8:26	lwt
Sieve-250 um (60 mesh)	ASA No.9, 15-4.2.2							11/08/11 8:26	lwt
Synthetic Precip. Leaching Procedure	M1312							11/03/11 13:45	lwt/ndj
Water Extraction	ASA No. 9 10-2.3.2							11/10/11 11:00	ndj

Wet Chemistry

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Nitrate as N, soluble (Water)	Calculation: NO3NO2 minus NO2	1.0	J HT-L		mg/Kg	0.1	0.5	11/14/11 12:35	calc
Nitrate/Nitrite as N, soluble (Water)	M353.2 - Automated Cadmium Reduction	1.3	↓	*	mg/Kg	0.1	0.5	11/10/11 22:34	pjb
Nitrite as N, soluble (Water)	M353.2 - Automated Cadmium Reduction J HT, SQL-L	0.23	B	*	mg/Kg	0.05	0.3	11/10/11 22:34	pjb

EB 03/30/12

** Please refer to Qualifier Reports for details.*

Inorganic Analytical Results

Freeport-McMoRan - Chino Mines Company		ACZ Sample ID:	***L91220-05***
Project ID:	ZN000000J8	Date Sampled:	*10/04/11 09:41*
Sample ID:	STS-AMD-2011-W2 12-1	Date Received:	*10/12/11*
		Sample Matrix:	*Soil*

Inorganic Prep

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Total Hot Plate Digestion	M3010A ICP							11/04/11 17:11	aeb

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Calcium, total (3050)	M6010B ICP ~~J SD-L~~	107000		*	mg/Kg	200	1000	11/11/11 11:51	jjc
Copper (1312)	M6010B ICP J SQ4 ~~Z~~ SD-L	0.03	B	*	mg/L	0.01	0.05	11/07/11 18:58	aeb
Copper, total (3050)	M6010B ICP	264		*	mg/Kg	1	5	11/10/11 14:02	aeb
Potassium, total (3050)	M6010B ICP	3530			mg/Kg	30	200	11/10/11 14:02	aeb

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Carbon, total (TC)	ASA No.9 29-2.2.4 Combustion/IR	4.9	J HT-L H	*	%	0.1	0.5	11/09/11 19:49	bsu
Carbon, total organic (TOC)	ASA No.9 29-2.2.4 Combustion/IR	1.7	↓	*	%	0.1	0.5	11/09/11 19:49	bsu
pH, Saturated Paste	USDA No. 60 (21A) J HT-L	7.7		*	units	0.1	0.1	11/10/11 9:00	ndj
Solids, Percent	CLPSOW390, PART F, D-98	91.9		*	%	0.1	0.5	11/01/11 17:09	lwt

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/01/11 12:57	lwt
Digestion - Hot Plate	M3050B ICP							11/09/11 7:07	lwt
Saturated Paste Extraction	USDA No. 60 (2)							11/09/11 11:45	ndj
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/08/11 8:39	lwt
Sieve-250 um (60 mesh)	ASA No.9, 15-4.2.2							11/08/11 8:39	lwt
Synthetic Precip. Leaching Procedure	M1312							11/03/11 13:47	lwt/ndj
Water Extraction	ASA No. 9 10-2.3.2							11/10/11 11:00	ndj

Wet Chemistry

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Nitrate as N, soluble (Water)	Calculation: NO3NO2 minus NO2	3.0	J HT-L		mg/Kg	0.1	0.5	11/14/11 12:35	calc
Nitrate/Nitrite as N, soluble (Water)	M353.2 - Automated Cadmium Reduction	3.2	↓	*	mg/Kg	0.1	0.5	11/10/11 22:35	pjb
Nitrite as N, soluble (Water)	M353.2 - Automated Cadmium Reduction	0.17	B	*	mg/Kg	0.05	0.3	11/10/11 22:35	pjb

J HT,SQL-L

EB 03/30/12

** Please refer to Qualifier Reports for details.*

ACZ Laboratories, Inc.

2773 Downhill Drive Steamboat Springs, CO 80487 (800) 334-5493

Inorganic Analytical Results

Freeport-McMoRan - Chino Mines Company		ACZ Sample ID:	***L91220-06***
Project ID:	ZN000000J8	Date Sampled:	*10/04/11 09:20*
Sample ID:	STS-AMD-2011-W3 12-1	Date Received:	*10/12/11*
		Sample Matrix:	*Soil*

Inorganic Prep

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Total Hot Plate Digestion	M3010A ICP							11/04/11 17:24	aeb

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Calcium, total (3050)	M6010B ICP	59400			mg/Kg	20	100	11/10/11 14:05	aeb
Copper (1312)	M6010B ICP J SQL, ZSD-L	0.02	B	*	mg/L	0.01	0.05	11/07/11 19:01	aeb
Copper, total (3050)	M6010B ICP	253		*	mg/Kg	1	5	11/10/11 14:05	aeb
Potassium, total (3050)	M6010B ICP	4190			mg/Kg	30	200	11/10/11 14:05	aeb

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Carbon, total (TC)	ASA No.9 29-2.2.4 Combustion/IR	4.0	J HT-L H	*	%	0.1	0.5	11/09/11 20:51	bsu
Carbon, total organic (TOC)	ASA No.9 29-2.2.4 Combustion/IR	1.8	↓	*	%	0.1	0.5	11/09/11 20:51	bsu
pH, Saturated Paste	USDA No. 60 (21A) J HT-L	7.7		*	units	0.1	0.1	11/10/11 9:03	ndj
Solids, Percent	CLPSOW390, PART F, D-98	88.9		*	%	0.1	0.5	11/01/11 17:11	lwt

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/01/11 13:01	lwt
Digestion - Hot Plate	M3050B ICP							11/09/11 7:08	lwt
Saturated Paste Extraction	USDA No. 60 (2)							11/09/11 11:54	ndj
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/08/11 8:51	lwt
Sieve-250 um (60 mesh)	ASA No.9, 15-4.2.2							11/08/11 8:51	lwt
Synthetic Precip. Leaching Procedure	M1312							11/03/11 13:48	lwt/ndj
Water Extraction	ASA No. 9 10-2.3.2							11/10/11 11:00	ndj

Wet Chemistry

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Nitrate as N, soluble (Water)	Calculation: NO3NO2 minus NO2	1.0	J HT-L		mg/Kg	0.1	0.5	11/14/11 12:35	calc
Nitrate/Nitrite as N, soluble (Water)	M353.2 - Automated Cadmium Reduction	1.2	↓	*	mg/Kg	0.1	0.5	11/10/11 22:36	pjb
Nitrite as N, soluble (Water)	M353.2 - Automated Cadmium Reduction J HT, SQL-L	0.19	B	*	mg/Kg	0.05	0.3	11/10/11 22:36	pjb

EB 03/30/12

** Please refer to Qualifier Reports for details.*

Freeport-McMoRan - Chino Mines Company

Project ID:	ZN000000J8	ACZ Sample ID:	*L91220-07*
Sample ID:	STS-AMD-2011-N1 0-6	Date Sampled:	*10/05/11 08:45*
		Date Received:	*10/12/11*
		Sample Matrix:	*Soil*

Inorganic Prep

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Total Hot Plate Digestion	M3010A ICP							11/04/11 17:37	aeb

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Calcium, total (3050)	M6010B ICP	10000			mg/Kg	20	100	11/10/11 14:08	aeb
Copper (1312)	M6010B ICP J SD-L	0.33		*	mg/L	0.01	0.05	11/07/11 19:10	aeb
Copper, total (3050)	M6010B ICP	2320		*	mg/Kg	1	5	11/10/11 14:08	aeb
Potassium, total (3050)	M6010B ICP	3730			mg/Kg	30	200	11/10/11 14:08	aeb

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Carbon, total (TC)	ASA No.9 29-2.2.4 Combustion/IR	1.9	J HT-L H	*	%	0.1	0.5	11/09/11 21:54	bsu
Carbon, total organic (TOC)	ASA No.9 29-2.2.4 Combustion/IR	1.8	↓	*	%	0.1	0.5	11/09/11 21:54	bsu
pH, Saturated Paste	USDA No. 60 (21A) J HT-L	5.4		*	units	0.1	0.1	11/10/11 9:06	ndj
Solids, Percent	CLPSOW390, PART F, D-98	90.8		*	%	0.1	0.5	11/01/11 17:13	lwt

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/01/11 13:05	lwt
Digestion - Hot Plate	M3050B ICP							11/09/11 7:09	lwt
Saturated Paste Extraction	USDA No. 60 (2)							11/09/11 12:03	ndj
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/08/11 9:04	lwt
Sieve-250 um (60 mesh)	ASA No.9, 15-4.2.2							11/08/11 9:04	lwt
Synthetic Precip. Leaching Procedure	M1312							11/03/11 13:51	lwt/ndj
Water Extraction	ASA No. 9 10-2.3.2							11/10/11 11:00	ndj

Wet Chemistry

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Nitrate as N, soluble (Water)	Calculation: NO3NO2 minus NO2	43.7	J HT-L		mg/Kg	0.4	2	11/14/11 12:35	calc
Nitrate/Nitrite as N, soluble (Water)	M353.2 - Automated Cadmium Reduction	43.8	↓	*	mg/Kg	0.4	2	11/10/11 23:10	pjb
Nitrite as N, soluble (Water)	M353.2 - Automated Cadmium Reduction	0.14	B	*	mg/Kg	0.05	0.3	11/10/11 22:40	pjb

J HT, SQL-L

EB 03/30/12

** Please refer to Qualifier Reports for details.*

Freeport-McMoRan - Chino Mines Company
Project ID: ZN000000J8
Sample ID: STS-AMD-2011-N2 0-6

ACZ Sample ID: ***L91220-08***
Date Sampled: *10/05/11 08:50*
Date Received: *10/12/11*
Sample Matrix: *Soil*

Inorganic Prep

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Total Hot Plate Digestion	M3010A ICP							11/04/11 17:49	aeb

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Calcium, total (3050)	M6010B ICP	9650			mg/Kg	20	100	11/10/11 14:17	aeb
Copper (1312)	M6010B ICP J SD-L	0.18		*	mg/L	0.01	0.05	11/07/11 19:16	aeb
Copper, total (3050)	M6010B ICP	1080		*	mg/Kg	1	5	11/10/11 14:17	aeb
Potassium, total (3050)	M6010B ICP	3070			mg/Kg	30	200	11/10/11 14:17	aeb

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Carbon, total (TC)	ASA No.9 29-2.2.4 Combustion/IR	1.4	J HT-L H	*	%	0.1	0.5	11/09/11 22:57	bsu
Carbon, total organic (TOC)	ASA No.9 29-2.2.4 Combustion/IR	1.3	↓	*	%	0.1	0.5	11/09/11 22:57	bsu
pH, Saturated Paste	USDA No. 60 (21A) J HT-L	5.9		*	units	0.1	0.1	11/10/11 9:10	ndj
Solids, Percent	CLPSOW390, PART F, D-98	93.7		*	%	0.1	0.5	11/01/11 17:15	lwt

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/01/11 13:09	lwt
Digestion - Hot Plate	M3050B ICP							11/09/11 7:10	lwt
Saturated Paste Extraction	USDA No. 60 (2)							11/09/11 12:12	ndj
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/08/11 9:16	lwt
Sieve-250 um (60 mesh)	ASA No.9, 15-4.2.2							11/08/11 9:16	lwt
Synthetic Precip. Leaching Procedure	M1312							11/03/11 13:53	lwt/ndj
Water Extraction	ASA No. 9 10-2.3.2							11/10/11 11:00	ndj

Wet Chemistry

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Nitrate as N, soluble (Water)	Calculation: NO3NO2 minus NO2	18.1	J HT-L		mg/Kg	0.1	0.5	11/14/11 12:35	calc
Nitrate/Nitrite as N, soluble (Water)	M353.2 - Automated Cadmium Reduction	18.2	↓	*	mg/Kg	0.1	0.5	11/10/11 22:41	pjb
Nitrite as N, soluble (Water)	M353.2 - Automated Cadmium Reduction J HT, SQL-L	0.15	B	*	mg/Kg	0.05	0.3	11/10/11 22:41	pjb

EB 03/30/12

** Please refer to Qualifier Reports for details.*

Freeport-McMoRan - Chino Mines Company
Project ID: ZN000000J8
Sample ID: STS-AMD-2011-N3 0-6

ACZ Sample ID: *L91220-09*
Date Sampled: *10/05/11 08:50*
Date Received: *10/12/11*
Sample Matrix: *Soil*

Inorganic Prep

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Total Hot Plate Digestion	M3010A ICP							11/04/11 18:02	aeb

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Calcium, total (3050)	M6010B ICP	7500			mg/Kg	20	100	11/10/11 14:20	aeb
Copper (1312)	M6010B ICP J SD-L	0.15		*	mg/L	0.01	0.05	11/07/11 19:19	aeb
Copper, total (3050)	M6010B ICP	990		*	mg/Kg	1	5	11/10/11 14:20	aeb
Potassium, total (3050)	M6010B ICP	3140			mg/Kg	30	200	11/10/11 14:20	aeb

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Carbon, total (TC)	ASA No.9 29-2.2.4 Combustion/IR	1.3 JHT-L	H	*	%	0.1	0.5	11/10/11 0:00	bsu
Carbon, total organic (TOC)	ASA No.9 29-2.2.4 Combustion/IR	1.2 ↓		*	%	0.1	0.5	11/10/11 0:00	bsu
pH, Saturated Paste	USDA No. 60 (21A) J HT-L	5.8		*	units	0.1	0.1	11/10/11 9:13	ndj
Solids, Percent	CLPSOW390, PART F, D-98	93.5		*	%	0.1	0.5	11/01/11 17:17	lwt

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/01/11 13:13	lwt
Digestion - Hot Plate	M3050B ICP							11/09/11 7:11	lwt
Saturated Paste Extraction	USDA No. 60 (2)							11/09/11 12:21	ndj
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/08/11 9:29	lwt
Sieve-250 um (60 mesh)	ASA No.9, 15-4.2.2							11/08/11 9:29	lwt
Synthetic Precip. Leaching Procedure	M1312							11/03/11 13:54	lwt/ndj
Water Extraction	ASA No. 9 10-2.3.2							11/10/11 11:00	ndj

Wet Chemistry

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Nitrate as N, soluble (Water)	Calculation: NO3NO2 minus NO2	21.9 J HT-L			mg/Kg	0.3	2	11/14/11 12:35	calc
Nitrate/Nitrite as N, soluble (Water)	M353.2 - Automated Cadmium Reduction	22.1 ↓		*	mg/Kg	0.3	2	11/10/11 23:11	pjb
Nitrite as N, soluble (Water)	M353.2 - Automated Cadmium Reduction J HT, SQL-L	0.16	B	*	mg/Kg	0.05	0.3	11/10/11 22:42	pjb

EB 03/30/12

* Please refer to Qualifier Reports for details.

Freeport-McMoRan - Chino Mines Company
Project ID: ZN000000J8
Sample ID: STS-AMD-2011-N1 18-2

ACZ Sample ID: ***L91220-10***
Date Sampled: *10/05/11 09:10*
Date Received: *10/12/11*
Sample Matrix: *Soil*

Inorganic Prep

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Total Hot Plate Digestion	M3010A ICP							11/04/11 18:15	aeb

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Calcium, total (3050)	M6010B ICP	14700			mg/Kg	20	100	11/10/11 14:23	aeb
Copper (1312)	M6010B ICP J SD-L	0.05		*	mg/L	0.01	0.05	11/07/11 19:22	aeb
Copper, total (3050)	M6010B ICP	640		*	mg/Kg	1	5	11/10/11 14:23	aeb
Potassium, total (3050)	M6010B ICP	3210			mg/Kg	30	200	11/10/11 14:23	aeb

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Carbon, total (TC)	ASA No.9 29-2.2.4 Combustion/IR	1.0	JHT-L H	*	%	0.1	0.5	11/10/11 1:02	bsu
Carbon, total organic (TOC)	ASA No.9 29-2.2.4 Combustion/IR	0.8	↓	*	%	0.1	0.5	11/10/11 1:02	bsu
pH, Saturated Paste	USDA No. 60 (21A) J HT-L	7.4		*	units	0.1	0.1	11/10/11 9:20	ndj
Solids, Percent	CLPSOW390, PART F, D-98	86.8		*	%	0.1	0.5	11/01/11 17:19	lwt

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/01/11 13:18	lwt
Digestion - Hot Plate	M3050B ICP							11/09/11 7:12	lwt
Saturated Paste Extraction	USDA No. 60 (2)							11/09/11 12:30	ndj
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/08/11 9:41	lwt
Sieve-250 um (60 mesh)	ASA No.9, 15-4.2.2							11/08/11 9:41	lwt
Synthetic Precip. Leaching Procedure	M1312							11/03/11 13:56	lwt/ndj
Water Extraction	ASA No. 9 10-2.3.2							11/10/11 11:00	ndj

Wet Chemistry

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Nitrate as N, soluble (Water)	Calculation: NO3NO2 minus NO2	4.7	J HT-L		mg/Kg	0.1	0.5	11/14/11 12:35	calc
Nitrate/Nitrite as N, soluble (Water)	M353.2 - Automated Cadmium Reduction	5.0	↓	*	mg/Kg	0.1	0.5	11/10/11 22:43	pjb
Nitrite as N, soluble (Water)	M353.2 - Automated Cadmium Reduction J HT, SQL-L	0.29	B	*	mg/Kg	0.05	0.3	11/10/11 22:43	pjb

EB 03/30/12

** Please refer to Qualifier Reports for details.*

Freeport-McMoRan - Chino Mines Company

Project ID:	ZN000000J8
Sample ID:	STS-AMD-2011-N2 18-2

ACZ Sample ID:	***L91220-11***
Date Sampled:	*10/05/11 09:40*
Date Received:	*10/12/11*
Sample Matrix:	*Soil*

Inorganic Prep

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Total Hot Plate Digestion	M3010A ICP							11/04/11 18:27	aeb

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Calcium, total (3050)	M6010B ICP	10700			mg/Kg	20	100	11/10/11 14:29	aeb
Copper (1312)	M6010B ICP J SQL, ZSD-L	0.03	B	*	mg/L	0.01	0.05	11/07/11 19:25	aeb
Copper, total (3050)	M6010B ICP	91		*	mg/Kg	1	5	11/10/11 14:29	aeb
Potassium, total (3050)	M6010B ICP	2390			mg/Kg	30	200	11/10/11 14:29	aeb

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Carbon, total (TC)	ASA No.9 29-2.2.4 Combustion/IR	0.7 J HT-L	H	*	%	0.1	0.5	11/10/11 2:05	bsu
Carbon, total organic (TOC)	ASA No.9 29-2.2.4 Combustion/IR	0.7 ↓		*	%	0.1	0.5	11/10/11 2:05	bsu
pH, Saturated Paste	USDA No. 60 (21A) J HT-L	7.3		*	units	0.1	0.1	11/10/11 9:23	ndj
Solids, Percent	CLPSOW390, PART F, D-98	87.5		*	%	0.1	0.5	11/01/11 17:20	lwt

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/01/11 13:22	lwt
Digestion - Hot Plate	M3050B ICP							11/09/11 7:13	lwt
Saturated Paste Extraction	USDA No. 60 (2)							11/09/11 12:39	ndj
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/08/11 9:53	lwt
Sieve-250 um (60 mesh)	ASA No.9, 15-4.2.2							11/08/11 9:53	lwt
Synthetic Precip. Leaching Procedure	M1312							11/03/11 13:57	lwt/ndj
Water Extraction	ASA No. 9 10-2.3.2							11/10/11 11:00	ndj

Wet Chemistry

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Nitrate as N, soluble (Water)	Calculation: NO3NO2 minus NO2	2.7	J HT-L		mg/Kg	0.1	0.5	11/14/11 12:35	calc
Nitrate/Nitrite as N, soluble (Water)	M353.2 - Automated Cadmium Reduction	3.0	↓	*	mg/Kg	0.1	0.5	11/10/11 22:44	pjb
Nitrite as N, soluble (Water)	M353.2 - Automated Cadmium Reduction J HT, SQL-L	0.26	B	*	mg/Kg	0.05	0.3	11/10/11 22:44	pjb

EB 03/30/12

ACZ Laboratories, Inc.
2773 Downhill Drive Steamboat Springs, CO 80487 (800) 334-5493

Inorganic Analytical Results

Freeport-McMoRan - Chino Mines Company
Project ID: ZN000000J8
Sample ID: STS-AMD-2011-N3 18-2

ACZ Sample ID: **L91220-12**
Date Sampled: 10/05/11 10:07
Date Received: 10/12/11
Sample Matrix: Soil

Inorganic Prep

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Total Hot Plate Digestion	M3010A ICP							11/04/11 18:40	aeb

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Calcium, total (3050)	M6010B ICP	9960			mg/Kg	20	100	11/10/11 14:32	aeb
Copper (1312)	M6010B ICP J SQL,ISD-L	0.02	B	*	mg/L	0.01	0.05	11/07/11 19:28	aeb
Copper, total (3050)	M6010B ICP	59		*	mg/Kg	1	5	11/10/11 14:32	aeb
Potassium, total (3050)	M6010B ICP	2740			mg/Kg	30	200	11/10/11 14:32	aeb

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Carbon, total (TC)	ASA No.9 29-2.2.4 Combustion/IR	1.1	J HT-L H	*	%	0.1	0.5	11/10/11 3:08	bsu
Carbon, total organic (TOC)	ASA No.9 29-2.2.4 Combustion/IR	1.0	↓	*	%	0.1	0.5	11/10/11 3:08	bsu
pH, Saturated Paste	USDA No. 60 (21A) J HT-L	7.2		*	units	0.1	0.1	11/10/11 9:26	ndj
Solids, Percent	CLPSOW390, PART F, D-98	91.1		*	%	0.1	0.5	11/01/11 17:22	lwt

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/01/11 13:26	lwt
Digestion - Hot Plate	M3050B ICP							11/09/11 7:14	lwt
Saturated Paste Extraction	USDA No. 60 (2)							11/09/11 12:48	ndj
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/08/11 10:06	lwt
Sieve-250 um (60 mesh)	ASA No.9, 15-4.2.2							11/08/11 10:06	lwt
Synthetic Precip. Leaching Procedure	M1312							11/03/11 13:59	lwt/ndj
Water Extraction	ASA No. 9 10-2.3.2							11/10/11 11:00	ndj

Wet Chemistry

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Nitrate as N, soluble (Water)	Calculation: NO3NO2 minus NO2	1.6	J HT-L		mg/Kg	0.1	0.5	11/14/11 12:35	calc
Nitrate/Nitrite as N, soluble (Water)	M353.2 - Automated Cadmium Reduction	1.9	↓	*	mg/Kg	0.1	0.5	11/10/11 22:46	pjb
Nitrite as N, soluble (Water)	M353.2 - Automated Cadmium Reduction J HT, SQL-L	0.24	B	*	mg/Kg	0.05	0.3	11/10/11 22:46	pjb

EB 03/30/12

** Please refer to Qualifier Reports for details.*

Freeport-McMoRan - Chino Mines Company		ACZ Sample ID:	***L91220-13***
Project ID:	ZN000000J8	Date Sampled:	*10/07/11 08:40*
Sample ID:	STS-AMD-2011-NE1 0-6	Date Received:	*10/12/11*
		Sample Matrix:	*Soil*

Inorganic Prep

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Total Hot Plate Digestion	M3010A ICP							11/04/11 18:53	aeb

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Calcium, total (3050)	M6010B ICP	6820			mg/Kg	20	100	11/10/11 14:35	aeb
Copper (1312)	M6010B ICP J SD-L	0.34		*	mg/L	0.01	0.05	11/07/11 19:31	aeb
Copper, total (3050)	M6010B ICP	3770		*	mg/Kg	1	5	11/10/11 14:35	aeb
Potassium, total (3050)	M6010B ICP	4300			mg/Kg	30	200	11/10/11 14:35	aeb

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Carbon, total (TC)	ASA No.9 29-2.2.4 Combustion/IR	2.4 J HT-L	H	*	%	0.1	0.5	11/10/11 4:11	bsu
Carbon, total organic (TOC)	ASA No.9 29-2.2.4 Combustion/IR	2.1 ↓		*	%	0.1	0.5	11/10/11 4:11	bsu
pH, Saturated Paste	USDA No. 60 (21A) J HT-L	5.5		*	units	0.1	0.1	11/10/11 9:30	ndj
Solids, Percent	CLPSOW390, PART F, D-98	84.0		*	%	0.1	0.5	11/01/11 17:24	lwt

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/01/11 13:30	lwt
Digestion - Hot Plate	M3050B ICP							11/09/11 7:15	lwt
Saturated Paste Extraction	USDA No. 60 (2)							11/09/11 12:57	ndj
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/08/11 10:18	lwt
Sieve-250 um (60 mesh)	ASA No.9, 15-4.2.2							11/08/11 10:18	lwt
Synthetic Precip. Leaching Procedure	M1312							11/03/11 14:00	lwt/ndj
Water Extraction	ASA No. 9 10-2.3.2							11/10/11 11:00	ndj

Wet Chemistry

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Nitrate as N, soluble (Water)	Calculation: NO3NO2 minus NO2	16.0	J HT-L		mg/Kg	0.1	0.5	11/14/11 12:35	calc
Nitrate/Nitrite as N, soluble (Water)	M353.2 - Automated Cadmium Reduction	16.1	↓	*	mg/Kg	0.1	0.5	11/10/11 22:47	pjb
Nitrite as N, soluble (Water)	M353.2 - Automated Cadmium Reduction	0.13	B	*	mg/Kg	0.05	0.3	11/10/11 22:47	pjb

J HT, SQL-L

EB 03/30/12

** Please refer to Qualifier Reports for details.*

Inorganic Analytical Results

Freeport-McMoRan - Chino Mines Company		ACZ Sample ID:	***L91220-14***
Project ID:	ZN000000J8	Date Sampled:	*10/07/11 08:35*
Sample ID:	STS-AMD-2011-NE2 0-6	Date Received:	*10/12/11*
		Sample Matrix:	*Soil*

Inorganic Prep

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Total Hot Plate Digestion	M3010A ICP							11/04/11 19:05	aeb

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Calcium, total (3050)	M6010B ICP	5670			mg/Kg	20	100	11/10/11 14:38	aeb
Copper (1312)	M6010B ICP JSD-L	0.15		*	mg/L	0.01	0.05	11/07/11 19:34	aeb
Copper, total (3050)	M6010B ICP	2310		*	mg/Kg	1	5	11/10/11 14:38	aeb
Potassium, total (3050)	M6010B ICP	4150			mg/Kg	30	200	11/10/11 14:38	aeb

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Carbon, total (TC)	ASA No.9 29-2.2.4 Combustion/IR	1.3	JHT-L H	*	%	0.1	0.5	11/10/11 5:13	bsu
Carbon, total organic (TOC)	ASA No.9 29-2.2.4 Combustion/IR	1.2	↓	*	%	0.1	0.5	11/10/11 5:13	bsu
pH, Saturated Paste	USDA No. 60 (21A) JHT-L	5.4		*	units	0.1	0.1	11/10/11 9:33	ndj
Solids, Percent	CLPSOW390, PART F, D-98	89.5		*	%	0.1	0.5	11/01/11 17:26	lwt

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/01/11 13:34	lwt
Digestion - Hot Plate	M3050B ICP							11/09/11 7:16	lwt
Saturated Paste Extraction	USDA No. 60 (2)							11/09/11 13:06	ndj
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/08/11 10:31	lwt
Sieve-250 um (60 mesh)	ASA No.9, 15-4.2.2							11/08/11 10:31	lwt
Synthetic Precip. Leaching Procedure	M1312							11/03/11 14:01	lwt/ndj
Water Extraction	ASA No. 9 10-2.3.2							11/10/11 11:00	ndj

Wet Chemistry

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Nitrate as N, soluble (Water)	Calculation: NO3NO2 minus NO2	4.8	JHT-L		mg/Kg	0.1	0.5	11/14/11 12:35	calc
Nitrate/Nitrite as N, soluble (Water)	M353.2 - Automated Cadmium Reduction	5.0	↓	*	mg/Kg	0.1	0.5	11/10/11 22:48	pjb
Nitrite as N, soluble (Water)	M353.2 - Automated Cadmium Reduction J HT, SQL-L	0.17	B	*	mg/Kg	0.05	0.3	11/10/11 22:48	pjb

EB 03/30/12

** Please refer to Qualifier Reports for details.*

Freeport-McMoRan - Chino Mines Company
Project ID: ZN000000J8
Sample ID: STS-AMD-2011-NE3 0-6

ACZ Sample ID: ***L91220-15***
Date Sampled: *10/07/11 08:56*
Date Received: *10/12/11*
Sample Matrix: *Soil*

Inorganic Prep

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Total Hot Plate Digestion	M3010A ICP							11/04/11 19:18	aeb

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Calcium, total (3050)	M6010B ICP	5270			mg/Kg	20	100	11/10/11 14:41	aeb
Copper (1312)	M6010B ICP	0.21	J SD-L	*	mg/L	0.01	0.05	11/07/11 19:37	aeb
Copper, total (3050)	M6010B ICP	2330		*	mg/Kg	1	5	11/10/11 14:41	aeb
Potassium, total (3050)	M6010B ICP	4880			mg/Kg	30	200	11/10/11 14:41	aeb

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Carbon, total (TC)	ASA No.9 29-2.2.4 Combustion/IR	1.6	J HT-L H	*	%	0.1	0.5	11/10/11 6:16	bsu
Carbon, total organic (TOC)	ASA No.9 29-2.2.4 Combustion/IR	1.6	↓	*	%	0.1	0.5	11/10/11 6:16	bsu
pH, Saturated Paste	USDA No. 60 (21A)	5.8	J HT-L	*	units	0.1	0.1	11/10/11 9:36	ndj
Solids, Percent	CLPSOW390, PART F, D-98	91.0		*	%	0.1	0.5	11/01/11 17:28	lwt

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/01/11 13:38	lwt
Digestion - Hot Plate	M3050B ICP							11/09/11 7:17	lwt
Saturated Paste Extraction	USDA No. 60 (2)							11/09/11 13:15	ndj
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/08/11 10:43	lwt
Sieve-250 um (60 mesh)	ASA No.9, 15-4.2.2							11/08/11 10:43	lwt
Synthetic Precip. Leaching Procedure	M1312							11/03/11 14:03	lwt/ndj
Water Extraction	ASA No. 9 10-2.3.2							11/10/11 11:00	ndj

Wet Chemistry

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Nitrate as N, soluble (Water)	Calculation: NO3NO2 minus NO2	13.6	J HT-L		mg/Kg	0.1	0.5	11/14/11 12:36	calc
Nitrate/Nitrite as N, soluble (Water)	M353.2 - Automated Cadmium Reduction	13.7	↓	*	mg/Kg	0.1	0.5	11/10/11 22:49	pjb
Nitrite as N, soluble (Water)	M353.2 - Automated Cadmium Reduction J HT, SQL-L	0.13	B	*	mg/Kg	0.05	0.3	11/10/11 22:49	pjb

EB 03/30/12

** Please refer to Qualifier Reports for details.*

Freeport-McMoRan - Chino Mines Company		ACZ Sample ID:	***L91220-16***
Project ID:	ZN000000J8	Date Sampled:	*10/07/11 08:55*
Sample ID:	STS-AMD-2011-NE1 18-	Date Received:	*10/12/11*
		Sample Matrix:	*Soil*

Inorganic Prep

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Total Hot Plate Digestion	M3010A ICP							11/04/11 19:31	aeb

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Calcium, total (3050)	M6010B ICP	7760			mg/Kg	20	100	11/10/11 14:44	aeb
Copper (1312)	M6010B ICP JSD-L	0.05		*	mg/L	0.01	0.05	11/07/11 19:47	aeb
Copper, total (3050)	M6010B ICP	105		*	mg/Kg	1	5	11/10/11 14:44	aeb
Potassium, total (3050)	M6010B ICP	3180			mg/Kg	30	200	11/10/11 14:44	aeb

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Carbon, total (TC)	ASA No.9 29-2.2.4 Combustion/IR	0.8	JHT-L H	*	%	0.1	0.5	11/10/11 7:19	bsu
Carbon, total organic (TOC)	ASA No.9 29-2.2.4 Combustion/IR	0.7	↓	*	%	0.1	0.5	11/10/11 7:19	bsu
pH, Saturated Paste	USDA No. 60 (21A) JHT-L	7.2		*	units	0.1	0.1	11/10/11 9:40	ndj
Solids, Percent	CLPSOW390, PART F, D-98	88.9		*	%	0.1	0.5	11/01/11 17:30	lwt

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/01/11 13:43	lwt
Digestion - Hot Plate	M3050B ICP							11/09/11 7:18	lwt
Saturated Paste Extraction	USDA No. 60 (2)							11/09/11 13:24	ndj
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/08/11 10:55	lwt
Sieve-250 um (60 mesh)	ASA No.9, 15-4.2.2							11/08/11 10:55	lwt
Synthetic Precip. Leaching Procedure	M1312							11/03/11 14:04	lwt/ndj
Water Extraction	ASA No. 9 10-2.3.2							11/10/11 11:00	ndj

Wet Chemistry

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Nitrate as N, soluble (Water)	Calculation: NO3NO2 minus NO2	2.0	JHT-L		mg/Kg	0.1	0.5	11/14/11 12:36	calc
Nitrate/Nitrite as N, soluble (Water)	M353.2 - Automated Cadmium Reduction	2.2	↓	*	mg/Kg	0.1	0.5	11/10/11 22:50	pjb
Nitrite as N, soluble (Water)	M353.2 - Automated Cadmium Reduction JHT, SQL'L	0.16	B	*	mg/Kg	0.05	0.3	11/10/11 22:50	pjb

EB 03/30/12

** Please refer to Qualifier Reports for details.*

Inorganic Analytical Results

Freeport-McMoRan - Chino Mines Company

Project ID:	ZN000000J8	ACZ Sample ID:	*L91220-17*
Sample ID:	STS-AMD-2011-NE2 18-	Date Sampled:	*10/07/11 09:20*
		Date Received:	*10/12/11*
		Sample Matrix:	*Soil*

Inorganic Prep

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Total Hot Plate Digestion	M3010A ICP							11/04/11 19:44	aeb

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Calcium, total (3050)	M6010B ICP	8530			mg/Kg	20	100	11/10/11 14:53	aeb
Copper (1312)	M6010B ICP J SQL, ISD-L	0.01	B	*	mg/L	0.01	0.05	11/07/11 19:50	aeb
Copper, total (3050)	M6010B ICP	121		*	mg/Kg	1	5	11/10/11 14:53	aeb
Potassium, total (3050)	M6010B ICP	4640			mg/Kg	30	200	11/10/11 14:53	aeb

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Carbon, total (TC)	ASA No.9 29-2.2.4 Combustion/IR	1.1 J HT-L	H	*	%	0.1	0.5	11/10/11 8:21	bsu
Carbon, total organic (TOC)	ASA No.9 29-2.2.4 Combustion/IR	1.1 ↓		*	%	0.1	0.5	11/10/11 8:21	bsu
pH, Saturated Paste	USDA No. 60 (21A) J HT-L	7.3		*	units	0.1	0.1	11/10/11 9:43	ndj
Solids, Percent	CLPSOW390, PART F, D-98	84.8		*	%	0.1	0.5	11/01/11 17:32	lwt

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/01/11 13:47	lwt
Digestion - Hot Plate	M3050B ICP							11/09/11 7:19	lwt
Saturated Paste Extraction	USDA No. 60 (2)							11/09/11 13:33	ndj
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/08/11 11:08	lwt
Sieve-250 um (60 mesh)	ASA No.9, 15-4.2.2							11/08/11 11:08	lwt
Synthetic Precip. Leaching Procedure	M1312							11/03/11 14:07	lwt/ndj
Water Extraction	ASA No. 9 10-2.3.2							11/10/11 11:00	ndj

Wet Chemistry

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Nitrate as N, soluble (Water)	Calculation: NO3NO2 minus NO2	1.8	J HT-L		mg/Kg	0.1	0.5	11/14/11 12:36	calc
Nitrate/Nitrite as N, soluble (Water)	M353.2 - Automated Cadmium Reduction	2.1	↓	*	mg/Kg	0.1	0.5	11/10/11 22:54	pjb
Nitrite as N, soluble (Water)	M353.2 - Automated Cadmium Reduction	0.30	B	*	mg/Kg	0.05	0.3	11/10/11 22:54	pjb

J HT, SQL-L

EB 03/30/12

** Please refer to Qualifier Reports for details.*

Inorganic Analytical Results

Freeport-McMoRan - Chino Mines Company

Project ID:	ZN000000J8	ACZ Sample ID:	***L91220-18***
Sample ID:	STS-AMD-2011-NE3 18-	Date Sampled:	*10/07/11 09:00*
		Date Received:	*10/12/11*
		Sample Matrix:	*Soil*

Inorganic Prep

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Total Hot Plate Digestion	M3010A ICP							11/04/11 19:56	aeb

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Calcium, total (3050)	M6010B ICP	8000			mg/Kg	20	100	11/10/11 14:56	aeb
Copper (1312)	M6010B ICP UJ SD L		U	*	mg/L	0.01	0.05	11/07/11 19:53	aeb
Copper, total (3050)	M6010B ICP ~~J SD L~~	26		*	mg/Kg	1	5	11/11/11 11:54	jjc
Potassium, total (3050)	M6010B ICP	5680			mg/Kg	30	200	11/10/11 14:56	aeb

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Carbon, total (TC)	ASA No.9 29-2.2.4 Combustion/IR	0.9 J HT-L	H	*	%	0.1	0.5	11/10/11 9:24	bsu
Carbon, total organic (TOC)	ASA No.9 29-2.2.4 Combustion/IR	0.8 ↓		*	%	0.1	0.5	11/10/11 9:24	bsu
pH, Saturated Paste	USDA No. 60 (21A) J HT-L	7.1		*	units	0.1	0.1	11/10/11 9:46	ndj
Solids, Percent	CLPSOW390, PART F, D-98	83.4		*	%	0.1	0.5	11/01/11 17:34	lwt

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/01/11 13:51	lwt
Digestion - Hot Plate	M3050B ICP							11/09/11 7:20	lwt
Saturated Paste Extraction	USDA No. 60 (2)							11/09/11 13:42	ndj
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/08/11 11:20	lwt
Sieve-250 um (60 mesh)	ASA No.9, 15-4.2.2							11/08/11 11:20	lwt
Synthetic Precip. Leaching Procedure	M1312							11/03/11 14:09	lwt/ndj
Water Extraction	ASA No. 9 10-2.3.2							11/10/11 11:00	ndj

Wet Chemistry

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Nitrate as N, soluble (Water)	Calculation: NO3NO2 minus NO2	1.4	J HT-L		mg/Kg	0.1	0.5	11/14/11 12:36	calc
Nitrate/Nitrite as N, soluble (Water)	M353.2 - Automated Cadmium Reduction	1.6	↓	*	mg/Kg	0.1	0.5	11/10/11 22:55	pjb
Nitrite as N, soluble (Water)	M353.2 - Automated Cadmium Reduction	0.17	B	*	mg/Kg	0.05	0.3	11/10/11 22:55	pjb

J HT, SQL-L

EB 03/30/12

** Please refer to Qualifier Reports for details.*

Inorganic Analytical Results

Freeport-McMoRan - Chino Mines Company

Project ID:	ZN000000J8
Sample ID:	STS-AMD-2011-E1 0-6

ACZ Sample ID:	***L91220-19***
Date Sampled:	*10/06/11 09:20*
Date Received:	*10/12/11*
Sample Matrix:	*Soil*

Inorganic Prep

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Total Hot Plate Digestion	M3010A ICP							11/04/11 20:09	aeb

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Calcium, total (3050)	M6010B ICP	6030			mg/Kg	20	100	11/10/11 14:59	aeb
Copper (1312)	M6010B ICP J SQL, Z SDL	0.02	B	*	mg/L	0.01	0.05	11/07/11 19:56	aeb
Copper, total (3050)	M6010B ICP	495		*	mg/Kg	1	5	11/10/11 14:59	aeb
Potassium, total (3050)	M6010B ICP	5190			mg/Kg	30	200	11/10/11 14:59	aeb

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Carbon, total (TC)	ASA No.9 29-2.2.4 Combustion/IR	1.2	JHT-L H	*	%	0.1	0.5	11/10/11 10:27	bsu
Carbon, total organic (TOC)	ASA No.9 29-2.2.4 Combustion/IR	1.1	↓	*	%	0.1	0.5	11/10/11 10:27	bsu
pH, Saturated Paste	USDA No. 60 (21A) JHT-L	7.2		*	units	0.1	0.1	11/10/11 9:50	ndj
Solids, Percent	CLPSOW390, PART F, D-98	83.0		*	%	0.1	0.5	11/01/11 17:36	lwt

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/01/11 13:55	lwt
Digestion - Hot Plate	M3050B ICP							11/09/11 7:21	lwt
Saturated Paste Extraction	USDA No. 60 (2)							11/09/11 13:51	ndj
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/08/11 11:33	lwt
Sieve-250 um (60 mesh)	ASA No.9, 15-4.2.2							11/08/11 11:33	lwt
Synthetic Precip. Leaching Procedure	M1312							11/03/11 14:10	lwt/ndj
Water Extraction	ASA No. 9 10-2.3.2							11/10/11 11:00	ndj

Wet Chemistry

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Nitrate as N, soluble (Water)	Calculation: NO3NO2 minus NO2	4.1	JHT-L		mg/Kg	0.1	0.5	11/14/11 12:36	calc
Nitrate/Nitrite as N, soluble (Water)	M353.2 - Automated Cadmium Reduction	4.4	↓	*	mg/Kg	0.1	0.5	11/10/11 22:56	pjb
Nitrite as N, soluble (Water)	M353.2 - Automated Cadmium Reduction JHT, SQL-L	0.30	B	*	mg/Kg	0.05	0.3	11/10/11 22:56	pjb

EB 03/30/12

** Please refer to Qualifier Reports for details.*

Inorganic Analytical Results

Freeport-McMoRan - Chino Mines Company
Project ID: ZN000000J8
Sample ID: STS-AMD-2011-E2 0-6

ACZ Sample ID: *L91220-20*
Date Sampled: *10/06/11 09:15*
Date Received: *10/12/11*
Sample Matrix: *Soil*

Inorganic Prep

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Total Hot Plate Digestion	M3010A ICP							11/04/11 20:22	aeb

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Calcium, total (3050)	M6010B ICP	3910			mg/Kg	20	100	11/10/11 15:02	aeb
Copper (1312)	M6010B ICP J SD-L	0.20		*	mg/L	0.01	0.05	11/07/11 19:59	aeb
Copper, total (3050)	M6010B ICP	1030		*	mg/Kg	1	5	11/10/11 15:02	aeb
Potassium, total (3050)	M6010B ICP	3260			mg/Kg	30	200	11/10/11 15:02	aeb

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Carbon, total (TC)	ASA No.9 29-2.2.4 Combustion/IR	1.3	JHT-L H	*	%	0.1	0.5	11/10/11 11:30	bsu
Carbon, total organic (TOC)	ASA No.9 29-2.2.4 Combustion/IR	1.2	↓	*	%	0.1	0.5	11/10/11 11:30	bsu
pH, Saturated Paste	USDA No. 60 (21A) J HT-L	6.4		*	units	0.1	0.1	11/10/11 9:56	ndj
Solids, Percent	CLPSOW390, PART F, D-98	95.0		*	%	0.1	0.5	11/01/11 17:38	lwt

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/01/11 13:59	lwt
Digestion - Hot Plate	M3050B ICP							11/09/11 7:22	lwt
Saturated Paste Extraction	USDA No. 60 (2)							11/09/11 14:00	ndj
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/08/11 11:45	lwt
Sieve-250 um (60 mesh)	ASA No.9, 15-4.2.2							11/08/11 11:45	lwt
Synthetic Precip. Leaching Procedure	M1312							11/03/11 14:12	lwt/ndj
Water Extraction	ASA No. 9 10-2.3.2							11/10/11 11:00	ndj

Wet Chemistry

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Nitrate as N, soluble (Water)	Calculation: NO3NO2 minus NO2	43.0	J HT-L		mg/Kg	0.4	2	11/14/11 12:36	calc
Nitrate/Nitrite as N, soluble (Water)	M353.2 - Automated Cadmium Reduction	43.1	↓	*	mg/Kg	0.4	2	11/10/11 23:12	pjb
Nitrite as N, soluble (Water)	M353.2 - Automated Cadmium Reduction	0.09	B	*	mg/Kg	0.05	0.3	11/10/11 22:58	pjb

J HT, SQL-L

EB 03/30/12

* *Please refer to Qualifier Reports for details.*

Inorganic Analytical Results

Freeport-McMoRan - Chino Mines Company
Project ID: ZN000000J8
Sample ID: STS-PCUG-2011-21

ACZ Sample ID: ***L91355-01***
Date Sampled: *10/11/11 09:05*
Date Received: *10/18/11*
Sample Matrix: *Soil*

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010B ICP	558			mg/Kg	1	5	11/14/11 10:58	aeb

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
pH, Saturated Paste	USDA No. 60 (21A) J HT-L	4.8		*	units	0.1	0.1	11/14/11 17:28	thf
Solids, Percent	CLPSOW390, PART F, D-98	93.7		*	%	0.1	0.5	11/16/11 15:00	ndj

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/04/11 11:00	nrc
Digestion - Hot Plate	M3050B ICP							11/11/11 10:52	nrc
Saturated Paste Extraction	USDA No. 60 (2)							11/14/11 14:45	thf
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/09/11 11:00	lwt

ATM 2/22/12

** Please refer to Qualifier Reports for details.*

Freeport-McMoRan - Chino Mines Company
Project ID: ZN000000J8
Sample ID: STS-PCUG-2011-22

ACZ Sample ID: ***L91355-02***
Date Sampled: *10/10/11 15:00*
Date Received: *10/18/11*
Sample Matrix: *Soil*

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010B ICP	976			mg/Kg	1	5	11/14/11 11:07	aeb

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
pH, Saturated Paste	USDA No. 60 (21A) J HT-L	7.4		*	units	0.1	0.1	11/14/11 18:50	thf
Solids, Percent	CLPSOW390, PART F, D-98	93.5		*	%	0.1	0.5	11/16/11 15:00	ndj

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/04/11 11:06	nrc
Digestion - Hot Plate	M3050B ICP							11/11/11 11:45	nrc
Saturated Paste Extraction	USDA No. 60 (2)							11/14/11 16:36	thf
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/09/11 11:02	lwt

MJM 2/22/12

** Please refer to Qualifier Reports for details.*

Freeport-McMoRan - Chino Mines Company
Project ID: ZN000000J8
Sample ID: STS-PCUG-2011-23

ACZ Sample ID: ***L91355-03***
Date Sampled: *10/11/11 13:35*
Date Received: *10/18/11*
Sample Matrix: *Soil*

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010B ICP	551			mg/Kg	1	5	11/14/11 11:10	aeb

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
pH, Saturated Paste	USDA No. 60 (21A) JHT-L	5.8		*	units	0.1	0.1	11/14/11 19:31	thf
Solids, Percent	CLPSOW390, PART F, D-98	93.5		*	%	0.1	0.5	11/16/11 15:00	ndj

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/04/11 11:12	nrc
Digestion - Hot Plate	M3050B ICP							11/11/11 12:02	nrc
Saturated Paste Extraction	USDA No. 60 (2)							11/14/11 17:31	thf
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/09/11 11:04	lwt

mTm 2/22/12

** Please refer to Qualifier Reports for details.*

Freeport-McMoRan - Chino Mines Company

Project ID:	ZN000000J8	ACZ Sample ID:	***L91355-04***
Sample ID:	STS-PCUG-2011-24	Date Sampled:	*10/08/11 14:50*
		Date Received:	*10/18/11*
		Sample Matrix:	*Soil*

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010B ICP	1000			mg/Kg	1	5	11/14/11 11:14	aeb

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
pH, Saturated Paste	USDA No. 60 (21A) J HT-L	4.2		*	units	0.1	0.1	11/14/11 20:12	thf
Solids, Percent	CLPSOW390, PART F, D-98	90.5		*	%	0.1	0.5	11/16/11 15:00	ndj

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/04/11 11:18	nrc
Digestion - Hot Plate	M3050B ICP							11/11/11 12:20	nrc
Saturated Paste Extraction	USDA No. 60 (2)							11/14/11 18:27	thf
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/09/11 11:07	lwt

MTM 2/22/12

Inorganic Analytical Results

Freeport-McMoRan - Chino Mines Company

Project ID:	ZN000000J8	ACZ Sample ID:	*L91355-05*
Sample ID:	STS-PCUG-2011-25	Date Sampled:	*10/10/11 09:50*
		Date Received:	*10/18/11*
		Sample Matrix:	*Soil*

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010B ICP	706			mg/Kg	1	5	11/14/11 11:17	aeb

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
pH, Saturated Paste	USDA No. 60 (21A) J HT-L	4.6		*	units	0.1	0.1	11/14/11 20:53	thf
Solids, Percent	CLPSOW390, PART F, D-98	92.2		*	%	0.1	0.5	11/16/11 15:00	ndj

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/04/11 11:25	nrc
Digestion - Hot Plate	M3050B ICP							11/11/11 12:37	nrc
Saturated Paste Extraction	USDA No. 60 (2)							11/14/11 19:23	thf
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/09/11 11:09	lwt

MTM 2/22/12

* *Please refer to Qualifier Reports for details.*

Inorganic Analytical Results

Freeport-McMoRan - Chino Mines Company
Project ID: ZN000000J8
Sample ID: DUP1

ACZ Sample ID: ***L91355-06***
Date Sampled: *10/06/11 00:00*
Date Received: *10/18/11*
Sample Matrix: *Soil*

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010B ICP	1310			mg/Kg	1	5	11/14/11 11:26	aeb

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
pH, Saturated Paste	USDA No. 60 (21A) JHT-L	4.0		*	units	0.1	0.1	11/14/11 21:34	thf
Solids, Percent	CLPSOW390, PART F, D-98	92.5		*	%	0.1	0.5	11/16/11 15:00	ndj

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/04/11 11:31	nrc
Digestion - Hot Plate	M3050B ICP							11/11/11 12:55	nrc
Saturated Paste Extraction	USDA No. 60 (2)							11/14/11 20:18	thf
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/09/11 11:12	lwt

MTM 2/22/12

** Please refer to Qualifier Reports for details.*

Inorganic Analytical Results

Freeport-McMoRan - Chino Mines Company

Project ID: ZN000000J8
Sample ID: DUP2

ACZ Sample ID: ***L91355-07***
Date Sampled: *10/11/11 00:00*
Date Received: *10/18/11*
Sample Matrix: *Soil*

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010B ICP	555			mg/Kg	1	5	11/14/11 11:29	aeb

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
pH, Saturated Paste	USDA No. 60 (21A) J HT-L	4.9		*	units	0.1	0.1	11/14/11 22:15	thf
Solids, Percent	CLPSOW390, PART F, D-98	94.5		*	%	0.1	0.5	11/16/11 15:00	ndj

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/04/11 11:37	nrc
Digestion - Hot Plate	M3050B ICP							11/11/11 13:12	nrc
Saturated Paste Extraction	USDA No. 60 (2)							11/14/11 21:14	thf
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/09/11 11:14	lwt

ATM 2/22/12

** Please refer to Qualifier Reports for details.*

Freeport-McMoRan - Chino Mines Company

Project ID:	ZN000000J8	ACZ Sample ID:	***L91355-08***
Sample ID:	STS-PCUG-2011-28	Date Sampled:	*10/09/11 16:45*
		Date Received:	*10/18/11*
		Sample Matrix:	*Soil*

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010B ICP	959			mg/Kg	1	5	11/14/11 11:35	aeb

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
pH, Saturated Paste	USDA No. 60 (21A) J HT-L	7.5		*	units	0.1	0.1	11/14/11 22:56	thf
Solids, Percent	CLPSOW390, PART F, D-98	94.3		*	%	0.1	0.5	11/16/11 15:00	ndj

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/04/11 11:44	nrc
Digestion - Hot Plate	M3050B ICP							11/11/11 13:30	nrc
Saturated Paste Extraction	USDA No. 60 (2)							11/14/11 22:10	thf
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/09/11 11:16	lwt

NTM 2/22/12

** Please refer to Qualifier Reports for details.*

Freeport-McMoRan - Chino Mines Company

Project ID: ZN000000J8
Sample ID: STS-PCUG-2011-29

ACZ Sample ID: ***L91355-09***
Date Sampled: *10/11/11 14:25*
Date Received: *10/18/11*
Sample Matrix: *Soil*

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010B ICP	671			mg/Kg	1	5	11/14/11 11:38	aeb

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
pH, Saturated Paste	USDA No. 60 (21A) J HT-L	5.2		*	units	0.1	0.1	11/14/11 23:37	thf
Solids, Percent	CLPSOW390, PART F, D-98	94.2		*	%	0.1	0.5	11/16/11 15:00	ndj

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/04/11 11:50	nrc
Digestion - Hot Plate	M3050B ICP							11/11/11 13:47	nrc
Saturated Paste Extraction	USDA No. 60 (2)							11/14/11 23:05	thf
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/09/11 11:19	lwt

NTM 2/22/12

** Please refer to Qualifier Reports for details.*

Freeport-McMoRan - Chino Mines Company
Project ID: ZN000000J8
Sample ID: STS-PCUG-2011-30

ACZ Sample ID: ***L91355-10***
Date Sampled: *10/09/11 16:10*
Date Received: *10/18/11*
Sample Matrix: *Soil*

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010B ICP	1500			mg/Kg	1	5	11/14/11 11:42	aeb

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
pH, Saturated Paste	USDA No. 60 (21A) JHT-L	7.4		*	units	0.1	0.1	11/15/11 0:59	thf
Solids, Percent	CLPSOW390, PART F, D-98	94.6		*	%	0.1	0.5	11/16/11 15:00	ndj

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/04/11 11:56	nrc
Digestion - Hot Plate	M3050B ICP							11/11/11 14:05	nrc
Saturated Paste Extraction	USDA No. 60 (2)							11/15/11 0:01	thf
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/09/11 11:21	lwt

2/22/12

** Please refer to Qualifier Reports for details.*

Inorganic Analytical Results

Freeport-McMoRan - Chino Mines Company
Project ID: ZN000000J8
Sample ID: DUP7

ACZ Sample ID: ***L91355-11***
Date Sampled: *10/06/11 00:00*
Date Received: *10/18/11*
Sample Matrix: *Soil*

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010B ICP	567			mg/Kg	1	5	11/14/11 11:45	aeb

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Solids, Percent	CLPSOW390, PART F, D-98	91.0		*	%	0.1	0.5	11/16/11 15:00	ndj

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/04/11 12:03	nrc
Digestion - Hot Plate	M3050B ICP							11/11/11 14:22	nrc
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/09/11 11:24	lwt

MTM 2/22/12

** Please refer to Qualifier Reports for details.*

Freeport-McMoRan - Chino Mines Company

Project ID: ZN000000J8

Sample ID: STS-CG-2011-42

ACZ Sample ID: ***L91355-12***

Date Sampled: *10/09/11 10:00*

Date Received: *10/18/11*

Sample Matrix: *Soil*

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010B ICP	958			mg/Kg	1	5	11/14/11 11:48	aeb

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Solids, Percent	CLPSOW390, PART F, D-98	90.8		*	%	0.1	0.5	11/16/11 15:00	ndj

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/04/11 12:09	nrc
Digestion - Hot Plate	M3050B ICP							11/11/11 14:40	nrc
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/09/11 11:26	lwt

MTM 2/22/12

** Please refer to Qualifier Reports for details.*

Freeport-McMoRan - Chino Mines Company
Project ID: ZN000000J8
Sample ID: STS-CG-2011-43

ACZ Sample ID: ***L91355-13***
Date Sampled: *10/06/11 16:00*
Date Received: *10/18/11*
Sample Matrix: *Soil*

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010B ICP	626			mg/Kg	1	5	11/14/11 11:51	aeb

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Solids, Percent	CLPSOW390, PART F, D-98	90.4		*	%	0.1	0.5	11/16/11 15:00	ndj

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/04/11 12:15	nrc
Digestion - Hot Plate	M3050B ICP							11/11/11 14:57	nrc
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/09/11 11:28	lwt

mTm 2/22/12

** Please refer to Qualifier Reports for details.*

ACZ Laboratories, Inc.
2773 Downhill Drive Steamboat Springs, CO 80487 (800) 334-5493

Inorganic Analytical Results

Freeport-McMoRan - Chino Mines Company
Project ID: ZN000000J8
Sample ID: DUP8

ACZ Sample ID: ***L91355-14***
Date Sampled: *10/07/11 00:00*
Date Received: *10/18/11*
Sample Matrix: *Soil*

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010B ICP	2450			mg/Kg	1	5	11/14/11 11:54	aeb

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Solids, Percent	CLPSOW390, PART F, D-98	89.8		*	%	0.1	0.5	11/16/11 15:00	ndj

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/04/11 12:22	nrc
Digestion - Hot Plate	M3050B ICP							11/11/11 15:15	nrc
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/09/11 11:31	lwt

MTM 2/22/12

** Please refer to Qualifier Reports for details.*

Inorganic Analytical Results

Freeport-McMoRan - Chino Mines Company
Project ID: ZN000000J8
Sample ID: STS-CG-2011-45

ACZ Sample ID: ***L91355-15***
Date Sampled: *10/06/11 14:50*
Date Received: *10/18/11*
Sample Matrix: *Soil*

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010B ICP	668			mg/Kg	1	5	11/14/11 12:03	aeb

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Solids, Percent	CLPSOW390, PART F, D-98	92.3		*	%	0.1	0.5	11/16/11 15:00	ndj

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/04/11 12:28	nrc
Digestion - Hot Plate	M3050B ICP							11/11/11 15:32	nrc
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/09/11 11:33	lwt

NTM 2/22/12

** Please refer to Qualifier Reports for details.*

Freeport-McMoRan - Chino Mines Company
Project ID: ZN000000J8
Sample ID: STS-CG-2011-46

ACZ Sample ID: ***L91355-16***
Date Sampled: *10/09/11 13:40*
Date Received: *10/18/11*
Sample Matrix: *Soil*

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010B ICP	1100			mg/Kg	1	5	11/14/11 12:06	aeb

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Solids, Percent	CLPSOW390, PART F, D-98	90.6		*	%	0.1	0.5	11/16/11 15:00	ndj

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/04/11 12:34	nrc
Digestion - Hot Plate	M3050B ICP							11/11/11 15:50	nrc
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/09/11 11:36	lwt

NTM 2/22/12

Freeport-McMoRan - Chino Mines Company

Project ID:	ZN000000J8	ACZ Sample ID:	*L91355-17*
Sample ID:	DUP9	Date Sampled:	*10/09/11 00:00*
		Date Received:	*10/18/11*
		Sample Matrix:	*Soil*

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010B ICP	1050			mg/Kg	1	5	11/14/11 12:09	aeb

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Solids, Percent	CLPSOW390, PART F, D-98	90.6		*	%	0.1	0.5	11/16/11 15:00	ndj

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/04/11 12:41	nrc
Digestion - Hot Plate	M3050B ICP							11/11/11 16:07	nrc
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/09/11 11:38	lwt

NTM 2/22/12

** Please refer to Qualifier Reports for details.*

Freeport-McMoRan - Chino Mines Company

Project ID:	ZN000000J8	ACZ Sample ID:	***L91355-18***
Sample ID:	DUP3	Date Sampled:	*10/13/11 00:00*
		Date Received:	*10/18/11*
		Sample Matrix:	*Soil*

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010B ICP	372			mg/Kg	1	5	11/14/11 12:12	aeb

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
pH, Saturated Paste	USDA No. 60 (21A) J HT-L	5.9		*	units	0.1	0.1	11/15/11 1:40	thf
Solids, Percent	CLPSOW390, PART F, D-98	97.0		*	%	0.1	0.5	11/16/11 15:00	ndj

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/04/11 12:47	nrc
Digestion - Hot Plate	M3050B ICP							11/11/11 16:25	nrc
Saturated Paste Extraction	USDA No. 60 (2)							11/15/11 0:57	thf
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/09/11 11:40	lwt

MTM 2/22/12

** Please refer to Qualifier Reports for details.*

ACZ Laboratories, Inc.
2773 Downhill Drive Steamboat Springs, CO 80487 (800) 334-5493

Inorganic Analytical Results

Freeport-McMoRan - Chino Mines Company
Project ID: ZN000000J8
Sample ID: STS-CG-2011-49

ACZ Sample ID: ***L91355-19***
Date Sampled: *10/09/11 11:55*
Date Received: *10/18/11*
Sample Matrix: *Soil*

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010B ICP	733			mg/Kg	1	5	11/14/11 12:16	aeb

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Solids, Percent	CLPSOW390, PART F, D-98	93.8		*	%	0.1	0.5	11/16/11 15:00	ndj

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/04/11 12:53	nrc
Digestion - Hot Plate	M3050B ICP							11/11/11 16:42	nrc
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/09/11 11:43	lwt

2/22/12

** Please refer to Qualifier Reports for details.*

Freeport-McMoRan - Chino Mines Company

Project ID: ZN000000J8

Sample ID: STS-CG-2011-50

ACZ Sample ID: ***L91355-20***

Date Sampled: *10/09/11 11:10*

Date Received: *10/18/11*

Sample Matrix: *Soil*

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010B ICP	620			mg/Kg	1	5	11/14/11 12:19	aeb

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Solids, Percent	CLPSOW390, PART F, D-98	92.4		*	%	0.1	0.5	11/16/11 15:00	ndj

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/04/11 13:00	nrc
Digestion - Hot Plate	M3050B ICP							11/11/11 17:00	nrc
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/09/11 11:45	lwt

MTM 2/22/12

** Please refer to Qualifier Reports for details.*

Inorganic Analytical Results

Freeport-McMoRan - Chino Mines Company
Project ID: ZN000000J8
Sample ID: STS-PCUG-2011-11

ACZ Sample ID: ***L91357-01***
Date Sampled: *10/13/11 17:30*
Date Received: *10/18/11*
Sample Matrix: *Soil*

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010B ICP	254		*	mg/Kg	1	5	11/15/11 18:27	aeb

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
pH, Saturated Paste	USDA No. 60 (21A) J HT-L	4.6		*	units	0.1	0.1	11/14/11 22:53	thf
Solids, Percent	CLPSOW390, PART F, D-98	94.3		*	%	0.1	0.5	11/15/11 15:33	thf/nrc

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/10/11 14:45	thf/nrc
Digestion - Hot Plate	M3050B ICP							11/14/11 11:00	ndj
Saturated Paste Extraction	USDA No. 60 (2)							11/14/11 19:48	thf
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/14/11 10:30	thf

ATm 2/22/12

Freeport-McMoRan - Chino Mines Company

Project ID:	ZN000000J8	ACZ Sample ID:	***L91357-02***
Sample ID:	STS-PCUG-2011-12	Date Sampled:	*10/12/11 12:20*
		Date Received:	*10/18/11*
		Sample Matrix:	*Soil*

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010B ICP	536		*	mg/Kg	1	5	11/15/11 18:36	aeb

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
pH, Saturated Paste	USDA No. 60 (21A) J HT-L	6.7		*	units	0.1	0.1	11/14/11 23:56	thf
Solids, Percent	CLPSOW390, PART F, D-98	93.3		*	%	0.1	0.5	11/15/11 16:28	thf/nrc

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/10/11 14:48	thf/nrc
Digestion - Hot Plate	M3050B ICP							11/14/11 11:00	ndj
Saturated Paste Extraction	USDA No. 60 (2)							11/14/11 21:25	thf
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/14/11 10:32	thf

MTM 2/22/12

** Please refer to Qualifier Reports for details.*

Freeport-McMoRan - Chino Mines Company

Project ID:	ZN000000J8	ACZ Sample ID:	***L91357-03***
Sample ID:	STS-PCUG-2011-13	Date Sampled:	*10/11/11 13:55*
		Date Received:	*10/18/11*
		Sample Matrix:	*Soil*

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010B ICP	602		*	mg/Kg	1	5	11/15/11 18:39	aeb

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
pH, Saturated Paste	USDA No. 60 (21A) JHT-L	5.1		*	units	0.1	0.1	11/15/11 0:59	thf
Solids, Percent	CLPSOW390, PART F, D-98	94.2		*	%	0.1	0.5	11/15/11 17:24	thf/nrc

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/10/11 14:51	thf/nrc
Digestion - Hot Plate	M3050B ICP							11/14/11 11:00	ndj
Saturated Paste Extraction	USDA No. 60 (2)							11/14/11 23:02	thf
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/14/11 10:35	thf

MJM 2/22/12

** Please refer to Qualifier Reports for details.*

Freeport-McMoRan - Chino Mines Company

Project ID:	ZN000000J8	ACZ Sample ID:	***L91357-04***
Sample ID:	STS-PCUG-2011-14	Date Sampled:	*10/13/11 10:00*
		Date Received:	*10/18/11*
		Sample Matrix:	*Soil*

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010B ICP	354		*	mg/Kg	1	5	11/15/11 18:42	aeb

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
pH, Saturated Paste	USDA No. 60 (21A) J HT-L	5.9		*	units	0.1	0.1	11/15/11 2:03	thf
Solids, Percent	CLPSOW390, PART F, D-98	97.2		*	%	0.1	0.5	11/15/11 18:19	thf/nrc

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/10/11 14:54	thf/nrc
Digestion - Hot Plate	M3050B ICP							11/14/11 11:00	ndj
Saturated Paste Extraction	USDA No. 60 (2)							11/15/11 0:39	thf
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/14/11 10:38	thf

MTM 2/22/12

** Please refer to Qualifier Reports for details.*

ACZ Laboratories, Inc.

2773 Downhill Drive Steamboat Springs, CO 80487 (800) 334-5493

Inorganic Analytical Results

Freeport-McMoRan - Chino Mines Company

Project ID:	ZN000000J8	ACZ Sample ID:	***L91357-05***
Sample ID:	STS-PCUG-2011-41	Date Sampled:	*10/13/11 08:40*
		Date Received:	*10/18/11*
		Sample Matrix:	*Soil*

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010B ICP	587		*	mg/Kg	1	5	11/15/11 18:45	aeb

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
pH, Saturated Paste	USDA No. 60 (21A) JHT·L	3.3		*	units	0.1	0.1	11/15/11 3:06	thf
Solids, Percent	CLPSOW390, PART F, D-98	96.7		*	%	0.1	0.5	11/15/11 19:14	thf/nrc

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/10/11 14:58	thf/nrc
Digestion - Hot Plate	M3050B ICP							11/14/11 11:00	ndj
Saturated Paste Extraction	USDA No. 60 (2)							11/15/11 2:16	thf
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/14/11 10:41	thf

mtm 2/22/12

** Please refer to Qualifier Reports for details.*

Inorganic Analytical Results

Freeport-McMoRan - Chino Mines Company
Project ID: ZN000000J8
Sample ID: STS-PCUG-2011-16

ACZ Sample ID: ***L91357-06***
Date Sampled: *10/09/11 12:55*
Date Received: *10/18/11*
Sample Matrix: *Soil*

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010B ICP	864		*	mg/Kg	1	5	11/15/11 18:54	aeb

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
pH, Saturated Paste	USDA No. 60 (21A) JHT-L	5.2		*	units	0.1	0.1	11/15/11 4:09	thf
Solids, Percent	CLPSOW390, PART F, D-98	89.1		*	%	0.1	0.5	11/15/11 20:10	thf/nrc

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/10/11 15:01	thf/nrc
Digestion - Hot Plate	M3050B ICP							11/14/11 11:00	ndj
Saturated Paste Extraction	USDA No. 60 (2)							11/15/11 3:53	thf
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/14/11 10:44	thf

MTM 2/22/12

** Please refer to Qualifier Reports for details.*

Inorganic Analytical Results

Freeport-McMoRan - Chino Mines Company

Project ID:	ZN000000J8	ACZ Sample ID:	***L91357-07***
Sample ID:	STS-PCUG-2011-17	Date Sampled:	*10/10/11 10:50*
		Date Received:	*10/18/11*
		Sample Matrix:	*Soil*

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010B ICP	994		*	mg/Kg	1	5	11/15/11 18:57	aeb

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
pH, Saturated Paste	USDA No. 60 (21A) J HT-L	5.1		*	units	0.1	0.1	11/15/11 5:12	thf
Solids, Percent	CLPSOW390, PART F, D-98	94.2		*	%	0.1	0.5	11/15/11 21:05	thf/nrc

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/10/11 15:04	thf/nrc
Digestion - Hot Plate	M3050B ICP							11/14/11 11:00	ndj
Saturated Paste Extraction	USDA No. 60 (2)							11/15/11 5:30	thf
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/14/11 10:47	thf

mm 2/22/12

** Please refer to Qualifier Reports for details.*

Freeport-McMoRan - Chino Mines Company

Project ID:	ZN000000J8	ACZ Sample ID:	***L91357-08***
Sample ID:	STS-PCUG-2011-18	Date Sampled:	*10/09/11 14:50*
		Date Received:	*10/18/11*
		Sample Matrix:	*Soil*

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010B ICP	1540		*	mg/Kg	1	5	11/15/11 19:00	aeb

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
pH, Saturated Paste	USDA No. 60 (21A) J HT-L	5.3		*	units	0.1	0.1	11/15/11 6:15	thf
Solids, Percent	CLPSOW390, PART F, D-98	93.3		*	%	0.1	0.5	11/15/11 22:00	thf/nrc

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/10/11 15:08	thf/nrc
Digestion - Hot Plate	M3050B ICP							11/14/11 11:00	ndj
Saturated Paste Extraction	USDA No. 60 (2)							11/15/11 7:07	thf
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/14/11 10:49	thf

MTM 2/22/12

** Please refer to Qualifier Reports for details.*

Freeport-McMoRan - Chino Mines Company
Project ID: ZN000000J8
Sample ID: STS-PCUG-2011-19

ACZ Sample ID: ***L91357-09***
Date Sampled: *10/06/11 12:00*
Date Received: *10/18/11*
Sample Matrix: *Soil*

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010B ICP	1210		*	mg/Kg	1	5	11/15/11 19:03	aeb

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
pH, Saturated Paste	USDA No. 60 (21A) J HT-L	3.9		*	units	0.1	0.1	11/15/11 8:21	thf
Solids, Percent	CLPSOW390, PART F, D-98	92.4		*	%	0.1	0.5	11/15/11 22:56	thf/nrc

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/10/11 15:11	thf/nrc
Digestion - Hot Plate	M3050B ICP							11/14/11 11:00	ndj
Saturated Paste Extraction	USDA No. 60 (2)							11/15/11 8:44	thf
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/14/11 10:52	thf

2/22/12

** Please refer to Qualifier Reports for details.*

Inorganic Analytical Results

Freeport-McMoRan - Chino Mines Company
Project ID: ZN000000J8
Sample ID: STS-PCUG-2011-20

ACZ Sample ID: ***L91357-10***
Date Sampled: *10/12/11 15:00*
Date Received: *10/18/11*
Sample Matrix: *Soil*

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010B ICP	520		*	mg/Kg	1	5	11/15/11 19:06	aeb

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
pH, Saturated Paste	USDA No. 60 (21A) J HT-L	4.1		*	units	0.1	0.1	11/15/11 9:24	thf
Solids, Percent	CLPSOW390, PART F, D-98	92.9		*	%	0.1	0.5	11/15/11 23:51	thf/nrc

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/10/11 15:14	thf/nrc
Digestion - Hot Plate	M3050B ICP							11/14/11 11:00	ndj
Saturated Paste Extraction	USDA No. 60 (2)							11/15/11 10:21	thf
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/14/11 10:55	thf

MTM 2/22/12

** Please refer to Qualifier Reports for details.*

Inorganic Analytical Results

Freeport-McMoRan - Chino Mines Company
Project ID: ZN000000J8
Sample ID: STS-CG-2011-21

ACZ Sample ID: ***L91357-11***
Date Sampled: *10/05/11 15:50*
Date Received: *10/18/11*
Sample Matrix: *Soil*

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010B ICP	448		*	mg/Kg	1	5	11/15/11 19:09	aeb

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Solids, Percent	CLPSOW390, PART F, D-98	90.4		*	%	0.1	0.5	11/16/11 0:46	thf/nrc

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/10/11 15:18	thf/nrc
Digestion - Hot Plate	M3050B ICP							11/14/11 11:00	ndj
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/14/11 10:58	thf

MTM 2/22/12

** Please refer to Qualifier Reports for details.*

Inorganic Analytical Results

Freeport-McMoRan - Chino Mines Company

Project ID: ZN000000J8
Sample ID: STS-CG-2011-9

ACZ Sample ID: ***L91357-12***
Date Sampled: *10/04/11 12:50*
Date Received: *10/18/11*
Sample Matrix: *Soil*

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010B ICP	646		*	mg/Kg	1	5	11/15/11 19:12	aeb

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Solids, Percent	CLPSOW390, PART F, D-98	93.6		*	%	0.1	0.5	11/16/11 1:42	thf/nrc

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/10/11 15:21	thf/nrc
Digestion - Hot Plate	M3050B ICP							11/14/11 11:00	ndj
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/14/11 11:01	thf

MTM 2/22/12

* *Please refer to Qualifier Reports for details.*

Freeport-McMoRan - Chino Mines Company

Project ID:	ZN000000J8
Sample ID:	STS-CG-2011-10
ACZ Sample ID:	***L91357-13***
Date Sampled:	*10/07/11 13:23*
Date Received:	*10/18/11*
Sample Matrix:	*Soil*

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010B ICP	1930		*	mg/Kg	1	5	11/15/11 19:15	aeb

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Solids, Percent	CLPSOW390, PART F, D-98	89.8		*	%	0.1	0.5	11/16/11 2:37	thf/nrc

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/10/11 15:24	thf/nrc
Digestion - Hot Plate	M3050B ICP							11/14/11 11:00	ndj
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/14/11 11:04	thf

2/22/12

** Please refer to Qualifier Reports for details.*

Inorganic Analytical Results

Freeport-McMoRan - Chino Mines Company

Project ID:	ZN000000J8	ACZ Sample ID:	***L91357-14***
Sample ID:	STS-CG-2011-24	Date Sampled:	*10/05/11 17:20*
		Date Received:	*10/18/11*
		Sample Matrix:	*Soil*

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010B ICP	917		*	mg/Kg	1	5	11/15/11 19:21	aeb

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Solids, Percent	CLPSOW390, PART F, D-98	91.4		*	%	0.1	0.5	11/16/11 3:32	thf/nrc

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/10/11 15:28	thf/nrc
Digestion - Hot Plate	M3050B ICP							11/14/11 11:00	ndj
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/14/11 11:07	thf

MTM 2/22/12

** Please refer to Qualifier Reports for details.*

ACZ Laboratories, Inc.

2773 Downhill Drive Steamboat Springs, CO 80487 (800) 334-5493

Inorganic Analytical Results

Freeport-McMoRan - Chino Mines Company

Project ID:	ZN000000J8	ACZ Sample ID:	***L91357-15***
Sample ID:	STS-CG-2011-25	Date Sampled:	*10/10/11 17:00*
		Date Received:	*10/18/11*
		Sample Matrix:	*Soil*

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010B ICP	1640		*	mg/Kg	1	5	11/15/11 19:31	aeb

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Solids, Percent	CLPSOW390, PART F, D-98	95.0		*	%	0.1	0.5	11/16/11 4:28	thf/nrc

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/10/11 15:31	thf/nrc
Digestion - Hot Plate	M3050B ICP							11/14/11 11:00	ndj
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/14/11 11:09	thf

mjm 2/22/12

** Please refer to Qualifier Reports for details.*

Inorganic Analytical Results

Freeport-McMoRan - Chino Mines Company

Project ID:	ZN000000J8	ACZ Sample ID:	***L91357-16***
Sample ID:	STS-CG-2011-26	Date Sampled:	*10/08/11 15:45*
		Date Received:	*10/18/11*
		Sample Matrix:	*Soil*

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010B ICP	416		*	mg/Kg	1	5	11/15/11 19:34	aeb

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Solids, Percent	CLPSOW390, PART F, D-98	91.4		*	%	0.1	0.5	11/16/11 5:23	thf/nrc

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/10/11 15:34	thf/nrc
Digestion - Hot Plate	M3050B ICP							11/14/11 11:00	ndj
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/14/11 11:12	thf

2/22/12

** Please refer to Qualifier Reports for details.*

Inorganic Analytical Results

Freeport-McMoRan - Chino Mines Company

Project ID:	ZN000000J8	ACZ Sample ID:	***L91357-17***
Sample ID:	STS-CG-2011-27	Date Sampled:	*10/08/11 10:00*
		Date Received:	*10/18/11*
		Sample Matrix:	*Soil*

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010B ICP	1870		*	mg/Kg	1	5	11/15/11 19:37	aeb

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Solids, Percent	CLPSOW390, PART F, D-98	92.3		*	%	0.1	0.5	11/16/11 6:18	thf/nrc

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/10/11 15:38	thf/nrc
Digestion - Hot Plate	M3050B ICP							11/14/11 11:00	ndj
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/14/11 11:15	thf

MTM 2/22/12

** Please refer to Qualifier Reports for details.*

Inorganic Analytical Results

Freeport-McMoRan - Chino Mines Company
Project ID: ZN000000J8
Sample ID: STS-CG-2011-28

ACZ Sample ID: ***L91357-18***
Date Sampled: *10/05/11 16:35*
Date Received: *10/18/11*
Sample Matrix: *Soil*

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010B ICP	606		*	mg/Kg	1	5	11/15/11 19:40	aeb

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Solids, Percent	CLPSOW390, PART F, D-98	88.2		*	%	0.1	0.5	11/16/11 7:14	thf/nrc

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/10/11 15:41	thf/nrc
Digestion - Hot Plate	M3050B ICP							11/14/11 11:00	ndj
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/14/11 11:18	thf

MM 2/22/12

** Please refer to Qualifier Reports for details.*

Freeport-McMoRan - Chino Mines Company
Project ID: ZN000000J8
Sample ID: STS-CG-2011-29

ACZ Sample ID: ***L91357-19***
Date Sampled: *10/10/11 14:15*
Date Received: *10/18/11*
Sample Matrix: *Soil*

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010B ICP	1390		*	mg/Kg	1	5	11/15/11 19:43	aeb

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Solids, Percent	CLPSOW390, PART F, D-98	93.6		*	%	0.1	0.5	11/16/11 8:09	thf/nrc

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/10/11 15:44	thf/nrc
Digestion - Hot Plate	M3050B ICP							11/14/11 11:00	ndj
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/14/11 11:21	thf

NTM 2/22/12

Freeport-McMoRan - Chino Mines Company

Project ID: ZN000000J8
Sample ID: STS-CG-2011-30

ACZ Sample ID: ***L91357-20***
Date Sampled: *10/08/11 10:50*
Date Received: *10/18/11*
Sample Matrix: *Soil*

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010B ICP	575		*	mg/Kg	1	5	11/15/11 19:46	aeb

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Solids, Percent	CLPSOW390, PART F, D-98	93.0		*	%	0.1	0.5	11/16/11 9:04	thf/nrc

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/10/11 15:48	thf/nrc
Digestion - Hot Plate	M3050B ICP							11/14/11 11:00	ndj
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/14/11 11:24	thf

nTm 2/22/12

** Please refer to Qualifier Reports for details.*

ACZ Laboratories, Inc.
2773 Downhill Drive Steamboat Springs, CO 80487 (800) 334-5493

Inorganic Analytical Results

Freeport-McMoRan - Chino Mines Company
Project ID: ZN000000J8
Sample ID: STS-PH-2011-FID37

ACZ Sample ID: ***L91358-01***
Date Sampled: *10/11/11 09:45*
Date Received: *10/18/11*
Sample Matrix: *Soil*

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010B ICP	654		*	mg/Kg	1	5	11/17/11 9:42	aeb

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Acid Generation Potential (calc on Sulfur total)	M600/2-78-054 1.3 J SQL-I	1	B		t CaCO3/Kt	1	5	11/30/11 10:13	calc
Acid Neutralization Potential (calc)	M600/2-78-054 1.3	1			t CaCO3/Kt	1	5	11/30/11 10:13	calc
Acid-Base Potential (calc on Sulfur total)	M600/2-78-054 1.3	0			t CaCO3/Kt	1	5	11/30/11 10:13	calc
Neutralization Potential as CaCO3	M600/2-78-054 3.2.3 J SQL-I	0.1	B	*	%	0.1	0.5	11/17/11 0:07	brd
pH, Saturated Paste	USDA No. 60 (21A)	4.6		*	units	0.1	0.1	11/21/11 19:53	bsu
Solids, Percent	CLPSOW390, PART F, D-98	93.6		*	%	0.1	0.5	11/16/11 16:00	ndj
Sulfur Forms	M600/2-78-054 3.2.4								
Sulfur Organic Residual	J SQL-I	0.03	B	*	%	0.01	0.1	11/16/11 0:00	bsu
Sulfur Pyritic Sulfide	J SQL-I	0.01	B	*	%	0.01	0.1	11/16/11 0:00	bsu
Sulfur Sulfate			U	*	%	0.01	0.1	11/16/11 0:00	bsu
Sulfur Total	J SQL-I ↓	0.04	B	*	%	0.01	0.1	11/16/11 0:00	bsu
Total Sulfur minus Sulfate		0.04	B	*	%	0.01	0.1	11/16/11 0:00	bsu

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/11/11 11:26	zsh
Crush and Pulverize	USDA No. 1, 1972							11/15/11 13:00	cra
Digestion - Hot Plate	M3050B ICP							11/16/11 11:00	mss2
Saturated Paste Extraction	USDA No. 60 (2)							11/21/11 17:00	bsu
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/15/11 15:48	cra/thf
Sieve-250 um (60 mesh)	ASA No.9, 15-4.2.2							11/15/11 15:48	cra/thf

EB 03/30/12

** Please refer to Qualifier Reports for details.*

Freeport-McMoRan - Chino Mines Company

Project ID:	ZN000000J8	ACZ Sample ID:	***L91358-02***
Sample ID:	STS-PCUG-2011-40	Date Sampled:	*10/13/11 13:55*
		Date Received:	*10/18/11*
		Sample Matrix:	*Soil*

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010B ICP	312		*	mg/Kg	1	5	11/17/11 9:52	aeb

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
pH, Saturated Paste	USDA No. 60 (21A) J HT-L	3.8		*	units	0.1	0.1	11/21/11 20:36	bsu
Solids, Percent	CLPSOW390, PART F, D-98	96.6		*	%	0.1	0.5	11/16/11 16:00	ndj

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/11/11 11:28	zsh
Digestion - Hot Plate	M3050B ICP							11/16/11 12:00	mss2
Saturated Paste Extraction	USDA No. 60 (2)							11/21/11 17:04	bsu
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/15/11 15:53	cra/thf
Sieve-250 um (60 mesh)	ASA No.9, 15-4.2.2							11/15/11 15:53	cra/thf

EB 03/30/12

** Please refer to Qualifier Reports for details.*

Freeport-McMoRan - Chino Mines Company
Project ID: ZN000000J8
Sample ID: STS-PH-2011-FID101

ACZ Sample ID: ***L91358-03***
Date Sampled: *10/12/11 16:45*
Date Received: *10/18/11*
Sample Matrix: *Soil*

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010B ICP	272		*	mg/Kg	1	5	11/17/11 10:01	aeb

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Acid Generation Potential (calc on Sulfur total)	M600/2-78-054 1.3	6			t CaCO3/Kt	1	5	11/30/11 10:14	calc
Acid Neutralization Potential (calc)	M600/2-78-054 1.3	2			t CaCO3/Kt	1	5	11/30/11 10:14	calc
Acid-Base Potential (calc on Sulfur total)	M600/2-78-054 1.3	-4			t CaCO3/Kt	1	5	11/30/11 10:14	calc
Neutralization Potential as CaCO3	M600/2-78-054 3.2.3 J SQL-I	0.2	B	*	%	0.1	0.5	11/17/11 4:37	brd
pH, Saturated Paste	USDA No. 60 (21A)	3.8		*	units	0.1	0.1	11/21/11 21:19	bsu
Solids, Percent	CLPSOW390, PART F, D-98	93.8		*	%	0.1	0.5	11/16/11 16:00	ndj
Sulfur Forms	M600/2-78-054 3.2.4								
Sulfur Organic Residual		0.11		*	%	0.01	0.1	11/16/11 0:00	bsu
Sulfur Pyritic Sulfide	J SQL-I	0.02	B	*	%	0.01	0.1	11/16/11 0:00	bsu
Sulfur Sulfate	↓	0.06	B	*	%	0.01	0.1	11/16/11 0:00	bsu
Sulfur Total		0.19		*	%	0.01	0.1	11/16/11 0:00	bsu
Total Sulfur minus Sulfate		0.13		*	%	0.01	0.1	11/16/11 0:00	bsu

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/11/11 11:31	zsh
Crush and Pulverize	USDA No. 1, 1972							11/15/11 13:17	cra
Digestion - Hot Plate	M3050B ICP							11/16/11 12:20	mss2
Saturated Paste Extraction	USDA No. 60 (2)							11/21/11 17:08	bsu
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/15/11 15:59	cra/thf
Sieve-250 um (60 mesh)	ASA No.9, 15-4.2.2							11/15/11 15:59	cra/thf

EB 03/30/12

ACZ Laboratories, Inc.

2773 Downhill Drive Steamboat Springs, CO 80487 (800) 334-5493

Inorganic Analytical Results

Freeport-McMoRan - Chino Mines Company

Project ID:	ZN000000J8	ACZ Sample ID:	***L91358-04***
Sample ID:	STS-PH-2011-REFPLOT3	Date Sampled:	*10/07/11 11:50*
		Date Received:	*10/18/11*
		Sample Matrix:	*Soil*

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010B ICP	1950		*	mg/Kg	1	5	11/17/11 10:04	aeb

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Acid Generation Potential (calc on Sulfur total)	M600/2-78-054 1.3 J SQL·I	3	B		t CaCO3/Kt	1	5	11/30/11 10:14	calc
Acid Neutralization Potential (calc)	M600/2-78-054 1.3	13			t CaCO3/Kt	1	5	11/30/11 10:14	calc
Acid-Base Potential (calc on Sulfur total)	M600/2-78-054 1.3	10			t CaCO3/Kt	1	5	11/30/11 10:14	calc
Neutralization Potential as CaCO3	M600/2-78-054 3.2.3	1.3		*	%	0.1	0.5	11/17/11 2:26	brd
pH, Saturated Paste	USDA No. 60 (21A)	5.6		*	units	0.1	0.1	11/21/11 22:02	bsu
Solids, Percent	CLPSOW390, PART F, D-98	91.2		*	%	0.1	0.5	11/16/11 16:00	ndj
Sulfur Forms	M600/2-78-054 3.2.4								
Sulfur Organic Residual	J SQL·I	0.07	B	*	%	0.01	0.1	11/16/11 0:00	bsu
Sulfur Pyritic Sulfide	↓	0.01	B	*	%	0.01	0.1	11/16/11 0:00	bsu
Sulfur Sulfate		0.02	B	*	%	0.01	0.1	11/16/11 0:00	bsu
Sulfur Total		0.10		*	%	0.01	0.1	11/16/11 0:00	bsu
Total Sulfur minus Sulfate	J SQL·I	0.08	B	*	%	0.01	0.1	11/16/11 0:00	bsu

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/11/11 11:33	zsh
Crush and Pulverize	USDA No. 1, 1972							11/15/11 13:35	cra
Digestion - Hot Plate	M3050B ICP							11/16/11 12:40	mss2
Saturated Paste Extraction	USDA No. 60 (2)							11/21/11 17:13	bsu
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/15/11 16:05	cra/thf
Sieve-250 um (60 mesh)	ASA No.9, 15-4.2.2							11/15/11 16:05	cra/thf

EB 03/30/12

** Please refer to Qualifier Reports for details.*

Inorganic Analytical Results

Freeport-McMoRan - Chino Mines Company
Project ID: ZN000000J8
Sample ID: STS-PH-2011-REFPLOT4

ACZ Sample ID: ***L91358-05***
Date Sampled: *10/06/11 10:39*
Date Received: *10/18/11*
Sample Matrix: *Soil*

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010B ICP	1130		*	mg/Kg	1	5	11/17/11 10:07	aeb

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Acid Generation Potential (calc on Sulfur total)	M600/2-78-054 1.3	7			t CaCO3/Kt	1	5	11/30/11 10:14	calc
Acid Neutralization Potential (calc)	M600/2-78-054 1.3	0.0			t CaCO3/Kt	1	5	11/30/11 10:14	calc
Acid-Base Potential (calc on Sulfur total)	M600/2-78-054 1.3	-7			t CaCO3/Kt	1	5	11/30/11 10:14	calc
Neutralization Potential as CaCO3	M600/2-78-054 3.2.3		U	*	%	0.1	0.5	11/28/11 14:33	mss2
pH, Saturated Paste	USDA No. 60 (21A)	5.4		*	units	0.1	0.1	11/21/11 22:46	bsu
Solids, Percent	CLPSOW390, PART F, D-98	90.8		*	%	0.1	0.5	11/16/11 16:00	ndj
Sulfur Forms	M600/2-78-054 3.2.4								
Sulfur Organic Residual		0.13		*	%	0.01	0.1	11/16/11 0:00	bsu
Sulfur Pyritic Sulfide	J SQL-I	0.03	B	*	%	0.01	0.1	11/16/11 0:00	bsu
Sulfur Sulfate	↓	0.05	B	*	%	0.01	0.1	11/16/11 0:00	bsu
Sulfur Total		0.21		*	%	0.01	0.1	11/16/11 0:00	bsu
Total Sulfur minus Sulfate		0.16		*	%	0.01	0.1	11/16/11 0:00	bsu

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/11/11 11:35	zsh
Crush and Pulverize	USDA No. 1, 1972							11/15/11 13:52	cra
Digestion - Hot Plate	M3050B ICP							11/16/11 13:00	mss2
Saturated Paste Extraction	USDA No. 60 (2)							11/21/11 17:17	bsu
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/15/11 16:10	cra/thf
Sieve-250 um (60 mesh)	ASA No.9, 15-4.2.2							11/15/11 16:10	cra/thf

EB 03/30/12

** Please refer to Qualifier Reports for details.*

Freeport-McMoRan - Chino Mines Company
Project ID: ZN000000J8
Sample ID: DUP11

ACZ Sample ID: ***L91358-06***
Date Sampled: *10/12/11 00:00*
Date Received: *10/18/11*
Sample Matrix: *Soil*

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010B ICP	341		*	mg/Kg	1	5	11/17/11 10:14	aeb

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Acid Generation Potential (calc on Sulfur total)	M600/2-78-054 1.3	6			t CaCO3/Kt	1	5	11/30/11 10:14	calc
Acid Neutralization Potential (calc)	M600/2-78-054 1.3	0.0			t CaCO3/Kt	1	5	11/30/11 10:14	calc
Acid-Base Potential (calc on Sulfur total)	M600/2-78-054 1.3	-6			t CaCO3/Kt	1	5	11/30/11 10:14	calc
Neutralization Potential as CaCO3	M600/2-78-054 3.2.3		U	*	%	0.1	0.5	11/17/11 6:35	brd
pH, Saturated Paste	USDA No. 60 (21A)	3.9		*	units	0.1	0.1	11/21/11 23:29	bsu
Solids, Percent	CLPSOW390, PART F, D-98	93.7		*	%	0.1	0.5	11/16/11 16:00	ndj
Sulfur Forms	M600/2-78-054 3.2.4								
Sulfur Organic Residual		0.13		*	%	0.01	0.1	11/17/11 0:00	bsu
Sulfur Pyritic Sulfide			U	*	%	0.01	0.1	11/17/11 0:00	bsu
Sulfur Sulfate	J SQL-I	0.06	B	*	%	0.01	0.1	11/17/11 0:00	bsu
Sulfur Total		0.19		*	%	0.01	0.1	11/17/11 0:00	bsu
Total Sulfur minus Sulfate		0.13		*	%	0.01	0.1	11/17/11 0:00	bsu

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/11/11 11:37	zsh
Crush and Pulverize	USDA No. 1, 1972							11/15/11 14:10	cra
Digestion - Hot Plate	M3050B ICP							11/16/11 13:20	mss2
Saturated Paste Extraction	USDA No. 60 (2)							11/21/11 17:22	bsu
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/15/11 16:16	cra/thf
Sieve-250 um (60 mesh)	ASA No.9, 15-4.2.2							11/15/11 16:16	cra/thf

EB 03/30/12

** Please refer to Qualifier Reports for details.*

Freeport-McMoRan - Chino Mines Company
Project ID: ZN000000J8
Sample ID: STS-PH-2011-FID105

ACZ Sample ID: *L91358-07*
Date Sampled: *10/06/11 13:30*
Date Received: *10/18/11*
Sample Matrix: *Soil*

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010B ICP	668		*	mg/Kg	1	5	11/17/11 10:17	aeb

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Acid Generation Potential (calc on Sulfur total)	M600/2-78-054 1.3 J SQL-I	3	B		t CaCO3/Kt	1	5	11/30/11 10:14	calc
Acid Neutralization Potential (calc)	M600/2-78-054 1.3	8			t CaCO3/Kt	1	5	11/30/11 10:14	calc
Acid-Base Potential (calc on Sulfur total)	M600/2-78-054 1.3	5			t CaCO3/Kt	1	5	11/30/11 10:14	calc
Neutralization Potential as CaCO3	M600/2-78-054 3.2.3	0.8		*	%	0.1	0.5	11/17/11 8:32	brd
pH, Saturated Paste	USDA No. 60 (21A)	4.9		*	units	0.1	0.1	11/22/11 0:12	bsu
Solids, Percent	CLPSOW390, PART F, D-98	91.1		*	%	0.1	0.5	11/16/11 16:00	ndj
Sulfur Forms	M600/2-78-054 3.2.4								
Sulfur Organic Residual	J SQL-I	0.07	B	*	%	0.01	0.1	11/17/11 0:00	bsu
Sulfur Pyritic Sulfide	↓	0.01	B	*	%	0.01	0.1	11/17/11 0:00	bsu
Sulfur Sulfate		0.02	B	*	%	0.01	0.1	11/17/11 0:00	bsu
Sulfur Total		0.10		*	%	0.01	0.1	11/17/11 0:00	bsu
Total Sulfur minus Sulfate	J SQL-I	0.08	B	*	%	0.01	0.1	11/17/11 0:00	bsu

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/11/11 11:39	zsh
Crush and Pulverize	USDA No. 1, 1972							11/15/11 14:27	cra
Digestion - Hot Plate	M3050B ICP							11/16/11 13:40	mss2
Saturated Paste Extraction	USDA No. 60 (2)							11/21/11 17:26	bsu
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/15/11 16:22	cra/thf
Sieve-250 um (60 mesh)	ASA No.9, 15-4.2.2							11/15/11 16:22	cra/thf

EB 03/30/12

** Please refer to Qualifier Reports for details.*

ACZ Laboratories, Inc.

2773 Downhill Drive Steamboat Springs, CO 80487 (800) 334-5493

Inorganic Analytical Results

Freeport-McMoRan - Chino Mines Company		ACZ Sample ID:	***L91358-08***
Project ID:	ZN000000J8	Date Sampled:	*10/13/11 00:00*
Sample ID:	DUP12	Date Received:	*10/18/11*
		Sample Matrix:	*Soil*

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010B ICP	467		*	mg/Kg	1	5	11/17/11 10:20	aeb

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Acid Generation Potential (calc on Sulfur total)	M600/2-78-054 1.3	6			t CaCO3/Kt	1	5	11/30/11 10:14	calc
Acid Neutralization Potential (calc)	M600/2-78-054 1.3	26			t CaCO3/Kt	1	5	11/30/11 10:14	calc
Acid-Base Potential (calc on Sulfur total)	M600/2-78-054 1.3	20			t CaCO3/Kt	1	5	11/30/11 10:14	calc
Neutralization Potential as CaCO3	M600/2-78-054 3.2.3	2.6		*	%	0.1	0.5	11/17/11 10:30	brd
pH, Saturated Paste	USDA No. 60 (21A)	6.3		*	units	0.1	0.1	11/22/11 0:55	bsu
Solids, Percent	CLPSOW390, PART F, D-98	95.3		*	%	0.1	0.5	11/16/11 16:00	ndj
Sulfur Forms	M600/2-78-054 3.2.4								
Sulfur Organic Residual		0.12		*	%	0.01	0.1	11/17/11 0:00	bsu
Sulfur Pyritic Sulfide	J SQL- I	0.03	B	*	%	0.01	0.1	11/17/11 0:00	bsu
Sulfur Sulfate	↓	0.04	B	*	%	0.01	0.1	11/17/11 0:00	bsu
Sulfur Total		0.19		*	%	0.01	0.1	11/17/11 0:00	bsu
Total Sulfur minus Sulfate		0.15		*	%	0.01	0.1	11/17/11 0:00	bsu

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/11/11 11:42	zsh
Crush and Pulverize	USDA No. 1, 1972							11/15/11 14:45	cra
Digestion - Hot Plate	M3050B ICP							11/16/11 14:00	mss2
Saturated Paste Extraction	USDA No. 60 (2)							11/21/11 17:30	bsu
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/15/11 16:27	cra/thf
Sieve-250 um (60 mesh)	ASA No.9, 15-4.2.2							11/15/11 16:27	cra/thf

EB 03/30/12

** Please refer to Qualifier Reports for details.*

Freeport-McMoRan - Chino Mines Company
Project ID: ZN000000J8
Sample ID: STS-PH-2011-REFPLOT1

ACZ Sample ID: ***L91358-09***
Date Sampled: *10/04/11 11:09*
Date Received: *10/18/11*
Sample Matrix: *Soil*

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010B ICP	597		*	mg/Kg	1	5	11/17/11 10:23	aeb

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Acid Generation Potential (calc on Sulfur total)	M600/2-78-054 1.3	J SQL-I 2	B		t CaCO3/Kt	1	5	11/30/11 10:14	calc
Acid Neutralization Potential (calc)	M600/2-78-054 1.3	101			t CaCO3/Kt	1	5	11/30/11 10:14	calc
Acid-Base Potential (calc on Sulfur total)	M600/2-78-054 1.3	99			t CaCO3/Kt	1	5	11/30/11 10:14	calc
Neutralization Potential as CaCO3	M600/2-78-054 3.2.3	10.1		*	%	0.1	0.5	11/17/11 7:05	brd
pH, Saturated Paste	USDA No. 60 (21A)	7.5		*	units	0.1	0.1	11/22/11 1:39	bsu
Solids, Percent	CLPSOW390, PART F, D-98	92.7		*	%	0.1	0.5	11/16/11 16:00	ndj
Sulfur Forms	M600/2-78-054 3.2.4								
Sulfur Organic Residual		J SQL-I 0.06	B	*	%	0.01	0.1	11/17/11 0:00	bsu
Sulfur Pyritic Sulfide			U	*	%	0.01	0.1	11/17/11 0:00	bsu
Sulfur Sulfate			U	*	%	0.01	0.1	11/17/11 0:00	bsu
Sulfur Total		J SQL-I 0.05	B	*	%	0.01	0.1	11/17/11 0:00	bsu
Total Sulfur minus Sulfate		↓ 0.05	B	*	%	0.01	0.1	11/17/11 0:00	bsu

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/11/11 11:44	zsh
Crush and Pulverize	USDA No. 1, 1972							11/15/11 15:02	cra
Digestion - Hot Plate	M3050B ICP							11/16/11 14:20	mss2
Saturated Paste Extraction	USDA No. 60 (2)							11/21/11 17:35	bsu
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/15/11 16:33	cra/thf
Sieve-250 um (60 mesh)	ASA No.9, 15-4.2.2							11/15/11 16:33	cra/thf

EB 03/30/12

** Please refer to Qualifier Reports for details.*

ACZ Laboratories, Inc.
2773 Downhill Drive Steamboat Springs, CO 80487 (800) 334-5493

Inorganic Analytical Results

Freeport-McMoRan - Chino Mines Company

Project ID:	ZN000000J8
Sample ID:	STS-PH-2011-REFPLOT2
ACZ Sample ID:	*L91358-10*
Date Sampled:	*10/05/11 12:30*
Date Received:	*10/18/11*
Sample Matrix:	*Soil*

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010B ICP	687		*	mg/Kg	1	5	11/17/11 10:26	aeb

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Acid Generation Potential (calc on Sulfur total)	M600/2-78-054 1.3	0			t CaCO3/Kt	1	5	11/30/11 10:14	calc
Acid Neutralization Potential (calc)	M600/2-78-054 1.3	11			t CaCO3/Kt	1	5	11/30/11 10:14	calc
Acid-Base Potential (calc on Sulfur total)	M600/2-78-054 1.3	11			t CaCO3/Kt	1	5	11/30/11 10:14	calc
Neutralization Potential as CaCO3	M600/2-78-054 3.2.3	1.1		*	%	0.1	0.5	11/17/11 12:27	brd
pH, Saturated Paste	USDA No. 60 (21A)	6.0		*	units	0.1	0.1	11/22/11 2:22	bsu
Solids, Percent	CLPSOW390, PART F, D-98	91.9		*	%	0.1	0.5	11/16/11 16:00	ndj
Sulfur Forms	M600/2-78-054 3.2.4								
Sulfur Organic Residual	J SQL-I	0.02	B	*	%	0.01	0.1	11/17/11 0:00	bsu
Sulfur Pyritic Sulfide			U	*	%	0.01	0.1	11/17/11 0:00	bsu
Sulfur Sulfate			U	*	%	0.01	0.1	11/17/11 0:00	bsu
Sulfur Total	J SQL-I	0.02	B	*	%	0.01	0.1	11/17/11 0:00	bsu
Total Sulfur minus Sulfate		0.02	B	*	%	0.01	0.1	11/17/11 0:00	bsu

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/11/11 11:46	zsh
Crush and Pulverize	USDA No. 1, 1972							11/15/11 15:20	cra
Digestion - Hot Plate	M3050B ICP							11/16/11 14:40	mss2
Saturated Paste Extraction	USDA No. 60 (2)							11/21/11 17:39	bsu
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/15/11 16:39	cra/thf
Sieve-250 um (60 mesh)	ASA No.9, 15-4.2.2							11/15/11 16:39	cra/thf

EB 03/30/12

** Please refer to Qualifier Reports for details.*

Freeport-McMoRan - Chino Mines Company
Project ID: ZN000000J8
Sample ID: STS-PH-2011-FID22

ACZ Sample ID: ***L91358-11***
Date Sampled: *10/13/11 16:40*
Date Received: *10/18/11*
Sample Matrix: *Soil*

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010B ICP	430			mg/Kg	1	5	11/17/11 10:29	aeb

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Acid Generation Potential (calc on Sulfur total)	M600/2-78-054 1.3	6			t CaCO3/Kt	1	5	11/30/11 10:14	calc
Acid Neutralization Potential (calc)	M600/2-78-054 1.3	16			t CaCO3/Kt	1	5	11/30/11 10:14	calc
Acid-Base Potential (calc on Sulfur total)	M600/2-78-054 1.3	10			t CaCO3/Kt	1	5	11/30/11 10:14	calc
Neutralization Potential as CaCO3	M600/2-78-054 3.2.3	1.6		*	%	0.1	0.5	11/17/11 16:22	brd
pH, Saturated Paste	USDA No. 60 (21A)	6.2		*	units	0.1	0.1	11/22/11 3:49	bsu
Solids, Percent	CLPSOW390, PART F, D-98	95.4		*	%	0.1	0.5	11/16/11 16:00	ndj
Sulfur Forms	M600/2-78-054 3.2.4								
Sulfur Organic Residual		0.11		*	%	0.01	0.1	11/17/11 0:00	bsu
Sulfur Pyritic Sulfide	J SQL·I	0.04	B	*	%	0.01	0.1	11/17/11 0:00	bsu
Sulfur Sulfate	↓	0.04	B	*	%	0.01	0.1	11/17/11 0:00	bsu
Sulfur Total		0.19		*	%	0.01	0.1	11/17/11 0:00	bsu
Total Sulfur minus Sulfate		0.15		*	%	0.01	0.1	11/17/11 0:00	bsu

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/11/11 11:48	zsh
Crush and Pulverize	USDA No. 1, 1972							11/15/11 15:37	cra
Digestion - Hot Plate	M3050B ICP							11/16/11 15:00	mss2
Saturated Paste Extraction	USDA No. 60 (2)							11/21/11 17:44	bsu
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/15/11 16:44	cra/thf
Sieve-250 um (60 mesh)	ASA No.9, 15-4.2.2							11/15/11 16:44	cra/thf

EB 03/30/12

Inorganic Analytical Results

Freeport-McMoRan - Chino Mines Company		ACZ Sample ID:	***L91358-12***
Project ID:	ZN000000J8	Date Sampled:	*10/07/11 14:35*
Sample ID:	STS-PH-2011-FID10	Date Received:	*10/18/11*
		Sample Matrix:	*Soil*

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010B ICP	2140		*	mg/Kg	1	5	11/17/11 10:38	aeb

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Acid Generation Potential (calc on Sulfur total)	M600/2-78-054 1.3 J SQL-I	3	B		t CaCO3/Kt	1	5	11/30/11 10:14	calc
Acid Neutralization Potential (calc)	M600/2-78-054 1.3	5			t CaCO3/Kt	1	5	11/30/11 10:14	calc
Acid-Base Potential (calc on Sulfur total)	M600/2-78-054 1.3	2			t CaCO3/Kt	1	5	11/30/11 10:14	calc
Neutralization Potential as CaCO3	M600/2-78-054 3.2.3 J SQL-I	0.5	B	*	%	0.1	0.5	11/17/11 18:20	brd
pH, Saturated Paste	USDA No. 60 (21A)	4.8		*	units	0.1	0.1	11/22/11 4:32	bsu
Solids, Percent	CLPSOW390, PART F, D-98	91.5		*	%	0.1	0.5	11/16/11 16:00	ndj
Sulfur Forms	M600/2-78-054 3.2.4								
Sulfur Organic Residual	J SQL-I	0.07	B	*	%	0.01	0.1	11/17/11 0:00	bsu
Sulfur Pyritic Sulfide	↓	0.02	B	*	%	0.01	0.1	11/17/11 0:00	bsu
Sulfur Sulfate		0.01	B	*	%	0.01	0.1	11/17/11 0:00	bsu
Sulfur Total		0.10		*	%	0.01	0.1	11/17/11 0:00	bsu
Total Sulfur minus Sulfate	J SQL-I	0.09	B	*	%	0.01	0.1	11/17/11 0:00	bsu

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/11/11 11:50	zsh
Crush and Pulverize	USDA No. 1, 1972							11/15/11 15:55	cra
Digestion - Hot Plate	M3050B ICP							11/16/11 15:20	mss2
Saturated Paste Extraction	USDA No. 60 (2)							11/21/11 17:48	bsu
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/15/11 16:50	cra/thf
Sieve-250 um (60 mesh)	ASA No.9, 15-4.2.2							11/15/11 16:50	cra/thf

EB 03/30/12

** Please refer to Qualifier Reports for details.*

Freeport-McMoRan - Chino Mines Company
Project ID: ZN000000J8
Sample ID: STS-PH-2011-FID15

ACZ Sample ID: ***L91358-13***
Date Sampled: *10/10/11 11:50*
Date Received: *10/18/11*
Sample Matrix: *Soil*

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010B ICP	2260		*	mg/Kg	1	5	11/17/11 10:41	aeb

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Acid Generation Potential (calc on Sulfur total)	M600/2-78-054 1.3	6			t CaCO3/Kt	1	5	11/30/11 10:14	calc
Acid Neutralization Potential (calc)	M600/2-78-054 1.3	0.0			t CaCO3/Kt	1	5	11/30/11 10:14	calc
Acid-Base Potential (calc on Sulfur total)	M600/2-78-054 1.3	-6			t CaCO3/Kt	1	5	11/30/11 10:14	calc
Neutralization Potential as CaCO3	M600/2-78-054 3.2.3		U	*	%	0.1	0.5	11/17/11 20:17	brd
pH, Saturated Paste	USDA No. 60 (21A)	4.8		*	units	0.1	0.1	11/22/11 5:15	bsu
Solids, Percent	CLPSOW390, PART F, D-98	92.8		*	%	0.1	0.5	11/16/11 16:00	ndj
Sulfur Forms	M600/2-78-054 3.2.4								
Sulfur Organic Residual		0.13		*	%	0.01	0.1	11/17/11 0:00	bsu
Sulfur Pyritic Sulfide	J SQL-I	0.04	B	*	%	0.01	0.1	11/17/11 0:00	bsu
Sulfur Sulfate		0.02	B	*	%	0.01	0.1	11/17/11 0:00	bsu
Sulfur Total	↓	0.19		*	%	0.01	0.1	11/17/11 0:00	bsu
Total Sulfur minus Sulfate		0.17		*	%	0.01	0.1	11/17/11 0:00	bsu

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/11/11 11:53	zsh
Crush and Pulverize	USDA No. 1, 1972							11/15/11 16:12	cra
Digestion - Hot Plate	M3050B ICP							11/16/11 15:40	mss2
Saturated Paste Extraction	USDA No. 60 (2)							11/21/11 17:53	bsu
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/15/11 16:56	cra/thf
Sieve-250 um (60 mesh)	ASA No.9, 15-4.2.2							11/15/11 16:56	cra/thf

EB 03/30/12

** Please refer to Qualifier Reports for details.*

Freeport-McMoRan - Chino Mines Company
Project ID: ZN000000J8
Sample ID: STS-PH-2011-FID16

ACZ Sample ID: ***L91358-14***
Date Sampled: *10/10/11 12:30*
Date Received: *10/18/11*
Sample Matrix: *Soil*

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010B ICP	2020		*	mg/Kg	1	5	11/17/11 10:44	aeb

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Acid Generation Potential (calc on Sulfur total)	M600/2-78-054 1.3 J SQL-I	5	B		t CaCO3/Kt	1	5	11/30/11 10:15	calc
Acid Neutralization Potential (calc)	M600/2-78-054 1.3	0.0			t CaCO3/Kt	1	5	11/30/11 10:15	calc
Acid-Base Potential (calc on Sulfur total)	M600/2-78-054 1.3	-5			t CaCO3/Kt	1	5	11/30/11 10:15	calc
Neutralization Potential as CaCO3	M600/2-78-054 3.2.3		U	*	%	0.1	0.5	11/17/11 22:15	brd
pH, Saturated Paste	USDA No. 60 (21A)	4.5		*	units	0.1	0.1	11/22/11 5:58	bsu
Solids, Percent	CLPSOW390, PART F, D-98	90.9		*	%	0.1	0.5	11/16/11 16:00	ndj
Sulfur Forms	M600/2-78-054 3.2.4								
Sulfur Organic Residual		0.16		*	%	0.01	0.1	11/17/11 0:00	bsu
Sulfur Pyritic Sulfide			U	*	%	0.01	0.1	11/17/11 0:00	bsu
Sulfur Sulfate	J SQL-I	0.02	B	*	%	0.01	0.1	11/17/11 0:00	bsu
Sulfur Total		0.15		*	%	0.01	0.1	11/17/11 0:00	bsu
Total Sulfur minus Sulfate		0.13		*	%	0.01	0.1	11/17/11 0:00	bsu

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/11/11 11:55	zsh
Crush and Pulverize	USDA No. 1, 1972							11/15/11 16:30	cra
Digestion - Hot Plate	M3050B ICP							11/16/11 16:00	mss2
Saturated Paste Extraction	USDA No. 60 (2)							11/21/11 17:57	bsu
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/15/11 17:01	cra/thf
Sieve-250 um (60 mesh)	ASA No.9, 15-4.2.2							11/15/11 17:01	cra/thf

EB 03/30/12

** Please refer to Qualifier Reports for details.*

ACZ Laboratories, Inc.
2773 Downhill Drive Steamboat Springs, CO 80487 (800) 334-5493

Inorganic Analytical Results

Freeport-McMoRan - Chino Mines Company

Project ID:	ZN000000J8	ACZ Sample ID:	***L91358-15***
Sample ID:	STS-PH-2011-FID17	Date Sampled:	*10/11/11 17:35*
		Date Received:	*10/18/11*
		Sample Matrix:	*Soil*

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010B ICP	4220		*	mg/Kg	1	5	11/17/11 10:48	aeb

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Acid Generation Potential (calc on Sulfur total)	M600/2-78-054 1.3	14			t CaCO3/Kt	1	5	11/30/11 10:15	calc
Acid Neutralization Potential (calc)	M600/2-78-054 1.3	8			t CaCO3/Kt	1	5	11/30/11 10:15	calc
Acid-Base Potential (calc on Sulfur total)	M600/2-78-054 1.3	-6			t CaCO3/Kt	1	5	11/30/11 10:15	calc
Neutralization Potential as CaCO3	M600/2-78-054 3.2.3	0.8		*	%	0.1	0.5	11/18/11 0:12	brd
pH, Saturated Paste	USDA No. 60 (21A)	6.0		*	units	0.1	0.1	11/22/11 6:42	bsu
Solids, Percent	CLPSOW390, PART F, D-98	94.0		*	%	0.1	0.5	11/16/11 16:00	ndj
Sulfur Forms	M600/2-78-054 3.2.4								
Sulfur Organic Residual		0.21		*	%	0.01	0.1	11/17/11 0:00	bsu
Sulfur Pyritic Sulfide		0.18		*	%	0.01	0.1	11/17/11 0:00	bsu
Sulfur Sulfate J SQL·I		0.06	B	*	%	0.01	0.1	11/17/11 0:00	bsu
Sulfur Total		0.45		*	%	0.01	0.1	11/17/11 0:00	bsu
Total Sulfur minus Sulfate		0.39		*	%	0.01	0.1	11/17/11 0:00	bsu

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/11/11 11:57	zsh
Crush and Pulverize	USDA No. 1, 1972							11/15/11 16:47	cra
Digestion - Hot Plate	M3050B ICP							11/16/11 16:20	mss2
Saturated Paste Extraction	USDA No. 60 (2)							11/21/11 18:01	bsu
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/15/11 17:07	cra/thf
Sieve-250 um (60 mesh)	ASA No.9, 15-4.2.2							11/15/11 17:07	cra/thf

EB 03/30/12

** Please refer to Qualifier Reports for details.*

Freeport-McMoRan - Chino Mines Company
Project ID: ZN000000J8
Sample ID: STS-PH-2011-FID18

ACZ Sample ID: ***L91358-16***
Date Sampled: *10/12/11 15:55*
Date Received: *10/18/11*
Sample Matrix: *Soil*

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010B ICP	254		*	mg/Kg	1	5	11/17/11 10:51	aeb

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Acid Generation Potential (calc on Sulfur total)	M600/2-78-054 1.3	5			t CaCO3/Kt	1	5	11/30/11 10:15	calc
Acid Neutralization Potential (calc)	M600/2-78-054 1.3	0.0			t CaCO3/Kt	1	5	11/30/11 10:15	calc
Acid-Base Potential (calc on Sulfur total)	M600/2-78-054 1.3	-5			t CaCO3/Kt	1	5	11/30/11 10:15	calc
Neutralization Potential as CaCO3	M600/2-78-054 3.2.3		U	*	%	0.1	0.5	11/18/11 2:10	brd
pH, Saturated Paste	USDA No. 60 (21A)	4.3		*	units	0.1	0.1	11/22/11 7:25	bsu
Solids, Percent	CLPSOW390, PART F, D-98	96.5		*	%	0.1	0.5	11/16/11 16:00	ndj
Sulfur Forms	M600/2-78-054 3.2.4								
Sulfur Organic Residual		0.10		*	%	0.01	0.1	11/17/11 0:00	bsu
Sulfur Pyritic Sulfide	J SQL-I	0.06	B	*	%	0.01	0.1	11/17/11 0:00	bsu
Sulfur Sulfate		0.01	B	*	%	0.01	0.1	11/17/11 0:00	bsu
Sulfur Total		0.17		*	%	0.01	0.1	11/17/11 0:00	bsu
Total Sulfur minus Sulfate		0.16		*	%	0.01	0.1	11/17/11 0:00	bsu

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/11/11 11:59	zsh
Crush and Pulverize	USDA No. 1, 1972							11/15/11 17:05	cra
Digestion - Hot Plate	M3050B ICP							11/16/11 16:40	mss2
Saturated Paste Extraction	USDA No. 60 (2)							11/21/11 18:06	bsu
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/15/11 17:13	cra/thf
Sieve-250 um (60 mesh)	ASA No.9, 15-4.2.2							11/15/11 17:13	cra/thf

EB 03/30/12

** Please refer to Qualifier Reports for details.*

Freeport-McMoRan - Chino Mines Company
Project ID: ZN000000J8
Sample ID: STS-CG-2011-11

ACZ Sample ID: ***L91359-01***
Date Sampled: *10/04/11 13:55*
Date Received: *10/18/11*
Sample Matrix: *Soil*

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010B ICP	1370		*	mg/Kg	1	5	11/15/11 20:31	aeb

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Solids, Percent	CLPSOW390, PART F, D-98	92.0		*	%	0.1	0.5	11/16/11 16:00	ndj

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/11/11 14:00	mss2
Digestion - Hot Plate	M3050B ICP							11/14/11 15:08	mss2
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/14/11 11:50	thf

MTM 3/9/12

** Please refer to Qualifier Reports for details.*

ACZ Laboratories, Inc.
2773 Downhill Drive Steamboat Springs, CO 80487 (800) 334-5493

Inorganic Analytical Results

Freeport-McMoRan - Chino Mines Company
Project ID: ZN000000J8
Sample ID: STS-CG-2011-12

ACZ Sample ID: ***L91359-02***
Date Sampled: *10/07/11 15:15*
Date Received: *10/18/11*
Sample Matrix: *Soil*

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010B ICP	1670		*	mg/Kg	1	5	11/15/11 20:40	aeb

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Solids, Percent	CLPSOW390, PART F, D-98	93.0		*	%	0.1	0.5	11/16/11 16:00	ndj

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/11/11 14:03	mss2
Digestion - Hot Plate	M3050B ICP							11/14/11 16:17	mss2
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/14/11 11:52	thf

MTM 3/6/12

** Please refer to Qualifier Reports for details.*

Freeport-McMoRan - Chino Mines Company
Project ID: ZN000000J8
Sample ID: STS-CG-2011-13

ACZ Sample ID: ***L91359-03***
Date Sampled: *10/04/11 14:25*
Date Received: *10/18/11*
Sample Matrix: *Soil*

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010B ICP	906		*	mg/Kg	1	5	11/15/11 20:43	aeb

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Solids, Percent	CLPSOW390, PART F, D-98	93.1		*	%	0.1	0.5	11/16/11 16:00	ndj

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/11/11 14:06	mss2
Digestion - Hot Plate	M3050B ICP							11/14/11 16:39	mss2
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/14/11 11:55	thf

MTm 3/6/12

** Please refer to Qualifier Reports for details.*

Inorganic Analytical Results

Freeport-McMoRan - Chino Mines Company

Project ID:	ZN000000J8	ACZ Sample ID:	***L91359-04***
Sample ID:	STS-CG-2011-14	Date Sampled:	*10/04/11 15:05*
		Date Received:	*10/18/11*
		Sample Matrix:	*Soil*

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010B ICP	977		*	mg/Kg	1	5	11/15/11 20:46	aeb

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Solids, Percent	CLPSOW390, PART F, D-98	93.5		*	%	0.1	0.5	11/16/11 16:00	ndj

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/11/11 14:09	mss2
Digestion - Hot Plate	M3050B ICP							11/14/11 17:02	mss2
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/14/11 11:58	thf

MTM 3/6/12

** Please refer to Qualifier Reports for details.*

Inorganic Analytical Results

Freeport-McMoRan - Chino Mines Company
Project ID: ZN000000J8
Sample ID: STS-CG-2011-15

ACZ Sample ID: ***L91359-05***
Date Sampled: *10/07/11 16:05*
Date Received: *10/18/11*
Sample Matrix: *Soil*

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010B ICP	1790		*	mg/Kg	1	5	11/15/11 20:49	aeb

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Solids, Percent	CLPSOW390, PART F, D-98	89.7		*	%	0.1	0.5	11/16/11 16:00	ndj

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/11/11 14:12	mss2
Digestion - Hot Plate	M3050B ICP							11/14/11 17:25	mss2
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/14/11 12:01	thf

3/6/12

** Please refer to Qualifier Reports for details.*

Freeport-McMoRan - Chino Mines Company
Project ID: ZN000000J8
Sample ID: STS-CG-2011-17

ACZ Sample ID: ***L91359-06***
Date Sampled: *10/04/11 15:50*
Date Received: *10/18/11*
Sample Matrix: *Soil*

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010B ICP	637		*	mg/Kg	1	5	11/15/11 20:58	aeb

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Solids, Percent	CLPSOW390, PART F, D-98	91.3		*	%	0.1	0.5	11/16/11 16:00	ndj

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/11/11 14:15	mss2
Digestion - Hot Plate	M3050B ICP							11/14/11 17:48	mss2
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/14/11 12:04	thf

NTM 3/9/12

** Please refer to Qualifier Reports for details.*

Freeport-McMoRan - Chino Mines Company

Project ID:	ZN000000J8
Sample ID:	STS-CG-2011-19
ACZ Sample ID:	***L91359-07***
Date Sampled:	*10/05/11 15:05*
Date Received:	*10/18/11*
Sample Matrix:	*Soil*

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010B ICP	1050		*	mg/Kg	1	5	11/15/11 21:01	aeb

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Solids, Percent	CLPSOW390, PART F, D-98	91.4		*	%	0.1	0.5	11/16/11 16:00	ndj

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/11/11 14:18	mss2
Digestion - Hot Plate	M3050B ICP							11/14/11 18:11	mss2
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/14/11 12:07	thf

MTM 3/6/12

** Please refer to Qualifier Reports for details.*

Freeport-McMoRan - Chino Mines Company
Project ID: ZN000000J8
Sample ID: STS-CG-2011-20

ACZ Sample ID: ***L91359-08***
Date Sampled: *10/08/11 16:40*
Date Received: *10/18/11*
Sample Matrix: *Soil*

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010B ICP	555		*	mg/Kg	1	5	11/15/11 21:04	aeb

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Solids, Percent	CLPSOW390, PART F, D-98	89.4		*	%	0.1	0.5	11/16/11 16:00	ndj

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/11/11 14:21	mss2
Digestion - Hot Plate	M3050B ICP							11/14/11 18:34	mss2
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/14/11 12:10	thf

3/6/12

** Please refer to Qualifier Reports for details.*

Freeport-McMoRan - Chino Mines Company

Project ID:	ZN000000J8	ACZ Sample ID:	*L91359-09*
Sample ID:	STS-PCUG-2011-1	Date Sampled:	*10/13/11 10:45*
		Date Received:	*10/18/11*
		Sample Matrix:	*Soil*

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010B ICP	263		*	mg/Kg	1	5	11/15/11 21:10	aeb

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
pH, Saturated Paste	USDA No. 60 (21A) J HT-L	5.6		*	units	0.1	0.1	11/15/11 2:21	thf
Solids, Percent	CLPSOW390, PART F, D-98	96.4		*	%	0.1	0.5	11/16/11 16:00	ndj

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/11/11 14:24	mss2
Digestion - Hot Plate	M3050B ICP							11/14/11 18:57	mss2
Saturated Paste Extraction	USDA No. 60 (2)							11/15/11 1:52	thf
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/14/11 12:13	thf

MTM 3/4/12

Freeport-McMoRan - Chino Mines Company
Project ID: ZN000000J8
Sample ID: STS-PCUG-2011-2

ACZ Sample ID: ***L91359-10***
Date Sampled: *10/12/11 11:15*
Date Received: *10/18/11*
Sample Matrix: *Soil*

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010B ICP	876		*	mg/Kg	1	5	11/15/11 21:13	aeb

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
pH, Saturated Paste	USDA No. 60 (21A) J HT-L	6.5		*	units	0.1	0.1	11/15/11 3:02	thf
Solids, Percent	CLPSOW390, PART F, D-98	95.6		*	%	0.1	0.5	11/16/11 16:00	ndj

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/11/11 14:27	mss2
Digestion - Hot Plate	M3050B ICP							11/14/11 19:19	mss2
Saturated Paste Extraction	USDA No. 60 (2)							11/15/11 2:48	thf
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/14/11 12:15	thf

nTm 3/4/12

** Please refer to Qualifier Reports for details.*

Freeport-McMoRan - Chino Mines Company
Project ID: ZN000000J8
Sample ID: STS-PCUG-2011-3

ACZ Sample ID: ***L91359-11***
Date Sampled: *10/12/11 09:30*
Date Received: *10/18/11*
Sample Matrix: *Soil*

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010B ICP	587		*	mg/Kg	1	5	11/15/11 21:16	aeb

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
pH, Saturated Paste	USDA No. 60 (21A) JHT-L	4.8		*	units	0.1	0.1	11/15/11 3:43	thf
Solids, Percent	CLPSOW390, PART F, D-98	91.0		*	%	0.1	0.5	11/16/11 16:00	ndj

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/11/11 14:30	mss2
Digestion - Hot Plate	M3050B ICP							11/14/11 19:42	mss2
Saturated Paste Extraction	USDA No. 60 (2)							11/15/11 3:44	thf
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/14/11 12:18	thf

MTM 3/9/12

** Please refer to Qualifier Reports for details.*

Freeport-McMoRan - Chino Mines Company
Project ID: ZN000000J8
Sample ID: STS-PCUG-2011-4

ACZ Sample ID: ***L91359-12***
Date Sampled: *10/11/11 11:00*
Date Received: *10/18/11*
Sample Matrix: *Soil*

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010B ICP	794		*	mg/Kg	1	5	11/15/11 21:19	aeb

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
pH, Saturated Paste	USDA No. 60 (21A) J HT-L	4.6		*	units	0.1	0.1	11/15/11 4:24	thf
Solids, Percent	CLPSOW390, PART F, D-98	92.2		*	%	0.1	0.5	11/16/11 16:00	ndj

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/11/11 14:33	mss2
Digestion - Hot Plate	M3050B ICP							11/14/11 20:05	mss2
Saturated Paste Extraction	USDA No. 60 (2)							11/15/11 4:39	thf
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/14/11 12:21	thf

nTn 3/4/12

** Please refer to Qualifier Reports for details.*

Inorganic Analytical Results

Freeport-McMoRan - Chino Mines Company
Project ID: ZN000000J8
Sample ID: STS-PCUG-2011-33

ACZ Sample ID: ***L91359-13***
Date Sampled: *10/13/11 12:15*
Date Received: *10/18/11*
Sample Matrix: *Soil*

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010B ICP	273		*	mg/Kg	1	5	11/15/11 21:22	aeb

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
pH, Saturated Paste	USDA No. 60 (21A) J HT-L	6.7		*	units	0.1	0.1	11/15/11 5:05	thf
Solids, Percent	CLPSOW390, PART F, D-98	95.8		*	%	0.1	0.5	11/16/11 16:00	ndj

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/11/11 14:36	mss2
Digestion - Hot Plate	M3050B ICP							11/14/11 20:28	mss2
Saturated Paste Extraction	USDA No. 60 (2)							11/15/11 5:35	thf
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/14/11 12:24	thf

ntm 3/4/12

** Please refer to Qualifier Reports for details.*

Freeport-McMoRan - Chino Mines Company
Project ID: ZN000000J8
Sample ID: STS-PCUG-2011-7

ACZ Sample ID: ***L91359-14***
Date Sampled: *10/05/11 18:15*
Date Received: *10/18/11*
Sample Matrix: *Soil*

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010B ICP	387		*	mg/Kg	1	5	11/15/11 21:25	aeb

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
pH, Saturated Paste	USDA No. 60 (21A) J HT-L	7.7		*	units	0.1	0.1	11/15/11 5:46	thf
Solids, Percent	CLPSOW390, PART F, D-98	89.8		*	%	0.1	0.5	11/16/11 16:00	ndj

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/11/11 14:39	mss2
Digestion - Hot Plate	M3050B ICP							11/14/11 20:51	mss2
Saturated Paste Extraction	USDA No. 60 (2)							11/15/11 6:31	thf
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/14/11 12:27	thf

MTM 3/6/12

** Please refer to Qualifier Reports for details.*

Freeport-McMoRan - Chino Mines Company
Project ID: ZN000000J8
Sample ID: STS-PCUG-2011-38

ACZ Sample ID: ***L91359-15***
Date Sampled: *10/13/11 15:55*
Date Received: *10/18/11*
Sample Matrix: *Soil*

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010B ICP	350		*	mg/Kg	1	5	11/15/11 21:35	aeb

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
pH, Saturated Paste	USDA No. 60 (21A) J HT-L	3.9		*	units	0.1	0.1	11/15/11 6:27	thf
Solids, Percent	CLPSOW390, PART F, D-98	95.4		*	%	0.1	0.5	11/16/11 16:00	ndj

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/11/11 14:42	mss2
Digestion - Hot Plate	M3050B ICP							11/14/11 21:14	mss2
Saturated Paste Extraction	USDA No. 60 (2)							11/15/11 7:26	thf
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/14/11 12:30	thf

3/4/12

** Please refer to Qualifier Reports for details.*

Freeport-McMoRan - Chino Mines Company		ACZ Sample ID:	***L91359-16***
Project ID:	ZN000000J8	Date Sampled:	*10/13/11 15:00*
Sample ID:	STS-PCUG-2011-39	Date Received:	*10/18/11*
		Sample Matrix:	*Soil*

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010B ICP	360		*	mg/Kg	1	5	11/15/11 21:38	aeb

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
pH, Saturated Paste	USDA No. 60 (21A) J HT-L	4.7		*	units	0.1	0.1	11/15/11 7:08	thf
Solids, Percent	CLPSOW390, PART F, D-98	96.6		*	%	0.1	0.5	11/16/11 16:00	ndj

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/11/11 14:45	mss2
Digestion - Hot Plate	M3050B ICP							11/14/11 21:37	mss2
Saturated Paste Extraction	USDA No. 60 (2)							11/15/11 8:22	thf
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/14/11 12:33	thf

MTM 3/4/12

** Please refer to Qualifier Reports for details.*

Freeport-McMoRan - Chino Mines Company
Project ID: ZN000000J8
Sample ID: STS-PCUG-2011-10

ACZ Sample ID: ***L91359-17***
Date Sampled: *10/13/11 11:20*
Date Received: *10/18/11*
Sample Matrix: *Soil*

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010B ICP	324		*	mg/Kg	1	5	11/15/11 21:41	aeb

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
pH, Saturated Paste	USDA No. 60 (21A) J HT-L	7.4		*	units	0.1	0.1	11/15/11 8:30	thf
Solids, Percent	CLPSOW390, PART F, D-98	96.1		*	%	0.1	0.5	11/16/11 16:00	ndj

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/11/11 14:48	mss2
Digestion - Hot Plate	M3050B ICP							11/14/11 21:59	mss2
Saturated Paste Extraction	USDA No. 60 (2)							11/15/11 9:18	thf
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/14/11 12:36	thf

MTM 3/4/12

** Please refer to Qualifier Reports for details.*

Freeport-McMoRan - Chino Mines Company		ACZ Sample ID:	***L91360-01***
Project ID:	ZN000000J8	Date Sampled:	*10/05/11 14:05*
Sample ID:	STS-CG-2011-31	Date Received:	*10/18/11*
		Sample Matrix:	*Soil*

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010B ICP	1770		*	mg/Kg	1	5	11/15/11 12:34	aeb

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Solids, Percent	CLPSOW390, PART F, D-98	90.6		*	%	0.1	0.5	11/21/11 17:00	bsu

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/11/11 16:00	nrc
Digestion - Hot Plate	M3050B ICP							11/14/11 15:20	mss2
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/14/11 12:39	thf

MTM 3/8/12

Inorganic Analytical Results

Freeport-McMoRan - Chino Mines Company

Project ID:	ZN000000J8	ACZ Sample ID:	***L91360-02***
Sample ID:	DUP5	Date Sampled:	*10/05/11 00:00*
		Date Received:	*10/18/11*
		Sample Matrix:	*Soil*

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010B ICP	528		*	mg/Kg	1	5	11/15/11 12:43	aeb

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Solids, Percent	CLPSOW390, PART F, D-98	89.4		*	%	0.1	0.5	11/21/11 19:02	bsu

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/11/11 16:06	nrc
Digestion - Hot Plate	M3050B ICP							11/14/11 16:40	mss2
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/14/11 12:41	thf

NTm 3/8/12

** Please refer to Qualifier Reports for details.*

Freeport-McMoRan - Chino Mines Company
Project ID: ZN000000J8
Sample ID: STS-CG-2011-33

ACZ Sample ID: ***L91360-03***
Date Sampled: *10/08/11 13:50*
Date Received: *10/18/11*
Sample Matrix: *Soil*

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010B ICP	666		*	mg/Kg	1	5	11/15/11 12:46	aeb

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Solids, Percent	CLPSOW390, PART F, D-98	91.2		*	%	0.1	0.5	11/21/11 20:02	bsu

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/11/11 16:13	nrc
Digestion - Hot Plate	M3050B ICP							11/14/11 18:00	mss2
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/14/11 12:44	thf

mm 3/8/12

** Please refer to Qualifier Reports for details.*

ACZ Laboratories, Inc.
2773 Downhill Drive Steamboat Springs, CO 80487 (800) 334-5493

Inorganic Analytical Results

Freeport-McMoRan - Chino Mines Company

Project ID:	ZN000000J8	ACZ Sample ID:	***L91360-04***
Sample ID:	STS-CG-2011-34	Date Sampled:	*10/10/11 15:30*
		Date Received:	*10/18/11*
		Sample Matrix:	*Soil*

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010B ICP	1190		*	mg/Kg	1	5	11/15/11 12:49	aeb

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Solids, Percent	CLPSOW390, PART F, D-98	96.4		*	%	0.1	0.5	11/21/11 21:03	bsu

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/11/11 16:20	nrc
Digestion - Hot Plate	M3050B ICP							11/14/11 18:26	mss2
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/14/11 12:47	thf

3/8/12

** Please refer to Qualifier Reports for details.*

Inorganic Analytical Results

Freeport-McMoRan - Chino Mines Company
Project ID: ZN000000J8
Sample ID: STS-CG-2011-35

ACZ Sample ID: ***L91360-05***
Date Sampled: *10/08/11 11:40*
Date Received: *10/18/11*
Sample Matrix: *Soil*

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010B ICP	362		*	mg/Kg	1	5	11/15/11 12:53	aeb

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Solids, Percent	CLPSOW390, PART F, D-98	91.2		*	%	0.1	0.5	11/21/11 22:04	bsu

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/11/11 16:26	nrc
Digestion - Hot Plate	M3050B ICP							11/14/11 18:53	mss2
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/14/11 12:50	thf

3/8/12

** Please refer to Qualifier Reports for details.*

Freeport-McMoRan - Chino Mines Company

Project ID: ZN000000J8
Sample ID: STS-CG-2011-36

ACZ Sample ID: ***L91360-06***
Date Sampled: *10/10/11 16:10*
Date Received: *10/18/11*
Sample Matrix: *Soil*

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010B ICP	507		*	mg/Kg	1	5	11/15/11 13:05	aeb

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Solids, Percent	CLPSOW390, PART F, D-98	94.3		*	%	0.1	0.5	11/21/11 23:04	bsu

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/11/11 16:33	nrc
Digestion - Hot Plate	M3050B ICP							11/14/11 19:20	mss2
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/14/11 12:53	thf

NJM 3/8/12

** Please refer to Qualifier Reports for details.*

Freeport-McMoRan - Chino Mines Company
Project ID: ZN000000J8
Sample ID: DUP6

ACZ Sample ID: ***L91360-07***
Date Sampled: *10/05/11 00:00*
Date Received: *10/18/11*
Sample Matrix: *Soil*

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010B ICP	613		*	mg/Kg	1	5	11/15/11 13:08	aeb

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Solids, Percent	CLPSOW390, PART F, D-98	90.7		*	%	0.1	0.5	11/22/11 0:05	bsu

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/11/11 16:40	nrc
Digestion - Hot Plate	M3050B ICP							11/14/11 19:46	mss2
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/14/11 12:56	thf

3/8/12

Freeport-McMoRan - Chino Mines Company

Project ID: ZN000000J8
Sample ID: STS-CG-2011-38

ACZ Sample ID: ***L91360-08***
Date Sampled: *10/08/11 12:50*
Date Received: *10/18/11*
Sample Matrix: *Soil*

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010B ICP	633		*	mg/Kg	1	5	11/15/11 13:11	aeb

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Solids, Percent	CLPSOW390, PART F, D-98	91.4		*	%	0.1	0.5	11/22/11 1:06	bsu

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/11/11 16:46	nrc
Digestion - Hot Plate	M3050B ICP							11/14/11 20:13	mss2
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/14/11 12:59	thf

ATM 3/6/12

** Please refer to Qualifier Reports for details.*

Freeport-McMoRan - Chino Mines Company
Project ID: ZN000000J8
Sample ID: STS-CG-2011-39

ACZ Sample ID: ***L91360-09***
Date Sampled: *10/09/11 08:35*
Date Received: *10/18/11*
Sample Matrix: *Soil*

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010B ICP	682		*	mg/Kg	1	5	11/15/11 13:14	aeb

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Solids, Percent	CLPSOW390, PART F, D-98	89.7		*	%	0.1	0.5	11/22/11 2:06	bsu

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/11/11 16:53	nrc
Digestion - Hot Plate	M3050B ICP							11/14/11 20:40	mss2
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/14/11 13:02	thf

MTm 3/8/'2

** Please refer to Qualifier Reports for details.*

ACZ Laboratories, Inc.
2773 Downhill Drive Steamboat Springs, CO 80487 (800) 334-5493

Inorganic Analytical Results

Freeport-McMoRan - Chino Mines Company
Project ID: ZN000000J8
Sample ID: STS-CG-2011-40

ACZ Sample ID: ***L91360-10***
Date Sampled: *10/06/11 17:00*
Date Received: *10/18/11*
Sample Matrix: *Soil*

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010B ICP	608		*	mg/Kg	1	5	11/15/11 13:17	aeb

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Solids, Percent	CLPSOW390, PART F, D-98	94.0		*	%	0.1	0.5	11/22/11 3:07	bsu

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/11/11 17:00	nrc
Digestion - Hot Plate	M3050B ICP							11/14/11 21:06	mss2
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/14/11 13:04	thf

3/8/12

** Please refer to Qualifier Reports for details.*

Freeport-McMoRan - Chino Mines Company

Project ID:	ZN000000J8	ACZ Sample ID:	***L91393-01***
Sample ID:	RINSATE3	Date Sampled:	*10/06/11 17:05*
		Date Received:	*10/19/11*
		Sample Matrix:	*Surface Water*

Inorganic Prep

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Total Hot Plate Digestion	M200.2 ICP-MS							10/25/11 11:01	mfm

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total	M200.8 ICP-MS		U		mg/L	0.0005	0.003	10/26/11 21:48	pmc

MTM 2/22/12

Inorganic Analytical Results

Freeport-McMoRan - Chino Mines Company

Project ID:	ZN000000J8	ACZ Sample ID:	***L91393-02***
Sample ID:	RINSATE4	Date Sampled:	*10/06/11 16:45*
		Date Received:	*10/19/11*
		Sample Matrix:	*Surface Water*

Inorganic Prep

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Total Hot Plate Digestion	M200.2 ICP-MS							10/25/11 11:03	mfm

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total	M200.8 ICP-MS		U		mg/L	0.0005	0.003	10/26/11 21:51	pmc

mtm 2/22/12

ACZ Laboratories, Inc.

2773 Downhill Drive Steamboat Springs, CO 80487 (800) 334-5493

Inorganic Analytical Results

Freeport-McMoRan - Chino Mines Company

Project ID: ZN000000J8

Sample ID: RINSATE1

ACZ Sample ID: ***L91393-03***

Date Sampled: *10/10/11 15:10*

Date Received: *10/19/11*

Sample Matrix: *Surface Water*

Inorganic Prep

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Total Hot Plate Digestion	M200.2 ICP-MS							10/25/11 11:04	mfm

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total	M200.8 ICP-MS		U		mg/L	0.0005	0.003	10/26/11 21:54	pmc

mm 2/22/12

ACZ Laboratories, Inc.
2773 Downhill Drive Steamboat Springs, CO 80487 (800) 334-5493

Inorganic Analytical Results

Freeport-McMoRan - Chino Mines Company

Project ID:	ZN000000J8
Sample ID:	RINSATE5
ACZ Sample ID:	***L91393-04***
Date Sampled:	*10/10/11 15:35*
Date Received:	*10/19/11*
Sample Matrix:	*Surface Water*

Inorganic Prep

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Total Hot Plate Digestion	M200.2 ICP-MS							10/25/11 11:05	mfm

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total	M200.8 ICP-MS		U		mg/L	0.0005	0.003	10/26/11 21:57	pmc

2/22/12

Freeport-McMoRan - Chino Mines Company

Project ID:	ZN000000J8
Sample ID:	RINSATE7

ACZ Sample ID:	***L91393-05***
Date Sampled:	*10/07/11 09:40*
Date Received:	*10/19/11*
Sample Matrix:	*Surface Water*

Inorganic Prep

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Total Hot Plate Digestion	M200.2 ICP-MS							10/25/11 11:09	mfm

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total	M200.8 ICP-MS		U		mg/L	0.0005	0.003	10/26/11 22:12	pmc

mm 2/22/12

Freeport-McMoRan - Chino Mines Company

Project ID:	ZN000000J8	ACZ Sample ID:	***L91393-06***
Sample ID:	RINSATE8	Date Sampled:	*10/07/11 10:20*
		Date Received:	*10/19/11*
		Sample Matrix:	*Surface Water*

Inorganic Prep

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Total Hot Plate Digestion	M200.2 ICP-MS							10/25/11 11:10	mfm

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total	M200.8 ICP-MS		U		mg/L	0.0005	0.003	10/26/11 22:15	pmc

MTM 2/22/12

Freeport-McMoRan - Chino Mines Company

Project ID:	ZN000000J8	ACZ Sample ID:	***L91393-07***
Sample ID:	RINSATE2	Date Sampled:	*10/11/11 11:20*
		Date Received:	*10/19/11*
		Sample Matrix:	*Surface Water*

Inorganic Prep

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Total Hot Plate Digestion	M200.2 ICP-MS							10/25/11 11:11	mfm

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total	M200.8 ICP-MS		U		mg/L	0.0005	0.003	10/26/11 22:18	pmc

MM 2/22/12

ACZ Laboratories, Inc.

2773 Downhill Drive Steamboat Springs, CO 80487 (800) 334-5493

Inorganic Analytical Results

Freeport-McMoRan - Chino Mines Company

Project ID: ZN000000J8

Sample ID: RINSATE6

ACZ Sample ID: ***L91393-08***

Date Sampled: *10/12/11 17:15*

Date Received: *10/19/11*

Sample Matrix: *Surface Water*

Inorganic Prep

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Total Hot Plate Digestion	M200.2 ICP-MS							10/25/11 11:12	mfm

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total	M200.8 ICP-MS JSBL-I	0.0007	B		mg/L	0.0005	0.003	10/26/11 22:21	pmc

2/22/12

ACZ Laboratories, Inc.
2773 Downhill Drive Steamboat Springs, CO 80487 (800) 334-5493

Inorganic Analytical Results

Freeport-McMoRan - Chino Mines Company

Project ID:	ZN000000J8	ACZ Sample ID:	***L91526-01***
Sample ID:	STS-PCUG-2011-27	Date Sampled:	*10/20/11 16:05*
		Date Received:	*10/26/11*
		Sample Matrix:	*Soil*

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010B ICP	438			mg/Kg	1	5	11/28/11 21:40	jjc

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
pH, Corrosivity	M9045D/M9040C								
pH		6.9	J HT-L		units	0.1	0.1	11/29/11 0:00	mss2
pH measured at		22.7			C	0.1	0.1	11/29/11 0:00	mss2
Solids, Percent	CLPSOW390, PART F, D-98	96.3		*	%	0.1	0.5	11/29/11 13:02	nrc

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/15/11 16:00	ndj
Crush and Pulverize	USDA No. 1, 1972							11/21/11 14:45	mfm/thf
Digestion - Hot Plate	M3050B ICP							11/23/11 10:52	nrc
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/21/11 14:45	mfm/thf

MTM 2/22/12

** Please refer to Qualifier Reports for details.*

Freeport-McMoRan - Chino Mines Company

Project ID:	ZN000000J8
Sample ID:	STS-PCUG-2011-31
ACZ Sample ID:	***L91526-02***
Date Sampled:	*10/19/11 10:50*
Date Received:	*10/26/11*
Sample Matrix:	*Soil*

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010B ICP	304			mg/Kg	1	5	11/28/11 21:49	jjc

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
pH, Corrosivity	M9045D/M9040C								
pH		4.3	J HT-L		units	0.1	0.1	11/29/11 0:00	mss2
pH measured at		22.5			C	0.1	0.1	11/29/11 0:00	mss2
Solids, Percent	CLPSOW390, PART F, D-98	96.7		*	%	0.1	0.5	11/29/11 14:05	nrc

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/15/11 16:01	ndj
Crush and Pulverize	USDA No. 1, 1972							11/21/11 16:01	mfm/thf
Digestion - Hot Plate	M3050B ICP							11/23/11 11:45	nrc
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/21/11 16:01	mfm/thf

2/22/12

** Please refer to Qualifier Reports for details.*

Freeport-McMoRan - Chino Mines Company
Project ID: ZN000000J8
Sample ID: DUP4

ACZ Sample ID: ***L91526-03***
Date Sampled: *10/19/11 00:00*
Date Received: *10/26/11*
Sample Matrix: *Soil*

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010B ICP	261			mg/Kg	1	5	11/28/11 21:52	jjc

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
pH, Corrosivity	M9045D/M9040C								
pH		4.2	J HT-L		units	0.1	0.1	11/29/11 0:00	mss2
pH measured at		22.3			C	0.1	0.1	11/29/11 0:00	mss2
Solids, Percent	CLPSOW390, PART F, D-98	96.7		*	%	0.1	0.5	11/29/11 15:08	nrc

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/15/11 16:03	ndj
Crush and Pulverize	USDA No. 1, 1972							11/21/11 17:18	mfm/thf
Digestion - Hot Plate	M3050B ICP							11/23/11 12:02	nrc
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/21/11 17:18	mfm/thf

mTm 2/22/12

** Please refer to Qualifier Reports for details.*

Freeport-McMoRan - Chino Mines Company
Project ID: ZN000000J8
Sample ID: STS-PCUG-2011-5

ACZ Sample ID: ***L91526-04***
Date Sampled: *10/20/11 13:25*
Date Received: *10/26/11*
Sample Matrix: *Soil*

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010B ICP	458			mg/Kg	1	5	11/28/11 21:55	jjc

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
pH, Corrosivity	M9045D/M9040C								
pH		5.8	J HT-L		units	0.1	0.1	11/29/11 0:00	mss2
pH measured at		22.4			C	0.1	0.1	11/29/11 0:00	mss2
Solids, Percent	CLPSOW390, PART F, D-98	94.8		*	%	0.1	0.5	11/29/11 16:11	nrc

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/15/11 16:04	ndj
Crush and Pulverize	USDA No. 1, 1972							11/21/11 18:34	mfm/thf
Digestion - Hot Plate	M3050B ICP							11/23/11 12:20	nrc
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/21/11 18:34	mfm/thf

MTM 2/22/12

** Please refer to Qualifier Reports for details.*

Freeport-McMoRan - Chino Mines Company
Project ID: ZN000000J8
Sample ID: STS-PCUG-2011-6

ACZ Sample ID: ***L91526-05***
Date Sampled: *10/18/11 10:55*
Date Received: *10/26/11*
Sample Matrix: *Soil*

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010B ICP	290			mg/Kg	1	5	11/28/11 22:07	jjc

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
pH, Corrosivity	M9045D/M9040C								
pH		5.0	J HT-L		units	0.1	0.1	11/29/11 0:00	mss2
pH measured at		22.3			C	0.1	0.1	11/29/11 0:00	mss2
Solids, Percent	CLPSOW390, PART F, D-98	95.4		*	%	0.1	0.5	11/29/11 17:14	nrc

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/15/11 16:06	ndj
Crush and Pulverize	USDA No. 1, 1972							11/21/11 19:51	mfm/thf
Digestion - Hot Plate	M3050B ICP							11/23/11 12:37	nrc
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/21/11 19:51	mfm/thf

mjm 2/22/12

Freeport-McMoRan - Chino Mines Company
Project ID: ZN000000J8
Sample ID: STS-PCUG-2011-8

ACZ Sample ID: ***L91526-06***
Date Sampled: *10/20/11 12:15*
Date Received: *10/26/11*
Sample Matrix: *Soil*

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010B ICP	449			mg/Kg	1	5	11/28/11 22:10	jjc

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
pH, Corrosivity	M9045D/M9040C								
pH		5.8	J HT-L		units	0.1	0.1	11/29/11 0:00	mss2
pH measured at		22.4			C	0.1	0.1	11/29/11 0:00	mss2
Solids, Percent	CLPSOW390, PART F, D-98	96.4		*	%	0.1	0.5	11/29/11 18:17	nrc

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/15/11 16:07	ndj
Crush and Pulverize	USDA No. 1, 1972							11/21/11 21:07	mfm/thf
Digestion - Hot Plate	M3050B ICP							11/23/11 12:55	nrc
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/21/11 21:07	mfm/thf

2/22/12

** Please refer to Qualifier Reports for details.*

ACZ Laboratories, Inc.
2773 Downhill Drive Steamboat Springs, CO 80487 (800) 334-5493

Inorganic Analytical Results

Freeport-McMoRan - Chino Mines Company

Project ID:	ZN000000J8
Sample ID:	STS-PCUG-2011-9
ACZ Sample ID:	*L91526-07*
Date Sampled:	*10/18/11 14:05*
Date Received:	*10/26/11*
Sample Matrix:	*Soil*

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010B ICP	246			mg/Kg	1	5	11/28/11 22:13	jjc

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
pH, Corrosivity	M9045D/M9040C								
pH		4.8	J HT-L		units	0.1	0.1	11/29/11 0:00	mss2
pH measured at		22.3			C	0.1	0.1	11/29/11 0:00	mss2
Solids, Percent	CLPSOW390, PART F, D-98	97.9		*	%	0.1	0.5	11/29/11 19:19	nrc

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/15/11 16:09	ndj
Crush and Pulverize	USDA No. 1, 1972							11/21/11 22:24	mfm/thf
Digestion - Hot Plate	M3050B ICP							11/23/11 13:12	nrc
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/21/11 22:24	mfm/thf

MTM 2/22/12

** Please refer to Qualifier Reports for details.*

Freeport-McMoRan - Chino Mines Company
Project ID: ZN000000J8
Sample ID: STS-PCUG-2011-15

ACZ Sample ID: ***L91526-08***
Date Sampled: *10/18/11 10:15*
Date Received: *10/26/11*
Sample Matrix: *Soil*

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010B ICP	357			mg/Kg	1	5	11/28/11 22:16	jjc

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
pH, Corrosivity	M9045D/M9040C								
pH		4.3	J HT-L		units	0.1	0.1	11/29/11 0:00	mss2
pH measured at		22.4			C	0.1	0.1	11/29/11 0:00	mss2
Solids, Percent	CLPSOW390, PART F, D-98	95.5		*	%	0.1	0.5	11/29/11 20:22	nrc

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/15/11 16:11	ndj
Crush and Pulverize	USDA No. 1, 1972							11/21/11 23:41	mfm/thf
Digestion - Hot Plate	M3050B ICP							11/23/11 13:30	nrc
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/21/11 23:41	mfm/thf

mfm 2/22/12

** Please refer to Qualifier Reports for details.*

Freeport-McMoRan - Chino Mines Company

Project ID:	ZN000000J8	ACZ Sample ID:	*L91526-09*
Sample ID:	STS-PH-2011-FID106	Date Sampled:	*10/18/11 12:05*
		Date Received:	*10/26/11*
		Sample Matrix:	*Soil*

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010B ICP	254			mg/Kg	1	5	11/28/11 22:19	jjc

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Acid Generation Potential (calc on Sulfur total)	M600/2-78-054 1.3 J SQL-I	1	B		t CaCO3/Kt	1	5	12/05/11 13:30	calc
Acid Neutralization Potential (calc)	M600/2-78-054 1.3	0.0			t CaCO3/Kt	1	5	12/05/11 13:30	calc
Acid-Base Potential (calc on Sulfur total)	M600/2-78-054 1.3	-1			t CaCO3/Kt	1	5	12/05/11 13:30	calc
Neutralization Potential as CaCO3	M600/2-78-054 3.2.3 - Modified (No Heat)		U	*	%	0.1	0.5	11/29/11 7:48	bsu
pH, Corrosivity	M9045D/M9040C								
pH		5.0 J HT-L			units	0.1	0.1	11/29/11 0:00	mss2
pH measured at		22.2			C	0.1	0.1	11/29/11 0:00	mss2
Solids, Percent	CLPSOW390, PART F, D-98	96.4		*	%	0.1	0.5	11/29/11 21:25	nrc
Sulfur Forms	M600/2-78-054 3.2.4-MOD								
Sulfur HCl Residue	~~J HT, P, SQL-I~~ J SQL·I	0.03	B	*	%	0.01	0.1	11/28/11 0:00	bsu
Sulfur HNO3 Residue		0.03	B	*	%	0.01	0.1	11/28/11 0:00	bsu
Sulfur Organic Residual Mod		0.03	B	*	%	0.01	0.1	11/28/11 0:00	bsu
Sulfur Pyritic Sulfide	~~UJ HT, P-I~~		U	*	%	0.01	0.1	11/28/11 0:00	bsu
Sulfur Sulfate	~~J HT, P, SQL-I~~ J SQL·I	0.01	B	*	%	0.01	0.1	11/28/11 0:00	bsu
Sulfur Total		0.04	B	*	%	0.01	0.1	11/28/11 0:00	bsu
Total Sulfur minus Sulfate		0.03	B	*	%	0.01	0.1	11/28/11 0:00	bsu

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/15/11 16:12	ndj
Crush and Pulverize	USDA No. 1, 1972							11/22/11 0:57	mfm/thf
Digestion - Hot Plate	M3050B ICP							11/23/11 13:47	nrc
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/22/11 0:57	mfm/thf
Sieve-250 um (60 mesh)	ASA No.9, 15-4.2.2							11/22/11 0:57	mfm/thf

MTM 2/22/12

** Please refer to Qualifier Reports for details.*

Freeport-McMoRan - Chino Mines Company

Project ID: ZN000000J8
Sample ID: STS-PCUG-2011-32

ACZ Sample ID: ***L91526-10***
Date Sampled: *10/19/11 11:25*
Date Received: *10/26/11*
Sample Matrix: *Soil*

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010B ICP	420			mg/Kg	1	5	11/28/11 22:22	jjc

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
pH, Corrosivity	M9045D/M9040C								
pH		3.8	J HT-L		units	0.1	0.1	11/29/11 0:00	mss2
pH measured at		22.3			C	0.1	0.1	11/29/11 0:00	mss2
Solids, Percent	CLPSOW390, PART F, D-98	96.6		*	%	0.1	0.5	11/29/11 22:28	nrc

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/15/11 16:14	ndj
Crush and Pulverize	USDA No. 1, 1972							11/22/11 2:14	mfm/thf
Digestion - Hot Plate	M3050B ICP							11/23/11 14:05	nrc
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/22/11 2:14	mfm/thf

MTm 2/22/12

** Please refer to Qualifier Reports for details.*

Freeport-McMoRan - Chino Mines Company

Project ID:	ZN000000J8	ACZ Sample ID:	*L91526-11*
Sample ID:	STS-PCUG-2011-34	Date Sampled:	*10/19/11 12:00*
		Date Received:	*10/26/11*
		Sample Matrix:	*Soil*

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010B ICP	364			mg/Kg	1	5	11/28/11 22:25	jjc

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
pH, Corrosivity	M9045D/M9040C								
pH		4.0	J HT-L		units	0.1	0.1	11/29/11 0:00	mss2
pH measured at		22.0			C	0.1	0.1	11/29/11 0:00	mss2
Solids, Percent	CLPSOW390, PART F, D-98	95.4		*	%	0.1	0.5	11/29/11 23:31	nrc

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/15/11 16:15	ndj
Crush and Pulverize	USDA No. 1, 1972							11/22/11 3:30	mfm/thf
Digestion - Hot Plate	M3050B ICP							11/23/11 14:22	nrc
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/22/11 3:30	mfm/thf

2/22/12

** Please refer to Qualifier Reports for details.*

Freeport-McMoRan - Chino Mines Company

Project ID: ZN000000J8
Sample ID: STS-PCUG-2011-35

ACZ Sample ID: ***L91526-12***
Date Sampled: *10/18/11 13:30*
Date Received: *10/26/11*
Sample Matrix: *Soil*

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010B ICP	287			mg/Kg	1	5	11/28/11 22:28	jjc

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
pH, Corrosivity	M9045D/M9040C								
pH		5.5	J HT·L		units	0.1	0.1	11/29/11 0:00	mss2
pH measured at		22.0			C	0.1	0.1	11/29/11 0:00	mss2
Solids, Percent	CLPSOW390, PART F, D-98	97.4		*	%	0.1	0.5	11/30/11 0:34	nrc

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/15/11 16:17	ndj
Crush and Pulverize	USDA No. 1, 1972							11/22/11 4:47	mfm/thf
Digestion - Hot Plate	M3050B ICP							11/23/11 14:40	nrc
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/22/11 4:47	mfm/thf

MTM 2/22/12

Freeport-McMoRan - Chino Mines Company

Project ID:	ZN000000J8	ACZ Sample ID:	***L91526-13***
Sample ID:	STS-PCUG-2011-36	Date Sampled:	*10/18/11 12:40*
		Date Received:	*10/26/11*
		Sample Matrix:	*Soil*

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010B ICP	270			mg/Kg	1	5	11/28/11 22:31	jjc

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
pH, Corrosivity	M9045D/M9040C								
pH		5.6	J HT-L		units	0.1	0.1	11/29/11 0:00	mss2
pH measured at		21.9			C	0.1	0.1	11/29/11 0:00	mss2
Solids, Percent	CLPSOW390, PART F, D-98	96.5		*	%	0.1	0.5	11/30/11 1:37	nrc

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/15/11 16:19	ndj
Crush and Pulverize	USDA No. 1, 1972							11/22/11 6:04	mfm/thf
Digestion - Hot Plate	M3050B ICP							11/23/11 14:57	nrc
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/22/11 6:04	mfm/thf

MTM 2/22/12

** Please refer to Qualifier Reports for details.*

ACZ Laboratories, Inc.
2773 Downhill Drive Steamboat Springs, CO 80487 (800) 334-5493

Inorganic Analytical Results

Freeport-McMoRan - Chino Mines Company
Project ID: ZN000000J8
Sample ID: STS-PCUG-2011-37

ACZ Sample ID: ***L91526-14***
Date Sampled: *10/19/11 10:05*
Date Received: *10/26/11*
Sample Matrix: *Soil*

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010B ICP	244			mg/Kg	1	5	11/28/11 22:34	jjc

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
pH, Corrosivity	M9045D/M9040C								
pH		6.9	J HT-L		units	0.1	0.1	11/29/11 0:00	mss2
pH measured at		21.9			C	0.1	0.1	11/29/11 0:00	mss2
Solids, Percent	CLPSOW390, PART F, D-98	95.8		*	%	0.1	0.5	11/30/11 2:39	nrc

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/15/11 16:20	ndj
Crush and Pulverize	USDA No. 1, 1972							11/22/11 7:20	mfm/thf
Digestion - Hot Plate	M3050B ICP							11/23/11 15:15	nrc
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/22/11 7:20	mfm/thf

mTm 2/22/12

** Please refer to Qualifier Reports for details.*

Inorganic Analytical Results

Freeport-McMoRan - Chino Mines Company

Project ID:	ZN000000J8
Sample ID:	DUP10
ACZ Sample ID:	***L91526-15***
Date Sampled:	*10/19/11 00:00*
Date Received:	*10/26/11*
Sample Matrix:	*Soil*

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010B ICP	248			mg/Kg	1	5	11/28/11 22:43	jjc

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Solids, Percent	CLPSOW390, PART F, D-98	95.9		*	%	0.1	0.5	11/30/11 3:42	nrc

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/15/11 16:22	ndj
Crush and Pulverize	USDA No. 1, 1972							11/22/11 8:37	mfm/thf
Digestion - Hot Plate	M3050B ICP							11/23/11 15:32	nrc
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/22/11 8:37	mfm/thf

2/23/12

** Please refer to Qualifier Reports for details.*

ACZ Laboratories, Inc.

2773 Downhill Drive Steamboat Springs, CO 80487 (800) 334-5493

Inorganic Analytical Results

Freeport-McMoRan - Chino Mines Company

Project ID:	ZN000000J8	ACZ Sample ID:	***L91526-16***
Sample ID:	STS-CG-2011-44	Date Sampled:	*10/20/11 11:25*
		Date Received:	*10/26/11*
		Sample Matrix:	*Soil*

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010B ICP	761			mg/Kg	1	5	11/28/11 22:46	jjc

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Solids, Percent	CLPSOW390, PART F, D-98	94.6		*	%	0.1	0.5	11/30/11 4:45	nrc

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/15/11 16:23	ndj
Crush and Pulverize	USDA No. 1, 1972							11/22/11 9:53	mfm/thf
Digestion - Hot Plate	M3050B ICP							11/23/11 15:50	nrc
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/22/11 9:53	mfm/thf

MTM 2/22/12

** Please refer to Qualifier Reports for details.*

Inorganic Analytical Results

Freeport-McMoRan - Chino Mines Company
Project ID: ZN000000J8
Sample ID: STS-CG-2011-47

ACZ Sample ID: ***L91526-17***
Date Sampled: *10/20/11 14:30*
Date Received: *10/26/11*
Sample Matrix: *Soil*

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010B ICP	472			mg/Kg	1	5	11/28/11 22:49	jjc

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Solids, Percent	CLPSOW390, PART F, D-98	94.3		*	%	0.1	0.5	11/30/11 5:48	nrc

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/15/11 16:25	ndj
Crush and Pulverize	USDA No. 1, 1972							11/22/11 11:10	mfm/thf
Digestion - Hot Plate	M3050B ICP							11/23/11 16:07	nrc
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/22/11 11:10	mfm/thf

mjm 4/22/12

** Please refer to Qualifier Reports for details.*

Freeport-McMoRan - Chino Mines Company
Project ID: ZN000000J8
Sample ID: STS-CG-2011-48

ACZ Sample ID: ***L91526-18***
Date Sampled: *10/20/11 09:30*
Date Received: *10/26/11*
Sample Matrix: *Soil*

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010B ICP	1260			mg/Kg	1	5	11/28/11 22:52	jjc

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Solids, Percent	CLPSOW390, PART F, D-98	95.8		*	%	0.1	0.5	11/30/11 6:51	nrc

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/15/11 16:26	ndj
Crush and Pulverize	USDA No. 1, 1972							11/22/11 12:26	mfm/thf
Digestion - Hot Plate	M3050B ICP							11/23/11 16:25	nrc
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/22/11 12:26	mfm/thf

nTm 2/22/12

** Please refer to Qualifier Reports for details.*

Freeport-McMoRan - Chino Mines Company		ACZ Sample ID:	***L91526-19***
Project ID:	ZN000000J8	Date Sampled:	*10/19/11 17:40*
Sample ID:	STS-CG-2011-16	Date Received:	*10/26/11*
		Sample Matrix:	*Soil*

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010B ICP	949			mg/Kg	1	5	11/28/11 22:55	jjc

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Solids, Percent	CLPSOW390, PART F, D-98	92.6		*	%	0.1	0.5	11/30/11 7:54	nrc

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/15/11 16:28	ndj
Crush and Pulverize	USDA No. 1, 1972							11/22/11 13:43	mfm/thf
Digestion - Hot Plate	M3050B ICP							11/23/11 16:42	nrc
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/22/11 13:43	mfm/thf

NTM 2/22/12

** Please refer to Qualifier Reports for details.*

ACZ Laboratories, Inc.
2773 Downhill Drive Steamboat Springs, CO 80487 (800) 334-5493

Inorganic Analytical Results

Freeport-McMoRan - Chino Mines Company
Project ID: ZN000000J8
Sample ID: STS-CG-2011-7

ACZ Sample ID: ***L91526-20***
Date Sampled: *10/19/11 15:30*
Date Received: *10/26/11*
Sample Matrix: *Soil*

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010B ICP	627			mg/Kg	1	5	11/28/11 22:58	jjc

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Solids, Percent	CLPSOW390, PART F, D-98	95.2		*	%	0.1	0.5	11/30/11 8:57	nrc

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/15/11 16:30	ndj
Crush and Pulverize	USDA No. 1, 1972							11/22/11 15:00	mfm/thf
Digestion - Hot Plate	M3050B ICP							11/23/11 17:00	nrc
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/22/11 15:00	mfm/thf

2/22/12

Freeport-McMoRan - Chino Mines Company

Project ID:	ZN000000J8
Sample ID:	STS-CG-2011-51

ACZ Sample ID:	***L91527-01***
Date Sampled:	*10/20/11 14:50*
Date Received:	*10/26/11*
Sample Matrix:	*Soil*

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010B ICP	463		*	mg/Kg	1	5	11/28/11 23:44	jjc

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Solids, Percent	CLPSOW390, PART F, D-98	94.5		*	%	0.1	0.5	11/29/11 16:51	nrc

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/15/11 16:00	nrc
Crush and Pulverize	USDA No. 1, 1972							11/22/11 14:00	thf
Digestion - Hot Plate	M3050B ICP							11/23/11 11:52	nrc
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/22/11 14:00	thf

MTM 2/24/12

Freeport-McMoRan - Chino Mines Company

Project ID:	ZN000000J8	ACZ Sample ID:	***L91527-02***
Sample ID:	STS-CG-2011-52	Date Sampled:	*10/20/11 10:00*
		Date Received:	*10/26/11*
		Sample Matrix:	*Soil*

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010B ICP	780		*	mg/Kg	1	5	11/28/11 23:53	jjc

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Solids, Percent	CLPSOW390, PART F, D-98	96.8		*	%	0.1	0.5	11/29/11 17:42	nrc

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/15/11 16:03	nrc
Crush and Pulverize	USDA No. 1, 1972							11/22/11 14:03	thf
Digestion - Hot Plate	M3050B ICP							11/23/11 12:45	nrc
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/22/11 14:03	thf

MTM 2/24/12

** Please refer to Qualifier Reports for details.*

Inorganic Analytical Results

Freeport-McMoRan - Chino Mines Company
Project ID: ZN000000J8
Sample ID: STS-CG-2011-53

ACZ Sample ID: *L91527-03*
Date Sampled: *10/20/11 15:20*
Date Received: *10/26/11*
Sample Matrix: *Soil*

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010B ICP	426		*	mg/Kg	1	5	11/28/11 23:56	jjc

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Solids, Percent	CLPSOW390, PART F, D-98	93.6		*	%	0.1	0.5	11/29/11 18:34	nrc

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/15/11 16:06	nrc
Crush and Pulverize	USDA No. 1, 1972							11/22/11 14:06	thf
Digestion - Hot Plate	M3050B ICP							11/23/11 13:02	nrc
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/22/11 14:06	thf

NTM 2/24/12

Inorganic Analytical Results

Freeport-McMoRan - Chino Mines Company
Project ID: ZN000000J8
Sample ID: STS-CG-2011-54

ACZ Sample ID: ***L91527-04***
Date Sampled: *10/20/11 16:40*
Date Received: *10/26/11*
Sample Matrix: *Soil*

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010B ICP	1100		*	mg/Kg	1	5	11/28/11 23:59	jjc

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Solids, Percent	CLPSOW390, PART F, D-98	96.9		*	%	0.1	0.5	11/29/11 19:25	nrc

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/15/11 16:09	nrc
Crush and Pulverize	USDA No. 1, 1972							11/22/11 14:09	thf
Digestion - Hot Plate	M3050B ICP							11/23/11 13:20	nrc
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/22/11 14:09	thf

nTm 2/24/12

** Please refer to Qualifier Reports for details.*

Freeport-McMoRan - Chino Mines Company
Project ID: ZN000000J8
Sample ID: STS-CG-2011-55

ACZ Sample ID: ***L91527-05***
Date Sampled: *10/20/11 15:40*
Date Received: *10/26/11*
Sample Matrix: *Soil*

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010B ICP	633		*	mg/Kg	1	5	11/29/11 0:11	jjc

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Solids, Percent	CLPSOW390, PART F, D-98	95.5		*	%	0.1	0.5	11/29/11 20:17	nrc

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/15/11 16:12	nrc
Crush and Pulverize	USDA No. 1, 1972							11/22/11 14:12	thf
Digestion - Hot Plate	M3050B ICP							11/23/11 13:37	nrc
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/22/11 14:12	thf

MTM 2/24/12

** Please refer to Qualifier Reports for details.*

Freeport-McMoRan - Chino Mines Company
Project ID: ZN000000J8
Sample ID: STS-CG-2011-56

ACZ Sample ID: ***L91527-06***
Date Sampled: *10/20/11 16:55*
Date Received: *10/26/11*
Sample Matrix: *Soil*

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010B ICP	177		*	mg/Kg	1	5	11/29/11 0:14	jjc

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Solids, Percent	CLPSOW390, PART F, D-98	97.6		*	%	0.1	0.5	11/29/11 21:08	nrc

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/15/11 16:15	nrc
Crush and Pulverize	USDA No. 1, 1972							11/22/11 14:15	thf
Digestion - Hot Plate	M3050B ICP							11/23/11 13:55	nrc
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/22/11 14:15	thf

NTM 2/24/12

** Please refer to Qualifier Reports for details.*

Inorganic Analytical Results

Freeport-McMoRan - Chino Mines Company

Project ID:	ZN000000J8
Sample ID:	STS-CG-2011-57
ACZ Sample ID:	***L91527-07***
Date Sampled:	*10/20/11 17:10*
Date Received:	*10/26/11*
Sample Matrix:	*Soil*

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010B ICP	434		*	mg/Kg	1	5	11/29/11 0:17	jjc

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Solids, Percent	CLPSOW390, PART F, D-98	95.7		*	%	0.1	0.5	11/29/11 22:00	nrc

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/15/11 16:18	nrc
Crush and Pulverize	USDA No. 1, 1972							11/22/11 14:18	thf
Digestion - Hot Plate	M3050B ICP							11/23/11 14:12	nrc
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/22/11 14:18	thf

mtm 2/24/12

** Please refer to Qualifier Reports for details.*

Freeport-McMoRan - Chino Mines Company

Project ID: ZN000000J8
Sample ID: STS-CG-2011-32

ACZ Sample ID: ***L91527-08***
Date Sampled: *10/20/11 10:30*
Date Received: *10/26/11*
Sample Matrix: *Soil*

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010B ICP	1500		*	mg/Kg	1	5	11/29/11 0:20	jjc

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Solids, Percent	CLPSOW390, PART F, D-98	95.9		*	%	0.1	0.5	11/29/11 22:51	nrc

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/15/11 16:22	nrc
Crush and Pulverize	USDA No. 1, 1972							11/22/11 14:22	thf
Digestion - Hot Plate	M3050B ICP							11/23/11 14:30	nrc
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/22/11 14:22	thf

NTM 2/24/12

** Please refer to Qualifier Reports for details.*

Freeport-McMoRan - Chino Mines Company
Project ID: ZN000000J8
Sample ID: STS-CG-2011-37

ACZ Sample ID: ***L91527-09***
Date Sampled: *10/20/11 11:00*
Date Received: *10/26/11*
Sample Matrix: *Soil*

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010B ICP	1560		*	mg/Kg	1	5	11/29/11 0:23	jjc

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Solids, Percent	CLPSOW390, PART F, D-98	94.4		*	%	0.1	0.5	11/29/11 23:42	nrc

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/15/11 16:25	nrc
Crush and Pulverize	USDA No. 1, 1972							11/22/11 14:25	thf
Digestion - Hot Plate	M3050B ICP							11/23/11 14:47	nrc
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/22/11 14:25	thf

mtm 2/24/12

** Please refer to Qualifier Reports for details.*

Freeport-McMoRan - Chino Mines Company
Project ID: ZN000000J8
Sample ID: STS-CG-2011-41

ACZ Sample ID: ***L91527-10***
Date Sampled: *10/20/11 14:15*
Date Received: *10/26/11*
Sample Matrix: *Soil*

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010B ICP	321		*	mg/Kg	1	5	11/29/11 0:26	jjc

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Solids, Percent	CLPSOW390, PART F, D-98	93.9		*	%	0.1	0.5	11/30/11 0:34	nrc

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/15/11 16:28	nrc
Crush and Pulverize	USDA No. 1, 1972							11/22/11 14:28	thf
Digestion - Hot Plate	M3050B ICP							11/23/11 15:05	nrc
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/22/11 14:28	thf

MTM 2/24/12

** Please refer to Qualifier Reports for details.*

Inorganic Analytical Results

Freeport-McMoRan - Chino Mines Company

Project ID:	ZN000000J8
Sample ID:	STS-CG-2011-1
ACZ Sample ID:	***L91527-11***
Date Sampled:	*10/19/11 14:40*
Date Received:	*10/26/11*
Sample Matrix:	*Soil*

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010B ICP	274		*	mg/Kg	1	5	11/29/11 0:29	jjc

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Solids, Percent	CLPSOW390, PART F, D-98	95.9		*	%	0.1	0.5	11/30/11 1:25	nrc

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/15/11 16:31	nrc
Crush and Pulverize	USDA No. 1, 1972							11/22/11 14:31	thf
Digestion - Hot Plate	M3050B ICP							11/23/11 15:22	nrc
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/22/11 14:31	thf

6/24/12

** Please refer to Qualifier Reports for details.*

Inorganic Analytical Results

Freeport-McMoRan - Chino Mines Company

Project ID:	ZN000000J8
Sample ID:	STS-CG-2011-2
ACZ Sample ID:	*L91527-12*
Date Sampled:	*10/19/11 14:15*
Date Received:	*10/26/11*
Sample Matrix:	*Soil*

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010B ICP	288		*	mg/Kg	1	5	11/29/11 0:32	jjc

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Solids, Percent	CLPSOW390, PART F, D-98	95.9		*	%	0.1	0.5	11/30/11 2:17	nrc

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/15/11 16:34	nrc
Crush and Pulverize	USDA No. 1, 1972							11/22/11 14:34	thf
Digestion - Hot Plate	M3050B ICP							11/23/11 15:40	nrc
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/22/11 14:34	thf

2/24/12

** Please refer to Qualifier Reports for details.*

Freeport-McMoRan - Chino Mines Company

Project ID: ZN000000J8
Sample ID: STS-CG-2011-3

ACZ Sample ID: ***L91527-13***
Date Sampled: *10/19/11 13:20*
Date Received: *10/26/11*
Sample Matrix: *Soil*

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010B ICP	573		*	mg/Kg	1	5	11/29/11 0:35	jjc

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Solids, Percent	CLPSOW390, PART F, D-98	95.6		*	%	0.1	0.5	11/30/11 3:08	nrc

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/15/11 16:37	nrc
Crush and Pulverize	USDA No. 1, 1972							11/22/11 14:37	thf
Digestion - Hot Plate	M3050B ICP							11/23/11 15:57	nrc
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/22/11 14:37	thf

MTM 2/24/12

** Please refer to Qualifier Reports for details.*

Freeport-McMoRan - Chino Mines Company

Project ID: ZN000000J8
Sample ID: STS-CG-2011-4

ACZ Sample ID: ***L91527-14***
Date Sampled: *10/19/11 13:35*
Date Received: *10/26/11*
Sample Matrix: *Soil*

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010B ICP	337		*	mg/Kg	1	5	11/29/11 0:38	jjc

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Solids, Percent	CLPSOW390, PART F, D-98	96.1		*	%	0.1	0.5	11/30/11 4:00	nrc

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/15/11 16:40	nrc
Crush and Pulverize	USDA No. 1, 1972							11/22/11 14:40	thf
Digestion - Hot Plate	M3050B ICP							11/23/11 16:15	nrc
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/22/11 14:40	thf

MTM 2/24/12

** Please refer to Qualifier Reports for details.*

Freeport-McMoRan - Chino Mines Company

Project ID:	ZN000000J8	ACZ Sample ID:	***L91527-15***
Sample ID:	STS-CG-2011-5	Date Sampled:	*10/19/11 16:05*
		Date Received:	*10/26/11*
		Sample Matrix:	*Soil*

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010B ICP	309		*	mg/Kg	1	5	11/29/11 0:47	jjc

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Solids, Percent	CLPSOW390, PART F, D-98	95.4		*	%	0.1	0.5	11/30/11 4:51	nrc

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/15/11 16:44	nrc
Crush and Pulverize	USDA No. 1, 1972							11/22/11 14:44	thf
Digestion - Hot Plate	M3050B ICP							11/23/11 16:32	nrc
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/22/11 14:44	thf

ntm 2/24/12

Freeport-McMoRan - Chino Mines Company		ACZ Sample ID:	***L91527-16***
Project ID:	ZN000000J8	Date Sampled:	*10/19/11 15:45*
Sample ID:	STS-CG-2011-6	Date Received:	*10/26/11*
		Sample Matrix:	*Soil*

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010B ICP	316		*	mg/Kg	1	5	11/29/11 0:50	jjc

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Solids, Percent	CLPSOW390, PART F, D-98	95.7		*	%	0.1	0.5	11/30/11 5:42	nrc

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/15/11 16:47	nrc
Crush and Pulverize	USDA No. 1, 1972							11/22/11 14:47	thf
Digestion - Hot Plate	M3050B ICP							11/23/11 16:50	nrc
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/22/11 14:47	thf

ATM 2/24/12

** Please refer to Qualifier Reports for details.*

Inorganic Analytical Results

Freeport-McMoRan - Chino Mines Company
Project ID: ZN000000J8
Sample ID: STS-CG-2011-18

ACZ Sample ID: ***L91527-17***
Date Sampled: *10/20/11 08:30*
Date Received: *10/26/11*
Sample Matrix: *Soil*

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010B ICP	1640		*	mg/Kg	1	5	11/29/11 0:53	jjc

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Solids, Percent	CLPSOW390, PART F, D-98	93.7		*	%	0.1	0.5	11/30/11 6:34	nrc

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/15/11 16:50	nrc
Crush and Pulverize	USDA No. 1, 1972							11/22/11 14:50	thf
Digestion - Hot Plate	M3050B ICP							11/23/11 17:07	nrc
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/22/11 14:50	thf

2/24/12

** Please refer to Qualifier Reports for details.*

Freeport-McMoRan - Chino Mines Company
Project ID: ZN000000J8
Sample ID: STS-CG-2011-8

ACZ Sample ID: ***L91527-18***
Date Sampled: *10/19/11 15:10*
Date Received: *10/26/11*
Sample Matrix: *Soil*

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010B ICP	490		*	mg/Kg	1	5	11/29/11 0:56	jjc

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Solids, Percent	CLPSOW390, PART F, D-98	95.5		*	%	0.1	0.5	11/30/11 7:25	nrc

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/15/11 16:53	nrc
Crush and Pulverize	USDA No. 1, 1972							11/22/11 14:53	thf
Digestion - Hot Plate	M3050B ICP							11/23/11 17:25	nrc
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/22/11 14:53	thf

MTM 2/24/12

** Please refer to Qualifier Reports for details.*

Freeport-McMoRan - Chino Mines Company
Project ID: ZN000000J8
Sample ID: STS-CG-2011-22

ACZ Sample ID: ***L91527-19***
Date Sampled: *10/20/11 08:05*
Date Received: *10/26/11*
Sample Matrix: *Soil*

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010B ICP	1560		*	mg/Kg	1	5	11/29/11 0:59	jjc

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Solids, Percent	CLPSOW390, PART F, D-98	94.4		*	%	0.1	0.5	11/30/11 8:17	nrc

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/15/11 16:56	nrc
Crush and Pulverize	USDA No. 1, 1972							11/22/11 14:56	thf
Digestion - Hot Plate	M3050B ICP							11/23/11 17:42	nrc
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/22/11 14:56	thf

MTM 2/24/12

** Please refer to Qualifier Reports for details.*

Inorganic Analytical Results

Freeport-McMoRan - Chino Mines Company
Project ID: ZN000000J8
Sample ID: STS-CG-2011-23

ACZ Sample ID: ***L91527-20***
Date Sampled: *10/19/11 18:20*
Date Received: *10/26/11*
Sample Matrix: *Soil*

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010B ICP	2070		*	mg/Kg	1	5	11/29/11 1:02	jjc

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Solids, Percent	CLPSOW390, PART F, D-98	96.3		*	%	0.1	0.5	11/30/11 9:08	nrc

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/15/11 16:59	nrc
Crush and Pulverize	USDA No. 1, 1972							11/22/11 14:59	thf
Digestion - Hot Plate	M3050B ICP							11/23/11 18:00	nrc
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/22/11 14:59	thf

mTm 2/24/12

** Please refer to Qualifier Reports for details.*

Freeport-McMoRan - Chino Mines Company
Project ID: ZN000000J8
Sample ID: STS-PH-2011-FID102

ACZ Sample ID: *L91528-01*
Date Sampled: *10/19/11 09:15*
Date Received: *10/26/11*
Sample Matrix: *Soil*

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010B ICP J SD-L	303		*	mg/Kg	1	5	11/30/11 13:43	scp

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Acid Generation Potential (calc on Sulfur total)	M600/2-78-054 1.3	23			t CaCO3/Kt	1	5	12/01/11 11:12	calc
Acid Neutralization Potential (calc)	M600/2-78-054 1.3	0.0			t CaCO3/Kt	1	5	12/01/11 11:12	calc
Acid-Base Potential (calc on Sulfur total)	M600/2-78-054 1.3	-23			t CaCO3/Kt	1	5	12/01/11 11:12	calc
Neutralization Potential as CaCO3	M600/2-78-054 3.2.3 - Modified (No Heat)		U	*	%	0.1	0.5	11/29/11 10:54	bsu
pH, Corrosivity	M9045D/M9040C								
pH		3.6	J HT-L		units	0.1	0.1	11/15/11 0:00	mss2
pH measured at		22.5			C	0.1	0.1	11/15/11 0:00	mss2
Solids, Percent	CLPSOW390, PART F, D-98	95.8		*	%	0.1	0.5	11/22/11 4:08	bsu
Sulfur Forms	M600/2-78-054 3.2.4-MOD								
Sulfur HCl Residue		0.48		*	%	0.01	0.1	11/29/11 0:00	bsu
Sulfur HNO3 Residue	J SQL-I	0.04	B	*	%	0.01	0.1	11/29/11 0:00	bsu
Sulfur Organic Residual Mod	↓	0.04	B	*	%	0.01	0.1	11/29/11 0:00	bsu
Sulfur Pyritic Sulfide		0.44		*	%	0.01	0.1	11/29/11 0:00	bsu
Sulfur Sulfate		0.27		*	%	0.01	0.1	11/29/11 0:00	bsu
Sulfur Total		0.75		*	%	0.01	0.1	11/29/11 0:00	bsu
Total Sulfur minus Sulfate		0.48		*	%	0.01	0.1	11/29/11 0:00	bsu

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/05/11 12:34	nrc
Crush and Pulverize	USDA No. 1, 1972							11/09/11 10:00	mss2
Digestion - Hot Plate	M3050B ICP							11/29/11 12:40	mss2
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/09/11 11:52	lwt
Sieve-250 um (60 mesh)	ASA No.9, 15-4.2.2							11/09/11 11:52	lwt

EB 03/30/12

Inorganic Analytical Results

Freeport-McMoRan - Chino Mines Company

Project ID:	ZN000000J8	ACZ Sample ID:	*L91528-02*
Sample ID:	STS-PH-2011-FID7	Date Sampled:	*10/18/11 11:45*
		Date Received:	*10/26/11*
		Sample Matrix:	*Soil*

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010B ICP J SD·L	494		*	mg/Kg	1	5	11/30/11 13:53	scp

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Acid Generation Potential (calc on Sulfur total)	M600/2-78-054 1.3 J SQL·I	4	B		t CaCO3/Kt	1	5	12/01/11 11:12	calc
Acid Neutralization Potential (calc)	M600/2-78-054 1.3	0.0			t CaCO3/Kt	1	5	12/01/11 11:12	calc
Acid-Base Potential (calc on Sulfur total)	M600/2-78-054 1.3	-4			t CaCO3/Kt	1	5	12/01/11 11:12	calc
Neutralization Potential as CaCO3	M600/2-78-054 3.2.3 - Modified (No Heat)		U	*	%	0.1	0.5	11/29/11 12:27	bsu
pH, Corrosivity	M9045D/M9040C								
pH		4.8 J HT-L			units	0.1	0.1	11/15/11 0:00	mss2
pH measured at		22.4			C	0.1	0.1	11/15/11 0:00	mss2
Solids, Percent	CLPSOW390, PART F, D-98	97.4		*	%	0.1	0.5	11/22/11 5:08	bsu
Sulfur Forms	M600/2-78-054 3.2.4-MOD								
Sulfur HCl Residue	J SQL·I	0.06	B	*	%	0.01	0.1	11/29/11 0:00	bsu
Sulfur HNO3 Residue		0.02	B	*	%	0.01	0.1	11/29/11 0:00	bsu
Sulfur Organic Residual Mod		0.02	B	*	%	0.01	0.1	11/29/11 0:00	bsu
Sulfur Pyritic Sulfide		0.04	B	*	%	0.01	0.1	11/29/11 0:00	bsu
Sulfur Sulfate		0.07	B	*	%	0.01	0.1	11/29/11 0:00	bsu
Sulfur Total		0.13		*	%	0.01	0.1	11/29/11 0:00	bsu
Total Sulfur minus Sulfate	J SQL·I	0.06	B	*	%	0.01	0.1	11/29/11 0:00	bsu

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/05/11 12:42	nrc
Crush and Pulverize	USDA No. 1, 1972							11/09/11 10:20	mss2
Digestion - Hot Plate	M3050B ICP							11/29/11 15:20	mss2
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/09/11 11:55	lwt
Sieve-250 um (60 mesh)	ASA No.9, 15-4.2.2							11/09/11 11:55	lwt

EB 03/30/12

** Please refer to Qualifier Reports for details.*

Inorganic Analytical Results

Freeport-McMoRan - Chino Mines Company

Project ID:	ZN000000J8	ACZ Sample ID:	***L91528-03***
Sample ID:	STS-PH-2011-FID8	Date Sampled:	*10/19/11 17:00*
		Date Received:	*10/26/11*
		Sample Matrix:	*Soil*

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010B ICP J SD-L	332		*	mg/Kg	1	5	11/30/11 13:56	scp

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Acid Generation Potential (calc on Sulfur total)	M600/2-78-054 1.3	15			t CaCO3/Kt	1	5	12/01/11 11:12	calc
Acid Neutralization Potential (calc)	M600/2-78-054 1.3	16			t CaCO3/Kt	1	5	12/01/11 11:12	calc
Acid-Base Potential (calc on Sulfur total)	M600/2-78-054 1.3	1			t CaCO3/Kt	1	5	12/01/11 11:12	calc
Neutralization Potential as CaCO3	M600/2-78-054 3.2.3 - Modified (No Heat)	1.6		*	%	0.1	0.5	11/29/11 9:42	bsu
pH, Corrosivity	M9045D/M9040C								
pH		6.4 J HT-L			units	0.1	0.1	11/15/11 0:00	mss2
pH measured at		22.2			C	0.1	0.1	11/15/11 0:00	mss2
Solids, Percent	CLPSOW390, PART F, D-98	92.9		*	%	0.1	0.5	11/22/11 6:09	bsu
Sulfur Forms	M600/2-78-054 3.2.4-MOD								
Sulfur HCl Residue		0.25		*	%	0.01	0.1	11/29/11 0:00	bsu
Sulfur HNO3 Residue	J SQL-I	0.03	B	*	%	0.01	0.1	11/29/11 0:00	bsu
Sulfur Organic Residual Mod	↓	0.03	B	*	%	0.01	0.1	11/29/11 0:00	bsu
Sulfur Pyritic Sulfide		0.22		*	%	0.01	0.1	11/29/11 0:00	bsu
Sulfur Sulfate		0.22		*	%	0.01	0.1	11/29/11 0:00	bsu
Sulfur Total		0.47		*	%	0.01	0.1	11/29/11 0:00	bsu
Total Sulfur minus Sulfate		0.25		*	%	0.01	0.1	11/29/11 0:00	bsu

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/05/11 12:51	nrc
Crush and Pulverize	USDA No. 1, 1972							11/09/11 10:40	mss2
Digestion - Hot Plate	M3050B ICP							11/29/11 16:13	mss2
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/09/11 11:57	lwt
Sieve-250 um (60 mesh)	ASA No.9, 15-4.2.2							11/09/11 11:57	lwt

EB 03/30/12

** Please refer to Qualifier Reports for details.*

ACZ Laboratories, Inc.
2773 Downhill Drive Steamboat Springs, CO 80487 (800) 334-5493

Inorganic Analytical Results

Freeport-McMoRan - Chino Mines Company

Project ID:	ZN000000J8	ACZ Sample ID:	*L91528-04*
Sample ID:	STS-PH-2011-FID28	Date Sampled:	*10/18/11 15:35*
		Date Received:	*10/26/11*
		Sample Matrix:	*Soil*

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010B ICP J SD-L	400		*	mg/Kg	1	5	11/30/11 13:59	scp

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Acid Generation Potential (calc on Sulfur total)	M600/2-78-054 1.3 J SQL-I	4	B		t CaCO3/Kt	1	5	12/01/11 11:12	calc
Acid Neutralization Potential (calc)	M600/2-78-054 1.3	35			t CaCO3/Kt	1	5	12/01/11 11:12	calc
Acid-Base Potential (calc on Sulfur total)	M600/2-78-054 1.3	31			t CaCO3/Kt	1	5	12/01/11 11:12	calc
Neutralization Potential as CaCO3	M600/2-78-054 3.2.3 - Modified (No Heat)	3.5		*	%	0.1	0.5	11/29/11 12:36	bsu
pH, Corrosivity	M9045D/M9040C								
pH		6.9 J HT-L			units	0.1	0.1	11/15/11 0:00	mss2
pH measured at		22.2			C	0.1	0.1	11/15/11 0:00	mss2
Solids, Percent	CLPSOW390, PART F, D-98	97.5		*	%	0.1	0.5	11/22/11 7:10	bsu
Sulfur Forms	M600/2-78-054 3.2.4-MOD								
Sulfur HCl Residue		0.12		*	%	0.01	0.1	11/29/11 0:00	bsu
Sulfur HNO3 Residue	J SQL-I	0.04	B	*	%	0.01	0.1	11/29/11 0:00	bsu
Sulfur Organic Residual Mod	↓	0.04	B	*	%	0.01	0.1	11/29/11 0:00	bsu
Sulfur Pyritic Sulfide	J SQL-I	0.08	B	*	%	0.01	0.1	11/29/11 0:00	bsu
Sulfur Sulfate	↓	0.01	B	*	%	0.01	0.1	11/29/11 0:00	bsu
Sulfur Total		0.13		*	%	0.01	0.1	11/29/11 0:00	bsu
Total Sulfur minus Sulfate		0.12		*	%	0.01	0.1	11/29/11 0:00	bsu

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/05/11 12:59	nrc
Crush and Pulverize	USDA No. 1, 1972							11/09/11 11:00	mss2
Digestion - Hot Plate	M3050B ICP							11/29/11 17:06	mss2
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/09/11 12:00	lwt
Sieve-250 um (60 mesh)	ASA No.9, 15-4.2.2							11/09/11 12:00	lwt

EB 03/30/12

** Please refer to Qualifier Reports for details.*

Inorganic Analytical Results

Freeport-McMoRan - Chino Mines Company
Project ID: ZN000000J8
Sample ID: STS-PH-2011-FID37

ACZ Sample ID: ***L92172-01***
Date Sampled: *10/11/11 09:45*
Date Received: *12/02/11*
Sample Matrix: *Soil*

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Sulfur Forms	M600/2-78-054 3.2.4-MOD								
Sulfur HCl Residue	J SQL·I ↓	0.05	B	*	%	0.01	0.1	12/12/11 0:00	bsu/brd
Sulfur HNO3 Residue		0.02	B	*	%	0.01	0.1	12/12/11 0:00	bsu/brd
Sulfur Organic Residual Mod		0.02	B	*	%	0.01	0.1	12/12/11 0:00	bsu/brd
Sulfur Pyritic Sulfide		0.03	B	*	%	0.01	0.1	12/12/11 0:00	bsu/brd
Sulfur Sulfate			U	*	%	0.01	0.1	12/12/11 0:00	bsu/brd
Sulfur Total	J SQL·I ↓	0.05	B	*	%	0.01	0.1	12/12/11 0:00	bsu/brd
Total Sulfur minus Sulfate		0.05	B	*	%	0.01	0.1	12/12/11 0:00	bsu/brd

EB 03/30/12

** Please refer to Qualifier Reports for details.*

Inorganic Analytical Results

Freeport-McMoRan - Chino Mines Company
Project ID: ZN000000J8
Sample ID: STS-PH-2011-FID101

ACZ Sample ID: ***L92172-02***
Date Sampled: *10/12/11 16:45*
Date Received: *12/02/11*
Sample Matrix: *Soil*

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Sulfur Forms	M600/2-78-054 3.2.4-MOD								
Sulfur HCl Residue		0.15		*	%	0.01	0.1	12/12/11 0:00	bsu/brd
Sulfur HNO3 Residue	J SQL-I	0.02	B	*	%	0.01	0.1	12/12/11 0:00	bsu/brd
Sulfur Organic Residual Mod	↓	0.02	B	*	%	0.01	0.1	12/12/11 0:00	bsu/brd
Sulfur Pyritic Sulfide		0.13		*	%	0.01	0.1	12/12/11 0:00	bsu/brd
Sulfur Sulfate	J SQL-I	0.06	B	*	%	0.01	0.1	12/12/11 0:00	bsu/brd
Sulfur Total		0.21		*	%	0.01	0.1	12/12/11 0:00	bsu/brd
Total Sulfur minus Sulfate		0.15		*	%	0.01	0.1	12/12/11 0:00	bsu/brd

EB 03/30/12

** Please refer to Qualifier Reports for details.*

Inorganic Analytical Results

Freeport-McMoRan - Chino Mines Company
Project ID: ZN000000J8
Sample ID: STS-PH-2011-REFPLOT3

ACZ Sample ID: ***L92172-03***
Date Sampled: *10/07/11 11:50*
Date Received: *12/02/11*
Sample Matrix: *Soil*

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Sulfur Forms	M600/2-78-054 3.2.4-MOD								
Sulfur HCl Residue		JSQL-I 0.09	B	*	%	0.01	0.1	12/13/11 0:00	bsu/brd
Sulfur HNO3 Residue		0.02	B	*	%	0.01	0.1	12/13/11 0:00	bsu/brd
Sulfur Organic Residual Mod		0.02	B	*	%	0.01	0.1	12/13/11 0:00	bsu/brd
Sulfur Pyritic Sulfide		0.07	B	*	%	0.01	0.1	12/13/11 0:00	bsu/brd
Sulfur Sulfate		0.07	B	*	%	0.01	0.1	12/13/11 0:00	bsu/brd
Sulfur Total		0.16		*	%	0.01	0.1	12/13/11 0:00	bsu/brd
Total Sulfur minus Sulfate		J SQL-I 0.09	B	*	%	0.01	0.1	12/13/11 0:00	bsu/brd

EB 03/30/12

** Please refer to Qualifier Reports for details.*

Freeport-McMoRan - Chino Mines Company
Project ID: ZN000000J8
Sample ID: STS-PH-2011-REFPLOT4

ACZ Sample ID: ***L92172-04***
Date Sampled: *10/06/11 10:39*
Date Received: *12/02/11*
Sample Matrix: *Soil*

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Sulfur Forms	M600/2-78-054 3.2.4-MOD								
Sulfur HCl Residue		0.18		*	%	0.01	0.1	12/13/11 0:00	osu/brd
Sulfur HNO3 Residue	J SQL-I	0.04	B	*	%	0.01	0.1	12/13/11 0:00	bsu/brd
Sulfur Organic Residual Mod	↓	0.04	B	*	%	0.01	0.1	12/13/11 0:00	bsu/brd
Sulfur Pyritic Sulfide		0.14		*	%	0.01	0.1	12/13/11 0:00	osu/brd
Sulfur Sulfate	J SQL-I	0.05	B	*	%	0.01	0.1	12/13/11 0:00	bsu/brd
Sulfur Total		0.23		*	%	0.01	0.1	12/13/11 0:00	osu/brd
Total Sulfur minus Sulfate		0.18		*	%	0.01	0.1	12/13/11 0:00	osu/brd

EB 03/30/12

Freeport-McMoRan - Chino Mines Company		ACZ Sample ID:	***L92172-05***
Project ID:	ZN000000J8	Date Sampled:	*10/06/11 13:30*
Sample ID:	STS-PH-2011-FID105	Date Received:	*12/02/11*
		Sample Matrix:	*Soil*

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Sulfur Forms	M600/2-78-054 3.2.4-MOD								
Sulfur HCl Residue	J SQL·I	0.09	B	*	%	0.01	0.1	12/13/11 0:00	bsu/brd
Sulfur HNO3 Residue		0.04	B	*	%	0.01	0.1	12/13/11 0:00	bsu/brd
Sulfur Organic Residual Mod		0.04	B	*	%	0.01	0.1	12/13/11 0:00	bsu/brd
Sulfur Pyritic Sulfide		0.05	B	*	%	0.01	0.1	12/13/11 0:00	bsu/brd
Sulfur Sulfate	↓	0.01	B	*	%	0.01	0.1	12/13/11 0:00	bsu/brd
Sulfur Total		0.10		*	%	0.01	0.1	12/13/11 0:00	bsu/brd
Total Sulfur minus Sulfate	J SQL·I	0.09	B	*	%	0.01	0.1	12/13/11 0:00	bsu/brd

EB 03/30/12

Inorganic Analytical Results

Freeport-McMoRan - Chino Mines Company
Project ID: ZN000000J8
Sample ID: STS-PH-2011-REFPLOT1

ACZ Sample ID: ***L92172-06***
Date Sampled: *10/04/11 11:09*
Date Received: *12/02/11*
Sample Matrix: *Soil*

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Sulfur Forms	M600/2-78-054 3.2.4-MOD								
Sulfur HCl Residue	J SQL-I	0.05	B	*	%	0.01	0.1	12/13/11 0:00	bsu/brd
Sulfur HNO3 Residue		0.02	B	*	%	0.01	0.1	12/13/11 0:00	bsu/brd
Sulfur Organic Residual Mod		0.02	B	*	%	0.01	0.1	12/13/11 0:00	bsu/brd
Sulfur Pyritic Sulfide		0.03	B	*	%	0.01	0.1	12/13/11 0:00	bsu/brd
Sulfur Sulfate		0.04	B	*	%	0.01	0.1	12/13/11 0:00	bsu/brd
Sulfur Total		0.09	B	*	%	0.01	0.1	12/13/11 0:00	bsu/brd
Total Sulfur minus Sulfate		0.05	B	*	%	0.01	0.1	12/13/11 0:00	bsu/brd

EB 03/30/12

** Please refer to Qualifier Reports for details.*

Inorganic Analytical Results

Freeport-McMoRan - Chino Mines Company
Project ID: ZN000000J8
Sample ID: STS-PH-2011-REFPLOT2

ACZ Sample ID: *L92172-07*
Date Sampled: *10/05/11 12:30*
Date Received: *12/02/11*
Sample Matrix: *Soil*

Soil Analysis

Parameter	EPA Method		Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Sulfur Forms	M600/2-78-054 3.2.4-MOD									
Sulfur HCl Residue		J SQL-I	0.02	B	*	%	0.01	0.1	12/13/11 0:00	bsu/brd
Sulfur HNO3 Residue			0.05	B	*	%	0.01	0.1	12/13/11 0:00	bsu/brd
Sulfur Organic Residual Mod		↓	0.05	B	*	%	0.01	0.1	12/13/11 0:00	bsu/brd
Sulfur Pyritic Sulfide				U	*	%	0.01	0.1	12/13/11 0:00	bsu/brd
Sulfur Sulfate				U	*	%	0.01	0.1	12/13/11 0:00	bsu/brd
Sulfur Total		J SQL-I	0.02	B	*	%	0.01	0.1	12/13/11 0:00	bsu/brd
Total Sulfur minus Sulfate		↓	0.02	B	*	%	0.01	0.1	12/13/11 0:00	bsu/brd

EB 03/30/12

** Please refer to Qualifier Reports for details.*

Inorganic Analytical Results

Freeport-McMoRan - Chino Mines Company
Project ID: ZN000000J8
Sample ID: STS-PH-2011-FID22

ACZ Sample ID: ***L92172-08***
Date Sampled: *10/13/11 16:40*
Date Received: *12/02/11*
Sample Matrix: *Soil*

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Sulfur Forms	M600/2-78-054 3.2.4-MOD								
Sulfur HCl Residue		0.23		*	%	0.01	0.1	12/13/11 0:00	osu/brd
Sulfur HNO3 Residue	J SQL·I	0.03	B	*	%	0.01	0.1	12/13/11 0:00	bsu/brd
Sulfur Organic Residual Mod	↓	0.03	B	*	%	0.01	0.1	12/13/11 0:00	bsu/brd
Sulfur Pyritic Sulfide		0.20		*	%	0.01	0.1	12/13/11 0:00	osu/brd
Sulfur Sulfate	J SQL·I	0.05	B	*	%	0.01	0.1	12/13/11 0:00	bsu/brd
Sulfur Total		0.28		*	%	0.01	0.1	12/13/11 0:00	osu/brd
Total Sulfur minus Sulfate		0.23		*	%	0.01	0.1	12/13/11 0:00	osu/brd

EB 03/30/12

** Please refer to Qualifier Reports for details.*

Freeport-McMoRan - Chino Mines Company
Project ID: ZN000000J8
Sample ID: STS-PH-2011-FID10

ACZ Sample ID: ***L92172-09***
Date Sampled: *10/07/11 14:35*
Date Received: *12/02/11*
Sample Matrix: *Soil*

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Sulfur Forms	M600/2-78-054 3.2.4-MOD								
Sulfur HCl Residue	J SQL·I	0.09	B	*	%	0.01	0.1	12/13/11 0:00	bsu/brd
Sulfur HNO3 Residue		0.02	B	*	%	0.01	0.1	12/13/11 0:00	bsu/brd
Sulfur Organic Residual Mod		0.02	B	*	%	0.01	0.1	12/13/11 0:00	bsu/brd
Sulfur Pyritic Sulfide		0.07	B	*	%	0.01	0.1	12/13/11 0:00	bsu/brd
Sulfur Sulfate		0.02	B	*	%	0.01	0.1	12/13/11 0:00	bsu/brd
Sulfur Total		0.11		*	%	0.01	0.1	12/13/11 0:00	bsu/brd
Total Sulfur minus Sulfate	J SQL·I	0.09	B	*	%	0.01	0.1	12/13/11 0:00	bsu/brd

EB 03/30/12

** Please refer to Qualifier Reports for details.*

ACZ Laboratories, Inc.
2773 Downhill Drive Steamboat Springs, CO 80487 (800) 334-5493

Inorganic Analytical Results

Freeport-McMoRan - Chino Mines Company
Project ID: ZN000000J8
Sample ID: STS-PH-2011-FID15

ACZ Sample ID: ***L92172-10***
Date Sampled: *10/10/11 11:50*
Date Received: *12/02/11*
Sample Matrix: *Soil*

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Sulfur Forms	M600/2-78-054 3.2.4-MOD								
Sulfur HCl Residue		0.19		*	%	0.01	0.1	12/13/11 0:00	osu/brd
Sulfur HNO3 Residue	J SQL·I	0.02	B	*	%	0.01	0.1	12/13/11 0:00	bsu/brd
Sulfur Organic Residual Mod	↓	0.02	B	*	%	0.01	0.1	12/13/11 0:00	bsu/brd
Sulfur Pyritic Sulfide		0.17		*	%	0.01	0.1	12/13/11 0:00	osu/brd
Sulfur Sulfate	J SQL·I	0.02	B	*	%	0.01	0.1	12/13/11 0:00	bsu/brd
Sulfur Total		0.21		*	%	0.01	0.1	12/13/11 0:00	osu/brd
Total Sulfur minus Sulfate		0.19		*	%	0.01	0.1	12/13/11 0:00	osu/brd

EB 03/30/12

** Please refer to Qualifier Reports for details.*

Freeport-McMoRan - Chino Mines Company

Project ID:	ZN000000J8	ACZ Sample ID:	***L92172-11***
Sample ID:	STS-PH-2011-FID16	Date Sampled:	*10/10/11 12:30*
		Date Received:	*12/02/11*
		Sample Matrix:	*Soil*

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Sulfur Forms	M600/2-78-054 3.2.4-MOD								
Sulfur HCl Residue		0.13		*	%	0.01	0.1	12/13/11 0:00	bsu/brd
Sulfur HNO3 Residue		0.14		*	%	0.01	0.1	12/13/11 0:00	bsu/brd
Sulfur Organic Residual Mod		0.14		*	%	0.01	0.1	12/13/11 0:00	bsu/brd
Sulfur Pyritic Sulfide			U	*	%	0.01	0.1	12/13/11 0:00	bsu/brd
Sulfur Sulfate		0.13		*	%	0.01	0.1	12/13/11 0:00	bsu/brd
Sulfur Total		0.26		*	%	0.01	0.1	12/13/11 0:00	bsu/brd
Total Sulfur minus Sulfate		0.13		*	%	0.01	0.1	12/13/11 0:00	bsu/brd

EB 03/30/12

Freeport-McMoRan - Chino Mines Company
Project ID: ZN000000J8
Sample ID: STS-PH-2011-FID17

ACZ Sample ID: *L92172-12*
Date Sampled: *10/11/11 17:35*
Date Received: *12/02/11*
Sample Matrix: *Soil*

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Sulfur Forms	M600/2-78-054 3.2.4-MOD								
Sulfur HCl Residue		0.43		*	%	0.01	0.1	12/14/11 0:00	bsu/brd
Sulfur HNO3 Residue	J SQL·I	0.05	B	*	%	0.01	0.1	12/14/11 0:00	bsu/brd
Sulfur Organic Residual Mod	↓	0.05	B	*	%	0.01	0.1	12/14/11 0:00	bsu/brd
Sulfur Pyritic Sulfide		0.38		*	%	0.01	0.1	12/14/11 0:00	bsu/brd
Sulfur Sulfate	J SQL·I	0.05	B	*	%	0.01	0.1	12/14/11 0:00	bsu/brd
Sulfur Total		0.48		*	%	0.01	0.1	12/14/11 0:00	bsu/brd
Total Sulfur minus Sulfate		0.43		*	%	0.01	0.1	12/14/11 0:00	bsu/brd

EB 03/30/12

** Please refer to Qualifier Reports for details.*

ACZ Laboratories, Inc.
2773 Downhill Drive Steamboat Springs, CO 80487 (800) 334-5493

Inorganic Analytical Results

Freeport-McMoRan - Chino Mines Company
Project ID: ZN000000J8
Sample ID: STS-PH-2011-FID18

ACZ Sample ID: ***L92172-13***
Date Sampled: *10/12/11 15:55*
Date Received: *12/02/11*
Sample Matrix: *Soil*

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Sulfur Forms	M600/2-78-054 3.2.4-MOD								
Sulfur HCl Residue		0.13		*	%	0.01	0.1	12/14/11 0:00	bsu/brd
Sulfur HNO3 Residue	J SQL·I	0.02	B	*	%	0.01	0.1	12/14/11 0:00	bsu/brd
Sulfur Organic Residual Mod	↓	0.02	B	*	%	0.01	0.1	12/14/11 0:00	bsu/brd
Sulfur Pyritic Sulfide		0.11		*	%	0.01	0.1	12/14/11 0:00	bsu/brd
Sulfur Sulfate	J SQL·I	0.03	B	*	%	0.01	0.1	12/14/11 0:00	bsu/brd
Sulfur Total		0.16		*	%	0.01	0.1	12/14/11 0:00	bsu/brd
Total Sulfur minus Sulfate		0.13		*	%	0.01	0.1	12/14/11 0:00	bsu/brd

EB 03/30/12

** Please refer to Qualifier Reports for details.*

Inorganic Analytical Results

Freeport-McMoRan - Chino Mines Company
Project ID: ZN000000J8
Sample ID: STS-PH-2011-FID106

ACZ Sample ID: ***L92172-14***
Date Sampled: *10/18/11 12:05*
Date Received: *12/02/11*
Sample Matrix: *Soil*

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Sulfur Forms	M600/2-78-054 3.2.4-MOD								
Sulfur HCl Residue	J SQL·I	0.04	B	*	%	0.01	0.1	12/14/11 0:00	bsu/brd
Sulfur HNO3 Residue		0.02	B	*	%	0.01	0.1	12/14/11 0:00	bsu/brd
Sulfur Organic Residual Mod		0.02	B	*	%	0.01	0.1	12/14/11 0:00	bsu/brd
Sulfur Pyritic Sulfide		0.02	B	*	%	0.01	0.1	12/14/11 0:00	bsu/brd
Sulfur Sulfate		0.01	B	*	%	0.01	0.1	12/14/11 0:00	bsu/brd
Sulfur Total		0.05	B	*	%	0.01	0.1	12/14/11 0:00	bsu/brd
Total Sulfur minus Sulfate		0.04	B	*	%	0.01	0.1	12/14/11 0:00	bsu/brd

EB 03/30/12

** Please refer to Qualifier Reports for details.*

Inorganic Analytical Results

Freeport-McMoRan - Chino Mines Company

Project ID:	ZN000000J8	ACZ Sample ID:	*L92172-15*
Sample ID:	STS-PH-2011-FID102	Date Sampled:	*10/19/11 09:15*
		Date Received:	*12/02/11*
		Sample Matrix:	*Soil*

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Sulfur Forms	M600/2-78-054 3.2.4-MOD								
Sulfur HCl Residue		0.56		*	%	0.01	0.1	12/14/11 0:00	bsu/brd
Sulfur HNO3 Residue	J SQL·I	0.06	B	*	%	0.01	0.1	12/14/11 0:00	bsu/brd
Sulfur Organic Residual Mod		0.06	B	*	%	0.01	0.1	12/14/11 0:00	bsu/brd
Sulfur Pyritic Sulfide		0.50		*	%	0.01	0.1	12/14/11 0:00	bsu/brd
Sulfur Sulfate		0.36		*	%	0.01	0.1	12/14/11 0:00	bsu/brd
Sulfur Total		0.92		*	%	0.01	0.1	12/14/11 0:00	bsu/brd
Total Sulfur minus Sulfate		0.56		*	%	0.01	0.1	12/14/11 0:00	bsu/brd

EB 03/30/12

** Please refer to Qualifier Reports for details.*

Freeport-McMoRan - Chino Mines Company

Project ID:	ZN000000J8	ACZ Sample ID:	***L92172-16***
Sample ID:	STS-PH-2011-FID7	Date Sampled:	*10/18/11 11:45*
		Date Received:	*12/02/11*
		Sample Matrix:	*Soil*

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Sulfur Forms	M600/2-78-054 3.2.4-MOD								
Sulfur HCl Residue	J SQL·I	0.06	B	*	%	0.01	0.1	12/14/11 0:00	bsu/brd
Sulfur HNO3 Residue		0.03	B	*	%	0.01	0.1	12/14/11 0:00	bsu/brd
Sulfur Organic Residual Mod		0.03	B	*	%	0.01	0.1	12/14/11 0:00	bsu/brd
Sulfur Pyritic Sulfide		0.03	B	*	%	0.01	0.1	12/14/11 0:00	bsu/brd
Sulfur Sulfate		0.01	B	*	%	0.01	0.1	12/14/11 0:00	bsu/brd
Sulfur Total		0.07	B	*	%	0.01	0.1	12/14/11 0:00	bsu/brd
Total Sulfur minus Sulfate		0.06	B	*	%	0.01	0.1	12/14/11 0:00	bsu/brd

EB 03/30/12

** Please refer to Qualifier Reports for details.*

Freeport-McMoRan - Chino Mines Company
Project ID: ZN000000J8
Sample ID: STS-PH-2011-FID8

ACZ Sample ID: ***L92172-17***
Date Sampled: *10/19/11 17:00*
Date Received: *12/02/11*
Sample Matrix: *Soil*

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Sulfur Forms	M600/2-78-054 3.2.4-MOD								
Sulfur HCl Residue		0.32		*	%	0.01	0.1	12/14/11 0:00	osu/brd
Sulfur HNO3 Residue	J SQL-I ↓	0.06	B	*	%	0.01	0.1	12/14/11 0:00	bsu/brd
Sulfur Organic Residual Mod		0.06	B	*	%	0.01	0.1	12/14/11 0:00	bsu/brd
Sulfur Pyritic Sulfide		0.26		*	%	0.01	0.1	12/14/11 0:00	osu/brd
Sulfur Sulfate		0.27		*	%	0.01	0.1	12/14/11 0:00	osu/brd
Sulfur Total		0.59		*	%	0.01	0.1	12/14/11 0:00	osu/brd
Total Sulfur minus Sulfate		0.32		*	%	0.01	0.1	12/14/11 0:00	bsu/brd

EB 03/30/12

** Please refer to Qualifier Reports for details.*

Freeport-McMoRan - Chino Mines Company

Project ID:	ZN000000J8	ACZ Sample ID:	***L92172-18***
Sample ID:	STS-PH-2011-FID28	Date Sampled:	*10/18/11 15:35*
		Date Received:	*12/02/11*
		Sample Matrix:	*Soil*

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Sulfur Forms	M600/2-78-054 3.2.4-MOD								
Sulfur HCl Residue		0.12		*	%	0.01	0.1	12/14/11 0:00	bsu/brd
Sulfur HNO3 Residue	J SQL-I ↓	0.04	B	*	%	0.01	0.1	12/14/11 0:00	bsu/brd
Sulfur Organic Residual Mod		0.04	B	*	%	0.01	0.1	12/14/11 0:00	bsu/brd
Sulfur Pyritic Sulfide		0.08	B	*	%	0.01	0.1	12/14/11 0:00	bsu/brd
Sulfur Sulfate		0.07	B	*	%	0.01	0.1	12/14/11 0:00	bsu/brd
Sulfur Total		0.19		*	%	0.01	0.1	12/14/11 0:00	bsu/brd
Total Sulfur minus Sulfate		0.12		*	%	0.01	0.1	12/14/11 0:00	bsu/brd

EB 03/30/12

Inorganic Analytical Results

Freeport-McMoRan - Chino Mines Company
Project ID: ZN000000J8
Sample ID: STS-AMD-2011-W1 0-6

ACZ Sample ID: ***L92223-01***
Date Sampled: *10/04/11 08:20*
Date Received: *12/07/11*
Sample Matrix: *Soil*

Inorganic Prep

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Nitrogen, total Kjeldahl, water extract	M351.2 - Block Digestor							01/05/12 9:41	mpb

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Water Extraction	ASA No. 9 10-2.3.2							01/03/12 9:00	ndj

Wet Chemistry

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Nitrogen, ammonia (Water)	M350.1 - Automated Phenate R		~~U~~	~~*~~	~~mg/Kg~~	~~0.5~~	~~3~~	~~01/05/12 16:52~~	~~tcd~~
Nitrogen, total Kjeldahl, water extract	M351.2 - Block Digestor J HT-L	5.6		*	mg/Kg	0.5	3	01/05/12 21:39	pjb

EB 03/30/12

** Please refer to Qualifier Reports for details.*

Freeport-McMoRan - Chino Mines Company
Project ID: ZN000000J8
Sample ID: STS-AMD-2011-W2 0-6

ACZ Sample ID: ***L92223-02***
Date Sampled: *10/04/11 09:23*
Date Received: *12/07/11*
Sample Matrix: *Soil*

Inorganic Prep

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Nitrogen, total Kjeldahl, water extract	M351.2 - Block Digestor							01/05/12 10:02	mpb

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Water Extraction	ASA No. 9 10-2.3.2							01/03/12 9:00	ndj

Wet Chemistry

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Nitrogen, ammonia (Water)	M350.1 - Automated Phenate R		~~U~~	~~*~~	~~mg/Kg~~	~~0.5~~	~~3~~	~~01/05/12 16:53~~	tcd
Nitrogen, total Kjeldahl, water extract	M351.2 - Block Digestor JHT-L	5.5		*	mg/Kg	0.5	3	01/05/12 21:40	pjb

EB 03/30/12

** Please refer to Qualifier Reports for details.*

Freeport-McMoRan - Chino Mines Company
Project ID: ZN000000J8
Sample ID: STS-AMD-2011-W3 0-6

ACZ Sample ID: ***L92223-03***
Date Sampled: *10/04/11 09:05*
Date Received: *12/07/11*
Sample Matrix: *Soil*

Inorganic Prep

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Nitrogen, total Kjeldahl, water extract	M351.2 - Block Digestor							01/05/12 10:23	mpb

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Water Extraction	ASA No. 9 10-2.3.2							01/03/12 9:00	ndj

Wet Chemistry

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Nitrogen, ammonia (Water)	M350.1 - Automated Phenate R		~~U~~	~~*~~	~~mg/Kg~~	~~0.5~~	~~3~~	~~01/05/12 16:54~~	~~tcd~~
Nitrogen, total Kjeldahl, water extract	M351.2 - Block Digestor J HT-L	6.1		*	mg/Kg	0.5	3	01/05/12 21:42	pjb

EB 03/30/12

ACZ Laboratories, Inc.
2773 Downhill Drive Steamboat Springs, CO 80487 (800) 334-5493

Inorganic Analytical Results

Freeport-McMoRan - Chino Mines Company
Project ID: ZN000000J8
Sample ID: STS-AMD-2011-W1 6-12

ACZ Sample ID: ***L92223-04***
Date Sampled: *10/04/11 08:30*
Date Received: *12/07/11*
Sample Matrix: *Soil*

Inorganic Prep

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Nitrogen, total Kjeldahl, water extract	M351.2 - Block Digestor							01/05/12 10:44	mpb

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Water Extraction	ASA No. 9 10-2.3.2							01/03/12 9:00	ndj

Wet Chemistry

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Nitrogen, ammonia (Water)	M350.1 - Automated Phenate R		~~U~~	~~*~~	~~mg/Kg~~	~~0.5~~	~~3~~	~~01/05/12 16:55~~	~~tcd~~
Nitrogen, total Kjeldahl, water extract	M351.2 - Block Digestor J HT-L	9.4		*	mg/Kg	0.5	3	01/05/12 21:43	pjb

EB 03/30/12

** Please refer to Qualifier Reports for details.*

Freeport-McMoRan - Chino Mines Company		ACZ Sample ID:	***L92223-05***
Project ID:	ZN000000J8	Date Sampled:	*10/04/11 09:41*
Sample ID:	STS-AMD-2011-W2 12-1	Date Received:	*12/07/11*
		Sample Matrix:	*Soil*

Inorganic Prep

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Nitrogen, total Kjeldahl, water extract	M351.2 - Block Digestor							01/05/12 11:05	mpb

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Water Extraction	ASA No. 9 10-2.3.2							01/03/12 9:00	ndj

Wet Chemistry

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Nitrogen, ammonia (Water)	M350.1 - Automated Phenate R		~~U~~	~~*~~	~~mg/Kg~~	~~0.5~~	~~3~~	~~01/05/12 16:56~~	~~tcd~~
Nitrogen, total Kjeldahl, water extract	M351.2 - Block Digestor J HT-L	6.7		*	mg/Kg	0.5	3	01/05/12 21:44	pjb

EB 03/30/12

** Please refer to Qualifier Reports for details.*

Freeport-McMoRan - Chino Mines Company		ACZ Sample ID:	***L92223-06***
Project ID:	ZN000000J8	Date Sampled:	*10/04/11 09:20*
Sample ID:	STS-AMD-2011-W3 12-1	Date Received:	*12/07/11*
		Sample Matrix:	*Soil*

Inorganic Prep

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Nitrogen, total Kjeldahl, water extract	M351.2 - Block Digestor							01/05/12 11:26	mpb

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Water Extraction	ASA No. 9 10-2.3.2							01/03/12 9:00	ndj

Wet Chemistry

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Nitrogen, ammonia (Water)	M350.1 - Automated Phenate R		~~U~~	~~*~~	~~mg/Kg~~	~~0.5~~	~~3~~	~~01/05/12 16:57~~	~~tcd~~
Nitrogen, total Kjeldahl, water extract	M351.2 - Block Digestor JHT-L	8.0		*	mg/Kg	0.5	3	01/05/12 21:45	pjb

EB 03/30/12

** Please refer to Qualifier Reports for details.*

Freeport-McMoRan - Chino Mines Company
Project ID: ZN000000J8
Sample ID: STS-AMD-2011-N1 0-6

ACZ Sample ID: ***L92223-07***
Date Sampled: *10/05/11 08:45*
Date Received: *12/07/11*
Sample Matrix: *Soil*

Inorganic Prep

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Nitrogen, total Kjeldahl, water extract	M351.2 - Block Digestor							01/05/12 11:46	mpb

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Water Extraction	ASA No. 9 10-2.3.2							01/03/12 9:00	ndj

Wet Chemistry

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Nitrogen, ammonia (Water)	M350.1 - Automated Phenate JHT, SQL-L	2.6	B	*	mg/Kg	0.5	3	01/05/12 16:58	tcd
Nitrogen, total Kjeldahl, water extract	M351.2 - Block Digestor J HT-L	18.2		*	mg/Kg	0.5	3	01/05/12 21:46	pjb

EB 03/30/12

** Please refer to Qualifier Reports for details.*

Inorganic Analytical Results

Freeport-McMoRan - Chino Mines Company

Project ID:	ZN000000J8
Sample ID:	STS-AMD-2011-N2 0-6

ACZ Sample ID:	***L92223-08***
Date Sampled:	*10/05/11 08:50*
Date Received:	*12/07/11*
Sample Matrix:	*Soil*

Inorganic Prep

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Nitrogen, total Kjeldahl, water extract	M351.2 - Block Digestor							01/05/12 12:28	mpb

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Water Extraction	ASA No. 9 10-2.3.2							01/03/12 9:00	ndj

Wet Chemistry

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Nitrogen, ammonia (Water)	M350.1 - Automated Phenate JHT, SQL-L	0.8	B	*	mg/Kg	0.5	3	01/05/12 16:59	tcd
Nitrogen, total Kjeldahl, water extract	M351.2 - Block Digestor JHT-L	12.8		*	mg/Kg	0.5	3	01/05/12 21:51	pjb

EB 03/30/12

** Please refer to Qualifier Reports for details.*

Freeport-McMoRan - Chino Mines Company

Project ID:	ZN000000J8	ACZ Sample ID:	***L92223-09***
Sample ID:	STS-AMD-2011-N3 0-6	Date Sampled:	*10/05/11 08:50*
		Date Received:	*12/07/11*
		Sample Matrix:	*Soil*

Inorganic Prep

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Nitrogen, total Kjeldahl, water extract	M351.2 - Block Digestor							01/05/12 13:10	mpb

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Water Extraction	ASA No. 9 10-2.3.2							01/03/12 9:00	ndj

Wet Chemistry

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Nitrogen, ammonia (Water)	M350.1 - Automated Phenate J HT, SQL-L	0.9	B	*	mg/Kg	0.5	3	01/05/12 17:05	tcd
Nitrogen, total Kjeldahl, water extract	M351.2 - Block Digestor J HT-L	11.6		*	mg/Kg	0.5	3	01/05/12 21:53	pjb

EB 03/30/12

* *Please refer to Qualifier Reports for details.*

Inorganic Analytical Results

Freeport-McMoRan - Chino Mines Company
Project ID: ZN000000J8
Sample ID: STS-AMD-2011-N1 18-2

ACZ Sample ID: ***L92223-10***
Date Sampled: *10/05/11 09:10*
Date Received: *12/07/11*
Sample Matrix: *Soil*

Inorganic Prep

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Nitrogen, total Kjeldahl, water extract	M351.2 - Block Digestor							01/05/12 13:31	mpb

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Water Extraction	ASA No. 9 10-2.3.2							01/03/12 9:00	ndj

Wet Chemistry

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Nitrogen, ammonia (Water)	M350.1 - Automated Phenate	R	~~U~~	~~*~~	mg/Kg	0.5	~~3~~	~~01/05/12 17:06~~	~~tcd~~
Nitrogen, total Kjeldahl, water extract	M351.2 - Block Digestor	J HT-L 5.3		*	mg/Kg	0.5	3	01/05/12 21:54	pjb

EB 03/30/12

** Please refer to Qualifier Reports for details.*

Inorganic Analytical Results

Freeport-McMoRan - Chino Mines Company
Project ID: ZN000000J8
Sample ID: STS-AMD-2011-N2 18-2

ACZ Sample ID: ***L92223-11***
Date Sampled: *10/05/11 09:40*
Date Received: *12/07/11*
Sample Matrix: *Soil*

Inorganic Prep

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Nitrogen, total Kjeldahl, water extract	M351.2 - Block Digestor							01/05/12 13:52	mpb

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Water Extraction	ASA No. 9 10-2.3.2							01/03/12 9:00	ndj

Wet Chemistry

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Nitrogen, ammonia (Water)	M350.1 - Automated Phenate R		~~U~~	~~*~~	~~mg/Kg~~	~~0.5~~	~~3~~	~~01/05/12 17:07~~	~~tcd~~
Nitrogen, total Kjeldahl, water extract	M351.2 - Block Digestor J HT-L	5.5		*	mg/Kg	0.5	3	01/05/12 21:55	pjb

EB 03/30/12

** Please refer to Qualifier Reports for details.*

Inorganic Analytical Results

Freeport-McMoRan - Chino Mines Company
Project ID: ZN000000J8
Sample ID: STS-AMD-2011-N3 18-2

ACZ Sample ID: ***L92223-12***
Date Sampled: *10/05/11 10:07*
Date Received: *12/07/11*
Sample Matrix: *Soil*

Inorganic Prep

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Nitrogen, total Kjeldahl, water extract	M351.2 - Block Digestor							01/05/12 14:13	mpb

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Water Extraction	ASA No. 9 10-2.3.2							01/03/12 9:00	ndj

Wet Chemistry

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Nitrogen, ammonia (Water)	M350.1 - Automated Phenate J HT, SQL-L	0.6	B	*	mg/Kg	0.5	3	01/05/12 17:08	tcd
Nitrogen, total Kjeldahl, water extract	M351.2 - Block Digestor J HT-L	5.5		*	mg/Kg	0.5	3	01/05/12 21:56	pjb

EB 03/30/12

** Please refer to Qualifier Reports for details.*

Freeport-McMoRan - Chino Mines Company
Project ID: ZN000000J8
Sample ID: STS-AMD-2011-NE1 0-6

ACZ Sample ID: ***L92223-13***
Date Sampled: *10/07/11 08:40*
Date Received: *12/07/11*
Sample Matrix: *Soil*

Inorganic Prep

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Nitrogen, total Kjeldahl, water extract	M351.2 - Block Digestor							01/05/12 14:33	mpb

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Water Extraction	ASA No. 9 10-2.3.2							01/03/12 9:00	ndj

Wet Chemistry

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Nitrogen, ammonia (Water)	M350.1 - Automated Phenate	2.1 J HT,SQL-L	B	*	mg/Kg	0.5	3	01/05/12 17:09	tcd
Nitrogen, total Kjeldahl, water extract	M351.2 - Block Digestor	16.2 J HT-L		*	mg/Kg	0.5	3	01/05/12 21:57	pjb

EB 03/30/12

Inorganic Analytical Results

Freeport-McMoRan - Chino Mines Company
Project ID: ZN000000J8
Sample ID: STS-AMD-2011-NE2 0-6

ACZ Sample ID: ***L92223-14***
Date Sampled: *10/07/11 08:35*
Date Received: *12/07/11*
Sample Matrix: *Soil*

Inorganic Prep

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Nitrogen, total Kjeldahl, water extract	M351.2 - Block Digestor							01/05/12 14:54	mpb

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Water Extraction	ASA No. 9 10-2.3.2							01/03/12 9:00	ndj

Wet Chemistry

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Nitrogen, ammonia (Water)	M350.1 - Automated Phenate	0.7 J HT, SQL-L	B	*	mg/Kg	0.5	3	01/05/12 17:10	tcd
Nitrogen, total Kjeldahl, water extract	M351.2 - Block Digestor	9.0 J HT-L		*	mg/Kg	0.5	3	01/05/12 21:58	pjb

EB 03/30/12

** Please refer to Qualifier Reports for details.*

Freeport-McMoRan - Chino Mines Company

Project ID:	ZN000000J8	ACZ Sample ID:	***L92223-15***
Sample ID:	STS-AMD-2011-NE3 0-6	Date Sampled:	*10/07/11 08:56*
		Date Received:	*12/07/11*
		Sample Matrix:	*Soil*

Inorganic Prep

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Nitrogen, total Kjeldahl, water extract	M351.2 - Block Digestor							01/05/12 15:15	mpb

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Water Extraction	ASA No. 9 10-2.3.2							01/03/12 9:00	ndj

Wet Chemistry

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Nitrogen, ammonia (Water)	M350.1 - Automated Phenate J HT, SQL-L	2.4	B	*	mg/Kg	0.5	3	01/05/12 17:11	tcd
Nitrogen, total Kjeldahl, water extract	M351.2 - Block Digestor J HT-L	17.6		*	mg/Kg	0.5	3	01/05/12 22:00	pjb

EB 03/30/12

* *Please refer to Qualifier Reports for details.*

Freeport-McMoRan - Chino Mines Company
Project ID: ZN000000J8
Sample ID: STS-AMD-2011-NE1 18-

ACZ Sample ID: ***L92223-16***
Date Sampled: *10/07/11 08:55*
Date Received: *12/07/11*
Sample Matrix: *Soil*

Inorganic Prep

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Nitrogen, total Kjeldahl, water extract	M351.2 - Block Digestor							01/05/12 15:36	mpb

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Water Extraction	ASA No. 9 10-2.3.2							01/03/12 9:00	ndj

Wet Chemistry

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Nitrogen, ammonia (Water)	M350.1 - Automated Phenate	R	~~U~~	~~*~~	~~mg/Kg~~	~~0.5~~	~~3~~	~~01/05/12 17:12~~	~~tcd~~
Nitrogen, total Kjeldahl, water extract	M351.2 - Block Digestor J HT-L	4.9		*	mg/Kg	0.5	3	01/05/12 22:01	pjb

EB 03/30/12

Freeport-McMoRan - Chino Mines Company
Project ID: ZN000000J8
Sample ID: STS-AMD-2011-NE2 18-

ACZ Sample ID: *L92223-17*
Date Sampled: *10/07/11 09:20*
Date Received: *12/07/11*
Sample Matrix: *Soil*

Inorganic Prep

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Nitrogen, total Kjeldahl, water extract	M351.2 - Block Digestor							01/05/12 15:57	mpb

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Water Extraction	ASA No. 9 10-2.3.2							01/03/12 9:00	ndj

Wet Chemistry

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Nitrogen, ammonia (Water)	M350.1 - Automated Phenate	R	~~U~~	~~*~~	~~mg/Kg~~	~~0.5~~	~~3~~	~~01/05/12 17:16~~	~~tcd~~
Nitrogen, total Kjeldahl, water extract	M351.2 - Block Digestor	J HT-L 7.4		*	mg/Kg	0.5	3	01/05/12 22:04	pjb

EB 03/30/12

** Please refer to Qualifier Reports for details.*

ACZ Laboratories, Inc.
2773 Downhill Drive Steamboat Springs, CO 80487 (800) 334-5493

Inorganic Analytical Results

Freeport-McMoRan - Chino Mines Company
Project ID: ZN000000J8
Sample ID: STS-AMD-2011-NE3 18-

ACZ Sample ID: ***L92223-18***
Date Sampled: *10/07/11 09:00*
Date Received: *12/07/11*
Sample Matrix: *Soil*

Inorganic Prep

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Nitrogen, total Kjeldahl, water extract	M351.2 - Block Digestor							01/05/12 16:18	mpb

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Water Extraction	ASA No. 9 10-2.3.2							01/03/12 9:00	ndj

Wet Chemistry

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Nitrogen, ammonia (Water)	M350.1 - Automated Phenate J HT,SQL-L	0.6	B	*	mg/Kg	0.5	3	01/05/12 17:17	tcd
Nitrogen, total Kjeldahl, water extract	M351.2 - Block Digestor J HT-L	7.0		*	mg/Kg	0.5	3	01/05/12 22:05	pjb

EB 03/30/12

** Please refer to Qualifier Reports for details.*

Inorganic Analytical Results

Freeport-McMoRan - Chino Mines Company
Project ID: ZN000000J8
Sample ID: STS-AMD-2011-E1 0-6

ACZ Sample ID: *L92223-19*
Date Sampled: *10/06/11 09:20*
Date Received: *12/07/11*
Sample Matrix: *Soil*

Inorganic Prep

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Nitrogen, total Kjeldahl, water extract	M351.2 - Block Digestor							01/05/12 16:39	mpb

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Water Extraction	ASA No. 9 10-2.3.2							01/03/12 9:00	ndj

Wet Chemistry

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Nitrogen, ammonia (Water)	M350.1 - Automated Phenate	R	~~U~~	~~*~~	~~mg/Kg~~	~~0.5~~	~~3~~	~~01/05/12 17:18~~	~~ted~~
Nitrogen, total Kjeldahl, water extract	M351.2 - Block Digestor J HT-L	8.1		*	mg/Kg	0.5	3	01/05/12 22:06	pjb

EB 03/30/12

** Please refer to Qualifier Reports for details.*

Inorganic Analytical Results

Freeport-McMoRan - Chino Mines Company
Project ID: ZN000000J8
Sample ID: STS-AMD-2011-E2 0-6

ACZ Sample ID: ***L92223-20***
Date Sampled: *10/06/11 09:15*
Date Received: *12/07/11*
Sample Matrix: *Soil*

Inorganic Prep

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Nitrogen, total Kjeldahl, water extract	M351.2 - Block Digestor							01/05/12 16:59	mpb

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Water Extraction	ASA No. 9 10-2.3.2							01/03/12 9:00	ndj

Wet Chemistry

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Nitrogen, ammonia (Water)	M350.1 - Automated Phenate	5.1	J HT-L	*	mg/Kg	0.5	3	01/05/12 17:19	tcd
Nitrogen, total Kjeldahl, water extract	M351.2 - Block Digestor	22.4	↓	*	mg/Kg	0.5	3	01/05/12 22:08	pjb

EB 03/30/12

** Please refer to Qualifier Reports for details.*

Freeport-McMoRan - Chino Mines Company
Project ID: ZN000000J8
Sample ID: STS-AMD-2011-E3 0-6

ACZ Sample ID: *L92224-01*
Date Sampled: *10/06/11 09:55*
Date Received: *12/07/11*
Sample Matrix: *Soil*

Inorganic Prep

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Nitrogen, total Kjeldahl, water extract	M351.2 - Block Digestor		H	*				01/04/12 9:58	lhb

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Water Extraction	ASA No. 9 10-2.3.2							12/30/11 9:50	bsu

Wet Chemistry

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Nitrogen, ammonia (Water)	M350.1 - Automated Phenate J SQL, HT-L	0.8	B	*	mg/Kg	0.5	3	01/05/12 17:32	tcd
Nitrogen, total Kjeldahl, water extract	M351.2 - Block Digestor J HT-L	4.2	H	*	mg/Kg	0.5	3	01/05/12 0:05	pjb

EB 03/30/12

** Please refer to Qualifier Reports for details.*

Freeport-McMoRan - Chino Mines Company
Project ID: ZN000000J8
Sample ID: STS-AMD-2011-E1 6-12

ACZ Sample ID: ***L92224-02***
Date Sampled: *10/06/11 09:40*
Date Received: *12/07/11*
Sample Matrix: *Soil*

Inorganic Prep

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Nitrogen, total Kjeldahl, water extract	M351.2 - Block Digestor		H	*				01/04/12 10:27	lhb

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Water Extraction	ASA No. 9 10-2.3.2							12/30/11 10:30	bsu

Wet Chemistry

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Nitrogen, ammonia (Water)	M350.1 - Automated Phenate R		~~U~~	~~*~~	~~mg/Kg~~	~~0.5~~	~~3~~	~~01/05/12 17:35~~	~~tcd~~
Nitrogen, total Kjeldahl, water extract	M351.2 - Block Digestor J HT-L	5.4	H	*	mg/Kg	0.5	3	01/05/12 0:07	pjb

EB 03/30/12

** Please refer to Qualifier Reports for details.*

ACZ Laboratories, Inc.
2773 Downhill Drive Steamboat Springs, CO 80487 (800) 334-5493

Inorganic Analytical Results

Freeport-McMoRan - Chino Mines Company
Project ID: ZN000000J8
Sample ID: STS-AMD-2011-E2 6-12

ACZ Sample ID: ***L92224-03***
Date Sampled: *10/06/11 09:35*
Date Received: *12/07/11*
Sample Matrix: *Soil*

Inorganic Prep

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Nitrogen, total Kjeldahl, water extract	M351.2 - Block Digestor		H	*				01/04/12 10:56	lhb

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Water Extraction	ASA No. 9 10-2.3.2							12/30/11 10:50	bsu

Wet Chemistry

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Nitrogen, ammonia (Water)	M350.1 - Automated Phenate	0.6 J HT, SQL-L	B	*	mg/Kg	0.5	3	01/05/12 17:36	tcd
Nitrogen, total Kjeldahl, water extract	M351.2 - Block Digestor	10.3 J HT-L	H	*	mg/Kg	0.5	3	01/05/12 0:09	pjb

EB 03/30/12

** Please refer to Qualifier Reports for details.*

ACZ Laboratories, Inc.
2773 Downhill Drive Steamboat Springs, CO 80487 (800) 334-5493

Inorganic Analytical Results

Freeport-McMoRan - Chino Mines Company
Project ID: ZN000000J8
Sample ID: STS-AMD-2011-E3 6-12

ACZ Sample ID: ***L92224-04***
Date Sampled: *10/06/11 10:15*
Date Received: *12/07/11*
Sample Matrix: *Soil*

Inorganic Prep

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Nitrogen, total Kjeldahl, water extract	M351.2 - Block Digestor		H	*				01/04/12 11:10	lhb

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Water Extraction	ASA No. 9 10-2.3.2							12/30/11 11:10	bsu

Wet Chemistry

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Nitrogen, ammonia (Water)	M350.1 - Automated Phenate R		~~U~~	~~*~~	~~mg/Kg~~	~~0.5~~	~~3~~	~~01/05/12 17:37~~	~~tcd~~
Nitrogen, total Kjeldahl, water extract	M351.2 - Block Digestor J HT-L	4.5	H	*	mg/Kg	0.5	3	01/05/12 0:10	pjb

EB 03/30/12

Freeport-McMoRan - Chino Mines Company
Project ID: ZN000000J8
Sample ID: STS-AMD-2011-WREF1 0

ACZ Sample ID: ***L92224-05***
Date Sampled: *10/04/11 09:30*
Date Received: *12/07/11*
Sample Matrix: *Soil*

Inorganic Prep

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Nitrogen, total Kjeldahl, water extract	M351.2 - Block Digestor		H	*				01/04/12 11:24	lhb

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Water Extraction	ASA No. 9 10-2.3.2							12/30/11 11:30	bsu

Wet Chemistry

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Nitrogen, ammonia (Water)	M350.1 - Automated Phenate R		~~U~~	~~*~~	~~mg/Kg~~	~~0.5~~	~~3~~	~~01/05/12 17:38~~	~~tcd~~
Nitrogen, total Kjeldahl, water extract	M351.2 - Block Digestor JHT-L	7.1	H	*	mg/Kg	0.5	3	01/05/12 0:12	pjb

EB 03/30/12

** Please refer to Qualifier Reports for details.*

ACZ Laboratories, Inc.
2773 Downhill Drive Steamboat Springs, CO 80487 (800) 334-5493

Inorganic Analytical Results

Freeport-McMoRan - Chino Mines Company

Project ID:	ZN000000J8	ACZ Sample ID:	***L92224-06***
Sample ID:	STS-AMD-2011-WREF2 0	Date Sampled:	*10/04/11 09:55*
		Date Received:	*12/07/11*
		Sample Matrix:	*Soil*

Inorganic Prep

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Nitrogen, total Kjeldahl, water extract	M351.2 - Block Digestor		H	*				01/04/12 11:39	lhb

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Water Extraction	ASA No. 9 10-2.3.2							12/30/11 11:50	bsu

Wet Chemistry

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Nitrogen, ammonia (Water)	M350.1 - Automated Phenate R		U	*	mg/Kg	0.5	3	01/05/12 17:39	tcd
Nitrogen, total Kjeldahl, water extract	M351.2 - Block Digestor J HT-L	6.8	H	*	mg/Kg	0.5	3	01/05/12 0:13	pjb

EB 03/30/12

** Please refer to Qualifier Reports for details.*

Freeport-McMoRan - Chino Mines Company
Project ID: ZN000000J8
Sample ID: STS-AMD-2011-WREF1 1

ACZ Sample ID: ***L92224-07***
Date Sampled: *10/04/11 10:26*
Date Received: *12/07/11*
Sample Matrix: *Soil*

Inorganic Prep

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Nitrogen, total Kjeldahl, water extract	M351.2 - Block Digestor		H	*				01/04/12 11:53	lhb

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Water Extraction	ASA No. 9 10-2.3.2							12/30/11 12:10	bsu

Wet Chemistry

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Nitrogen, ammonia (Water)	M350.1 - Automated Phenate	R	~~U~~	~~*~~	~~mg/Kg~~	~~0.5~~	~~3~~	~~01/05/12 17:42~~	tcd
Nitrogen, total Kjeldahl, water extract	M351.2 - Block Digestor	4.7	H	*	mg/Kg	0.5	3	01/05/12 0:16	pjb

J HT-L

EB 03/30/12

** Please refer to Qualifier Reports for details.*

Inorganic Analytical Results

Freeport-McMoRan - Chino Mines Company
Project ID: ZN000000J8
Sample ID: STS-AMD-2011-WREF2 1

ACZ Sample ID: ***L92224-08***
Date Sampled: *10/04/11 10:40*
Date Received: *12/07/11*
Sample Matrix: *Soil*

Inorganic Prep

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Nitrogen, total Kjeldahl, water extract	M351.2 - Block Digestor		H	*				01/04/12 12:07	lhb

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Water Extraction	ASA No. 9 10-2.3.2							12/30/11 12:30	bsu

Wet Chemistry

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Nitrogen, ammonia (Water)	M350.1 - Automated Phenate R		~~U~~	~~*~~	~~mg/Kg~~	~~0.5~~	~~3~~	~~01/05/12 17:44~~	~~tcd~~
Nitrogen, total Kjeldahl, water extract	M351.2 - Block Digestor J HT-L	5.8	H	*	mg/Kg	0.5	3	01/05/12 0:17	pjb

EB 03/30/12

** Please refer to Qualifier Reports for details.*

Freeport-McMoRan - Chino Mines Company
Project ID: ZN000000J8
Sample ID: STS-AMD-2011-NREF1 0

ACZ Sample ID: ***L92224-09***
Date Sampled: *10/05/11 10:00*
Date Received: *12/07/11*
Sample Matrix: *Soil*

Inorganic Prep

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Nitrogen, total Kjeldahl, water extract	M351.2 - Block Digestor		H	*				01/04/12 12:22	lhb

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Water Extraction	ASA No. 9 10-2.3.2							12/30/11 12:50	bsu

Wet Chemistry

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Nitrogen, ammonia (Water)	M350.1 - Automated Phenate J HT,SQL-L	0.8	B	*	mg/Kg	0.5	3	01/05/12 17:45	tcd
Nitrogen, total Kjeldahl, water extract	M351.2 - Block Digestor J HT-L	13.2	H	*	mg/Kg	0.5	3	01/05/12 0:18	pjb

EB 03/30/12

Freeport-McMoRan - Chino Mines Company
Project ID: ZN000000J8
Sample ID: STS-AMD-2011-NREF2 0

ACZ Sample ID: ***L92224-10***
Date Sampled: *10/05/11 10:50*
Date Received: *12/07/11*
Sample Matrix: *Soil*

Inorganic Prep

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Nitrogen, total Kjeldahl, water extract	M351.2 - Block Digestor		H	*				01/04/12 12:36	lhb

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Water Extraction	ASA No. 9 10-2.3.2							12/30/11 13:10	bsu

Wet Chemistry

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Nitrogen, ammonia (Water)	M350.1 - Automated Phenate J HT, SQL·L	1.3	B	*	mg/Kg	0.5	3	01/05/12 17:46	tcd
Nitrogen, total Kjeldahl, water extract	M351.2 - Block Digestor J HT-L	9.8	H	*	mg/Kg	0.5	3	01/05/12 0:19	pjb

EB 03/30/12

** Please refer to Qualifier Reports for details.*

ACZ Laboratories, Inc.
2773 Downhill Drive Steamboat Springs, CO 80487 (800) 334-5493

Inorganic Analytical Results

Freeport-McMoRan - Chino Mines Company
Project ID: ZN000000J8
Sample ID: STS-AMD-2011-NREF1 1

ACZ Sample ID: ***L92224-11***
Date Sampled: *10/05/11 10:50*
Date Received: *12/07/11*
Sample Matrix: *Soil*

Inorganic Prep

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Nitrogen, total Kjeldahl, water extract	M351.2 - Block Digestor		H	*				01/04/12 12:50	lhb

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Water Extraction	ASA No. 9 10-2.3.2							12/30/11 13:30	bsu

Wet Chemistry

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Nitrogen, ammonia (Water)	M350.1 - Automated Phenate R		~~U~~	~~*~~	~~mg/Kg~~	~~0.5~~	~~3~~	~~01/05/12 17:47~~	~~tcd~~
Nitrogen, total Kjeldahl, water extract	M351.2 - Block Digestor J HT-L	3.4	H	*	mg/Kg	0.5	3	01/05/12 0:21	pjb

EB 03/30/12

** Please refer to Qualifier Reports for details.*

ACZ Laboratories, Inc.
2773 Downhill Drive Steamboat Springs, CO 80487 (800) 334-5493

Inorganic Analytical Results

Freeport-McMoRan - Chino Mines Company
Project ID: ZN000000J8
Sample ID: STS-AMD-2011-NREF2 1

ACZ Sample ID: ***L92224-12***
Date Sampled: *10/05/11 11:20*
Date Received: *12/07/11*
Sample Matrix: *Soil*

Inorganic Prep

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Nitrogen, total Kjeldahl, water extract	M351.2 - Block Digestor		H	*				01/04/12 13:05	lhb

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Water Extraction	ASA No. 9 10-2.3.2							12/30/11 13:50	bsu

Wet Chemistry

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Nitrogen, ammonia (Water)	M350.1 - Automated Phenate	R	~~U~~	~~*~~	~~mg/Kg~~	~~0.5~~	~~3~~	~~01/05/12 17:48~~	~~tcd~~
Nitrogen, total Kjeldahl, water extract	M351.2 - Block Digestor	8.3	H	*	mg/Kg	0.5	3	01/05/12 0:22	pjb

J HT-L

EB 03/30/12

Freeport-McMoRan - Chino Mines Company
Project ID: ZN000000J8
Sample ID: STS-AMD-2011-NEREF1

ACZ Sample ID: ***L92224-13***
Date Sampled: *10/07/11 10:20*
Date Received: *12/07/11*
Sample Matrix: *Soil*

Inorganic Prep

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Nitrogen, total Kjeldahl, water extract	M351.2 - Block Digestor		H	*				01/04/12 13:19	lhb

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Water Extraction	ASA No. 9 10-2.3.2							12/30/11 14:10	bsu

Wet Chemistry

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Nitrogen, ammonia (Water)	M350.1 - Automated Phenate	11.6		*	mg/Kg	0.5	3	01/05/12 17:49	tcd
Nitrogen, total Kjeldahl, water extract	M351.2 - Block Digestor	J HT-L ↓ 18.5	H	*	mg/Kg	0.5	3	01/05/12 0:23	pjb

EB 03/30/12

** Please refer to Qualifier Reports for details.*

Inorganic Analytical Results

Freeport-McMoRan - Chino Mines Company

Project ID:	ZN000000J8	ACZ Sample ID:	***L92224-14***
Sample ID:	STS-AMD-2011-NEREF2	Date Sampled:	*10/07/11 10:05*
		Date Received:	*12/07/11*
		Sample Matrix:	*Soil*

Inorganic Prep

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Nitrogen, total Kjeldahl, water extract	M351.2 - Block Digestor		H	*				01/04/12 13:33	lhb

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Water Extraction	ASA No. 9 10-2.3.2							12/30/11 14:30	bsu

Wet Chemistry

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Nitrogen, ammonia (Water)	M350.1 - Automated Phenate J HT, SQL-L	0.8	B	*	mg/Kg	0.5	3	01/05/12 17:50	tcd
Nitrogen, total Kjeldahl, water extract	M351.2 - Block Digestor J HT-L	9.6	H	*	mg/Kg	0.5	3	01/05/12 0:24	pjb

EB 03/30/12

** Please refer to Qualifier Reports for details.*

Freeport-McMoRan - Chino Mines Company		ACZ Sample ID:	***L92224-15***
Project ID:	ZN000000J8	Date Sampled:	*10/07/11 11:05*
Sample ID:	STS-AMD-2011-NEREF1	Date Received:	*12/07/11*
		Sample Matrix:	*Soil*

Inorganic Prep

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Nitrogen, total Kjeldahl, water extract	M351.2 - Block Digestor		H	*				01/04/12 13:48	lhb

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Water Extraction	ASA No. 9 10-2.3.2							12/30/11 14:50	bsu

Wet Chemistry

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Nitrogen, ammonia (Water)	M350.1 - Automated Phenate	R	~~U~~	~~*~~	~~mg/Kg~~	~~0.5~~	~~3~~	~~01/05/12 17:51~~	~~tcd~~
Nitrogen, total Kjeldahl, water extract	M351.2 - Block Digestor	4.8 J HT-L	H	*	mg/Kg	0.5	3	01/05/12 0:25	pjb

EB 03/30/12

ACZ Laboratories, Inc.
2773 Downhill Drive Steamboat Springs, CO 80487 (800) 334-5493

Inorganic Analytical Results

Freeport-McMoRan - Chino Mines Company
Project ID: ZN000000J8
Sample ID: STS-AMD-2011-NEREF2

ACZ Sample ID: ***L92224-16***
Date Sampled: *10/07/11 10:45*
Date Received: *12/07/11*
Sample Matrix: *Soil*

Inorganic Prep

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Nitrogen, total Kjeldahl, water extract	M351.2 - Block Digestor		H	*				01/04/12 14:02	lhb

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Water Extraction	ASA No. 9 10-2.3.2							12/30/11 15:10	bsu

Wet Chemistry

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Nitrogen, ammonia (Water)	M350.1 - Automated Phenate R		~~U~~	~~*~~	~~mg/Kg~~	~~0.5~~	~~3~~	~~01/05/12 17:52~~	~~tcd~~
Nitrogen, total Kjeldahl, water extract	M351.2 - Block Digestor J HT-L	8.7	H	*	mg/Kg	0.5	3	01/05/12 0:26	pjb

EB 03/30/12

** Please refer to Qualifier Reports for details.*

Inorganic Analytical Results

Freeport-McMoRan - Chino Mines Company
Project ID: ZN000000J8
Sample ID: STS-AMD-2011-EREF1 0

ACZ Sample ID: ***L92224-17***
Date Sampled: *10/06/11 08:55*
Date Received: *12/07/11*
Sample Matrix: *Soil*

Inorganic Prep

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Nitrogen, total Kjeldahl, water extract	M351.2 - Block Digestor		H	*				01/04/12 14:17	lhb

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Water Extraction	ASA No. 9 10-2.3.2							12/30/11 15:30	bsu

Wet Chemistry

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Nitrogen, ammonia (Water)	M350.1 - Automated Phenate	0.8 J HT, SQL-L	B	*	mg/Kg	0.5	3	01/05/12 17:56	tcd
Nitrogen, total Kjeldahl, water extract	M351.2 - Block Digestor	5.6 J HT-L	H	*	mg/Kg	0.5	3	01/05/12 0:30	pjb

EB 03/30/12

** Please refer to Qualifier Reports for details.*

Freeport-McMoRan - Chino Mines Company
Project ID: ZN000000J8
Sample ID: STS-AMD-2011-EREF2 0

ACZ Sample ID: ***L92224-18***
Date Sampled: *10/06/11 08:50*
Date Received: *12/07/11*
Sample Matrix: *Soil*

Inorganic Prep

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Nitrogen, total Kjeldahl, water extract	M351.2 - Block Digestor		H	*				01/04/12 14:31	lhb

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Water Extraction	ASA No. 9 10-2.3.2							12/30/11 15:50	bsu

Wet Chemistry

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Nitrogen, ammonia (Water)	M350.1 - Automated Phenate	0.6 J HT, SQL-L	B	*	mg/Kg	0.5	3	01/05/12 17:57	tcd
Nitrogen, total Kjeldahl, water extract	M351.2 - Block Digestor	2.3 J HT, SQL-L	BH	*	mg/Kg	0.5	3	01/05/12 0:31	pjb

EB 03/30/12

** Please refer to Qualifier Reports for details.*

Inorganic Analytical Results

Freeport-McMoRan - Chino Mines Company
Project ID: ZN000000J8
Sample ID: STS-AMD-2011-EREF1 6

ACZ Sample ID: ***L92224-19***
Date Sampled: *10/06/11 09:05*
Date Received: *12/07/11*
Sample Matrix: *Soil*

Inorganic Prep

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Nitrogen, total Kjeldahl, water extract	M351.2 - Block Digestor		H	*				01/04/12 14:45	lhb

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Water Extraction	ASA No. 9 10-2.3.2							12/30/11 16:10	bsu

Wet Chemistry

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Nitrogen, ammonia (Water)	M350.1 - Automated Phenate	R	~~U~~	~~*~~	~~mg/Kg~~	~~0.5~~	~~3~~	~~01/05/12 17:58~~	tcd
Nitrogen, total Kjeldahl, water extract	M351.2 - Block Digestor	4.1	H	*	mg/Kg	0.5	3	01/05/12 0:32	pjb

J HT-L

EB 03/30/12

** Please refer to Qualifier Reports for details.*

Freeport-McMoRan - Chino Mines Company
Project ID: ZN000000J8
Sample ID: STS-AMD-2011-EREF2 6

ACZ Sample ID: *L92224-20*
Date Sampled: *10/06/11 09:00*
Date Received: *12/07/11*
Sample Matrix: *Soil*

Inorganic Prep

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Nitrogen, total Kjeldahl, water extract	M351.2 - Block Digestor		H	*				01/04/12 15:00	lhb

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Water Extraction	ASA No. 9 10-2.3.2							12/30/11 16:30	bsu

Wet Chemistry

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Nitrogen, ammonia (Water)	M350.1 - Automated Phenate	R	~~U~~	~~*~~	~~mg/Kg~~	~~0.5~~	~~3~~	~~01/05/12 17:50~~	~~tcd~~
Nitrogen, total Kjeldahl, water extract	M351.2 - Block Digestor	5.9 JHT-L	H	*	mg/Kg	0.5	3	01/05/12 0:33	pjb

EB 03/30/12

** Please refer to Qualifier Reports for details.*

Attachment C: Photographs of Woody Cover Transects along Drainages

Drainage Bank Study Photo Log

Freeport-McMoran Chino Mines Company
Vanadium, New Mexico
Smelter/Tailing Soils Investigation Unit Feasibility Study

Transect Photo ID	Transect Location	Longitude	Latitude
STS-BWC-2011-7-712	Drainage Bank	-108.125579	32.68687279
STS-BWC-2011-7-713	Drainage Bank	-108.125579	32.68687279
STS-BWC-2011-7-714	Upland	-108.125579	32.68687279
STS-BWC-2011-7-715	Upland	-108.125579	32.68687279
STS-BWC-2011-7-716	Upland	-108.125579	32.68687279
STS-BWC-2011-8-755	Drainage Bank	-108.1251833	32.68513381
STS-BWC-2011-8-756	Drainage Bank	-108.1251833	32.68513381
STS-BWC-2011-8-757	Upland	-108.1251833	32.68513381
STS-BWC-2011-8-758	Upland	-108.1251833	32.68513381
STS-BWC-2011-9-724	Drainage Bank	-108.1010343	32.6962483
STS-BWC-2011-9-725	Drainage Bank	-108.1010343	32.6962483
STS-BWC-2011-9-726	Drainage Bank	-108.1010343	32.6962483
STS-BWC-2011-9-727	Drainage Bank	-108.1010343	32.6962483
STS-BWC-2011-9-728	Upland	-108.1010343	32.6962483
STS-BWC-2011-9-729	Upland	-108.1010343	32.6962483
STS-BWC-2011-9-730	Upland	-108.1010343	32.6962483
STS-BWC-2011-10-707	Drainage Bank	-108.1014994	32.69957595
STS-BWC-2011-10-708	Drainage Bank	-108.1014994	32.69957595
STS-BWC-2011-10-709	Drainage Bank	-108.1014994	32.69957595
STS-BWC-2011-10-710	Upland	-108.1014994	32.69957595
STS-BWC-2011-10-711	Upland	-108.1014994	32.69957595
STS-BWC-2011-11-759	Drainage Bank	-108.1005023	32.70313759
STS-BWC-2011-11-760	Drainage Bank	-108.1005023	32.70313759
STS-BWC-2011-11-761	Drainage Bank	-108.1005023	32.70313759
STS-BWC-2011-11-762	Drainage Bank	-108.1005023	32.70313759
STS-BWC-2011-11-763	Upland	-108.1005023	32.70313759
STS-BWC-2011-11-764	Upland	-108.1005023	32.70313759
STS-BWC-2011-11-765	Upland	-108.1005023	32.70313759
STS-BWC-2011-12-718	Drainage Bank	-108.1058242	32.69997892
STS-BWC-2011-12-719	Drainage Bank	-108.1058242	32.69997892
STS-BWC-2011-12-720	Drainage Bank	-108.1058242	32.69997892
STS-BWC-2011-12-721	Upland	-108.1058242	32.69997892
STS-BWC-2011-12-722	Upland	-108.1058242	32.69997892
STS-BWC-2011-12-723	Upland	-108.1058242	32.69997892


Transect Photo ID: STS-BWC-2011-1-687


Transect Photo ID: STS-BWC-2011-1-688
Location: Upland


Transect Photo ID: STS-BWC-2011-1-689
Location: Drainage Bank


Transect Photo ID: STS-BWC-2011-1-690
Location: Drainage Bank

Transect Photo ID: STS-RWU-2012-2-693
Location: Upland


Transect Photo ID: STS-RWU-2012-2-694
Location: Upland

FREEPORT-MCMORAN CHINO MINES COMPANY
VANADIUM, NEW MEXICO

ATTACHMENT C IN APPENDIX D

DRAINAGE BANK PHOTO LOG

ARCADIS

ATTACHMENT C


Transect Photo ID: STS-BWC-2011-2-695
Location: Drainage Bank


Transect Photo ID: STS-BWC-2011-2-696
Location: Drainage Bank


Transect Photo ID: STS-BWC-2011-2-697
Location: Drainage Bank


Transect Photo ID: STS-BWC-2011-3-698
Location: Upland


Transect Photo ID: STS-BWC-2011-3-699
Location:Upland


Transect Photo ID: STS-RWU-2011-3-700
Location: Drainage Bank

FREEPORT-MCMORAN CHINO MINES COMPANY
VANADIUM, NEW MEXICO

ATTACHMENT C IN APPENDIX D

DRAINAGE BANK PHOTO LOG

ARCADIS

ATTACHMENT C


Transect Photo ID: STS-BWC-2011-3-701
Location: Drainage Bank


Transect Photo ID: STS-BWC-2011-3-702
Location: Drainage Bank


Transect Photo ID: STS-BWC-2011-4-749
Location: Drainage Bank


Transect Photo ID: STS-BWC-2011-4-750
Location: Drainage Bank


Transect Photo ID: STS-BWC-2011-4-751
Location: Drainage Bank


Transect Photo ID: STS-BWC-2011-4-752
Location: Upland

FREEPORT-MCMORAN CHINO MINES COMPANY
VANADIUM, NEW MEXICO

ATTACHMENT C IN APPENDIX D

DRAINAGE BANK PHOTO LOG

ARCADIS

ATTACHMENT C

Transect Photo ID: STS-BWC-2011-4-753
Location: Upland

Transect Photo ID: STS-BWC-2011-4-754
Location: Upland

Transect Photo ID: STS-BWC-2011-5-766
Location: Drainage Bank

Transect Photo ID: STS-BWC-2011-5-767
Location: Drainage Bank

Transect Photo ID: STS-BWC-2011-5-768
Location: Drainage Bank

Transect Photo ID: STS-BWC-2011-5-769
Location: Upland

FREEPORT-MCMORAN CHINO MINES COMPANY
VANADIUM, NEW MEXICO

ATTACHMENT C IN APPENDIX D

DRAINAGE BANK PHOTO LOG

ARCADIS

ATTACHMENT C


Transect Photo ID: STS-BWC-2011-5-770
Location: Upland


Transect Photo ID: STS-BWC-2011-5-775
Location: Drainage Bank


Transect Photo ID: STS-BWC-2011-6-703
Location: Drainage Bank


Transect Photo ID: STS-BWC-2011-6-704
Location: Drainage Bank


Transect Photo ID: STS-BWC-2011-6-705
Location: Upland

FREEPORT-MCMORAN CHINO MINES COMPANY
VANADIUM, NEW MEXICO

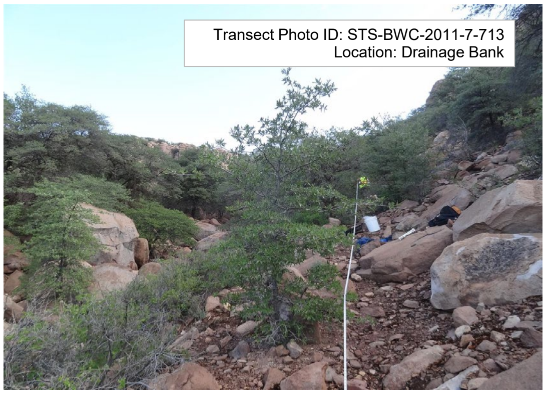
ATTACHMENT C IN APPENDIX D

DRAINAGE BANK PHOTO LOG

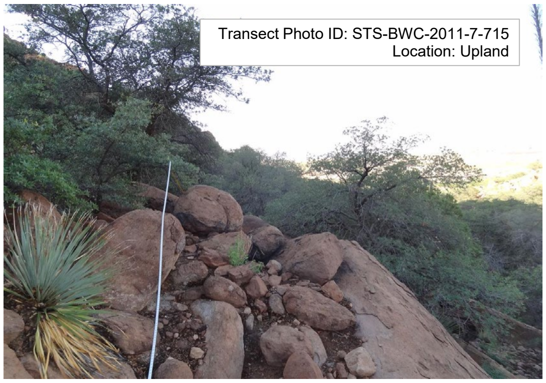
ARCADIS

ATTACHMENT C


Transect Photo ID: STS-BWC-2011-7-712
Location: Drainage Bank


Transect Photo ID: STS-BWC-2011-7-713
Location: Drainage Bank


Transect Photo ID: STS-BWC-2011-7-714
Location: Upland


Transect Photo ID: STS-BWC-2011-7-715
Location: Upland


Transect Photo ID: STS-BWC-2011-7-716
Location: Upland

FREEPORT-MCMORAN CHINO MINES COMPANY
VANADIUM, NEW MEXICO

ATTACHMENT C IN APPENDIX D

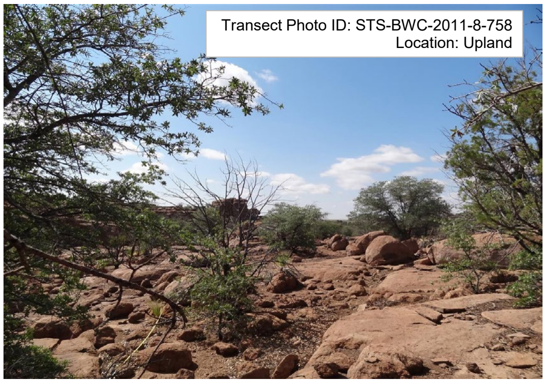
DRAINAGE BANK PHOTO LOG

ARCADIS

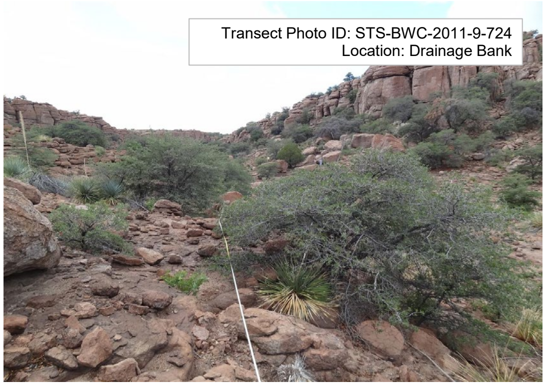
Transect Photo ID: STS-BWC-2011-8-755
Location: Drainage Bank

Transect Photo ID: STS-BWC-2011-8-756
Location: Drainage Bank

Transect Photo ID: STS-BWC-2011-8-757
Location: Upland



Transect Photo ID: STS-BWC-2011-8-758
Location: Upland



Transect Photo ID: STS-BWC-2011-9-724
Location: Drainage Bank

Transect Photo ID: STS-BWC-2011-9-725
Location: Drainage Bank

FREEPORT-MCMORAN CHINO MINES COMPANY
VANADIUM, NEW MEXICO

ATTACHMENT C IN APPENDIX D

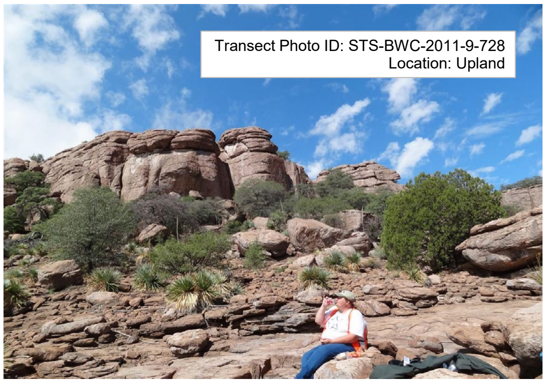
DRAINAGE BANK PHOTO LOG

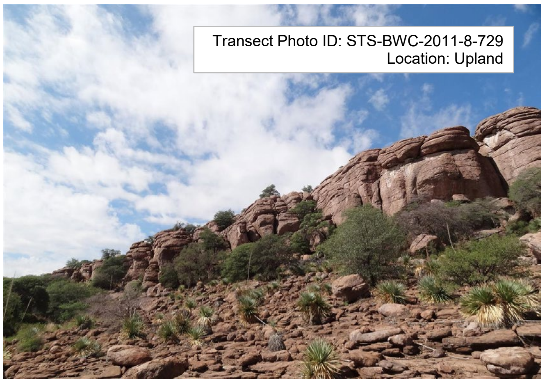
ARCADIS

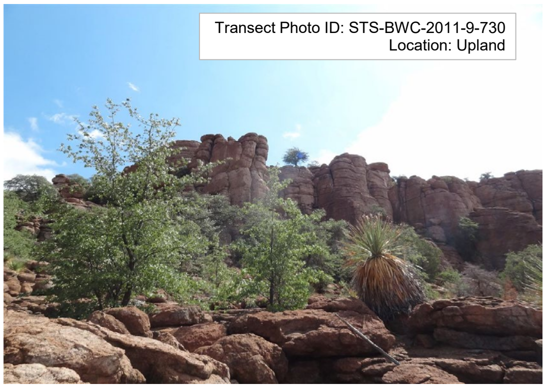
ATTACHMENT C
Page 7


Transect Photo ID: STS-BWC-2011-9-726
Location: Drainage Bank


Transect Photo ID: STS-BWC-2011-9-727
Location: Drainage Bank


Transect Photo ID: STS-BWC-2011-9-728
Location: Upland


Transect Photo ID: STS-BWC-2011-8-729
Location: Upland


Transect Photo ID: STS-BWC-2011-9-730
Location: Upland


Transect Photo ID: STS-BWC-2011-10-707
Location: Drainage Bank

FREEPORT-MCMORAN CHINO MINES COMPANY
VANADIUM, NEW MEXICO

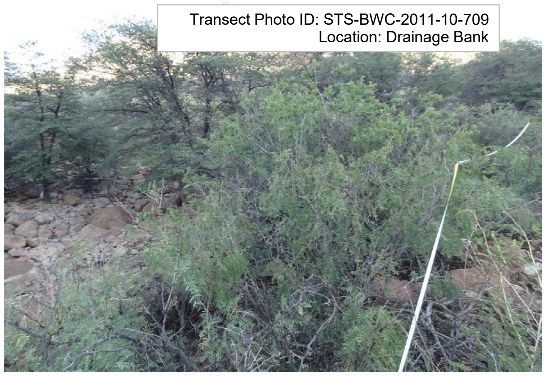
ATTACHMENT C IN APPENDIX D

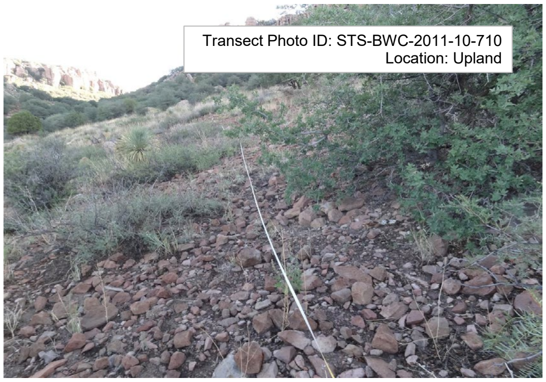
DRAINAGE BANK PHOTO LOG

ARCADIS

ATTACHMENT C


Transect Photo ID: STS-BWC-2011-10-708
Location: Drainage Bank


Transect Photo ID: STS-BWC-2011-10-709
Location: Drainage Bank


Transect Photo ID: STS-BWC-2011-10-710
Location: Upland


Transect Photo ID: STS-BWC-2011-10-711
Location: Upland


Transect Photo ID: STS-BWC-2011-11-759
Location: Drainage Bank

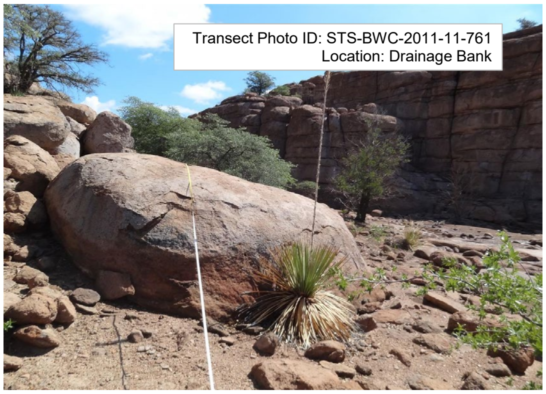

Transect Photo ID: STS-BWC-2011-11-760
Location: Drainage Bank

FREEPORT-MCMORAN CHINO MINES COMPANY
VANADIUM, NEW MEXICO

ATTACHMENT C IN APPENDIX D

DRAINAGE BANK PHOTO LOG

ARCADIS


Transect Photo ID: STS-BWC-2011-11-761
Location: Drainage Bank


Transect Photo ID: STS-BWC-2011-11-762
Location: Drainage Bank


Transect Photo ID: STS-BWC-2011-11-763
Location: Upland


Transect Photo ID: STS-BWC-2011-11-764
Location: Upland


Transect Photo ID: STS-BWC-2011-11-765
Location: Upland

FREEPORT-MCMORAN CHINO MINES COMPANY
VANADIUM, NEW MEXICO

ATTACHMENT C IN APPENDIX D

DRAINAGE BANK PHOTO LOG

ARCADIS


Transect Photo ID: STS-BWC-2011-12-718
Location: Drainage Bank


Transect Photo ID: STS-BWC-2011-12-719
Location: Drainage Bank


Transect Photo ID: STS-BWC-2011-12-720
Location: Drainage Bank


Transect Photo ID: STS-BWC-2011-12-721
Location: Upland


Transect Photo ID: STS-BWC-2011-12-722
Location: Upland


Transect Photo ID: STS-BWC-2011-12-723
Location: Upland

FREEPORT-MCMORAN CHINO MINES COMPANY
VANADIUM, NEW MEXICO

ATTACHMENT C IN APPENDIX D

DRAINAGE BANK PHOTO LOG

ARCADIS

Attachment D: Woody Cover Field and Remote Sensing Data along Drainages

Attachment Table D-D-1. Drainage bank study data.

Date sampled	Location_ID of Transect	GPS Starting Point for Bank Transect[1]				Field Woody Cover (%)[2]		Remote Sensing Woody Cover (%)		Bank dominant species	Adjacent upland dominant species	Photograph Information		Soil Chemistry		
		State Plane x coord	State Plane_y coord	Latitude	Longitude	Bank	Upland	Bank	Upland			Photo numbers	Photo notes	Cu (mg/kg)	pH (SU)	pCu calculated (ephemeral equation)
9/14/2011	STS-BWC-2011-1	2638190	620323	32.705	-108.109	64	0	89	0	oak, mesquite	oak trees in bedrock but missed on transect	687-690	upland is 688	766	5.2	5.11
9/14/2011	STS-BWC-2011-2	2639560	619139	32.702	-108.105	85	81	36	51	oak (some willow)	mesquite	693-697	upland is 693-694	667	6	6.19
9/14/2011	STS-BWC-2011-3	2639480	622610	32.711	-108.105	66	63	64	51	oak, juniper	mesquite	698-702	upland is 698-699	622	5.4	5.41
9/16/2011	STS-BWC-2011-4	2637830	619720	32.703	-108.111	36	52	12	1	oak	oak	749-754	upland is 752-754	521	4.9	4.78
9/16/2011	STS-BWC-2011-5	2639910	619599	32.703	-108.104	48	13	2	0	oak	oak	766-770	upland is 769-770	975	4.9	4.67
9/14/2011	STS-BWC-2011-6	2639070	621388	32.708	-108.106	86	64	95	48	oak (some mesquite)	mesquite (some oak)	703-705	upland is 705	426	5.6	5.74
9/15/2011	**STS-BWC-2011-7**	2633180	613744	32.687	-108.126	85	83	92	100	oak (some juniper)	oak (some juniper)	712-716	upland is 714-716	2110	5.5	5.32
9/16/2011	STS-BWC-2011-8	2633300	613111	32.685	-108.125	38	32	0	13	oak	oak	755-758	upland is 757-758	691	4.5	4.20
9/15/2011	**STS-BWC-2011-9**	2640740	617135	32.696	-108.101	50	54	41	62	oak (some juniper)	oak (some mesquite)	724-731	upland 728-731	610	4.8	4.62
9/15/2011	**STS-BWC-2011-10**	2640600	618346	32.700	-108.102	89	60	94	44	oak (some juniper, mesquite)	mesquite (some oak)	707-711	upland is 710-711	972	5.6	5.59
9/16/2011	STS-BWC-2011-11	2640910	619641	32.703	-108.100	49	48	3	0	oak	oak	759-765	upland is 763-765	1590	4.6	4.19
9/15/2011	**STS-BWC-2011-12**	2639270	618496	32.700	-108.106	70	46	69	47	oak (small mahogany)	oak (some mesquite)	718-723	upland is 721-723	709	5.2	5.12

[1] 0 m (southern end) is always at GPS point in table (or closest point on bank to GPS since points off somewhat on mapped hydrography). Drainage D3 transects, focus of analysis because has copper > 1600 mg/kg, are bolded.

[2] Canopy cover was estimated for all woody species (trees, shrubs) intersecting line intercept or that would intercept it if tape were moved to within 7.5' on either side of transect.

Placement of tape could not always follow irregular line of trees on bank, and to make upland estimate comparable, both used the 15' strip method.

Therefore canopy cover is not true canopy cover for woody species but an index for comparison of banks to upland areas, and remote sensing estimate is closer to true estimate.

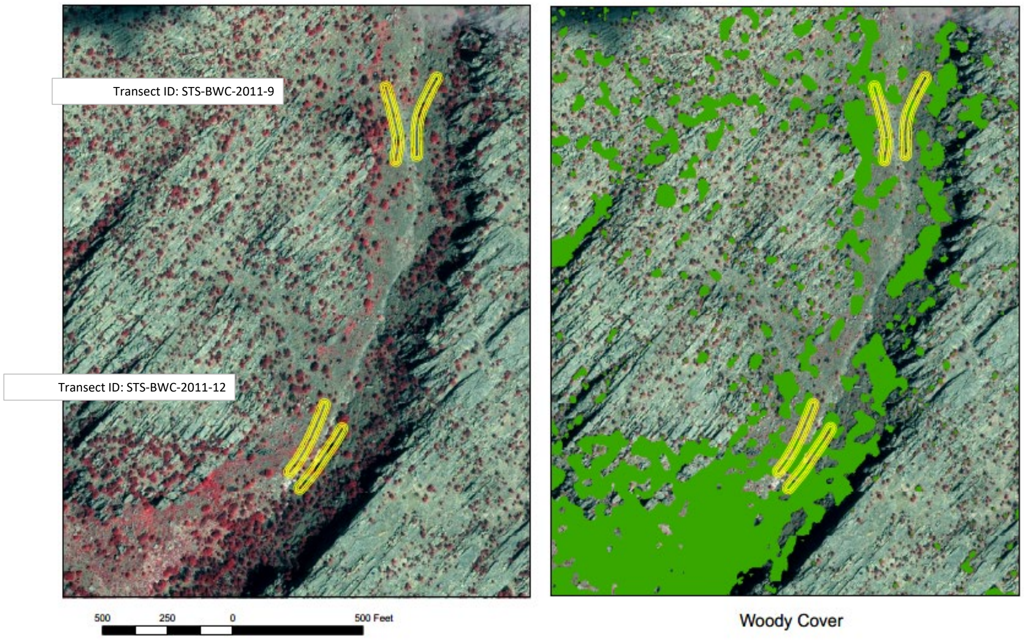
[3] Soil samples were composite of 3 samples at 0 feet, 150 feet, and 300 feet sieved to < 2 mm. Sample interval was 0-6" depth below ground surface mostly (some 0-4" if hit refusal because soil shallow).

Attachment Table D-D-2. Distance (feet) with no woody vegetation on 300-foot tape using line-intercept sampling. Subtract from 300 feet of the tape and divide by 300 to calculate percent cover.

	Site 1 (bank)	Site 1 (upland)	Site 2 (bank)	Site 2 (upland)	Site 3 (bank)	Site 3 (upland)	site 4 (bank)	site 4 (upland)	site 5 (bank)	site 5 (upland)	Site 6 (bank)	site 6 (upland)	site 7 (bank)	site 7 (upland)	site 8 (bank)	site 8 (upland)	site 9 (bank)	site 9 (upland)	site 10(bank)	site 10 (upland)	site 11 (bank)	site 11 (upland)	site 12 (bank)	site 12 (upland)
	21.6	300	2.8	31	18	13	45	16	4	10	2	1	1	3	63	5	13	3	10	8	19	3	10	29
	23.3		17.5	0.25	14	13	64	17	27	150	1	42	2	1	45	21	12	17	7	28	61	40	3	11
	7.6		4.2	1	3	6	14	2	53	100	4	6	4	2	34	38	8	17	16	1	14	9	32	8
	3.3		3.7	2	4	2	15	5	73		12	4	5	4	3	4	6	30	1	19	7	30	7	7
	13.2		2.0	7.8	4	6	17	13			14	9	2	12	3	18	4	18		2	3	2	6	90
	38.6		14.0	10.9	13	1	12	15			5	6	7	4	28	117	73	5		6	49	71	10	16
				3	15	4	25	48			3.5	10	20	4	11		26	23		5			15	
					5	1		29				7	3	11			9	26		6			7	
					5	2						24		4						11				
					5	4								1						22				
					2	1								1						8				
					13	2								1						5				
					1	8								1										
						48								3										
Sum	108	300	44	56	102	111	192	145	157	260	41.5	109	44	52	187	203	151	139	34	121	153	155	90	161
% cover	64%	0%	85%	81%	66%	63%	36%	52%	48%	13%	86%	64%	85%	83%	38%	32%	50%	54%	89%	60%	49%	48%	70%	46%

Note: Site X is the same as STS-BWC-2011-X.

Example of 2 of the 4 Transects on Aerial Image on which Woody Cover was Estimated (left image is near infrared photo, right is remote sensing classification of woody cover in green)

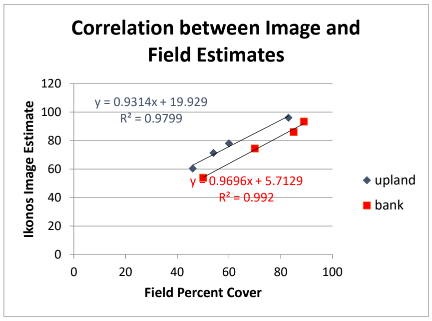


Comparison of Percent Woody Cover in Drainage D3 Transects from Image and Field.

Transect ID	Ikonos Woody Cover	Field Estimate	Difference by type & transect ID	Average difference by Transect ID
Upland				
STS-BWC-2011-9	71	54	17	10.7
STS-BWC-2011-12	60	46	14	9.5
STS-BWC-2011-7	96	83	13	7.1
STS-BWC-2011-10	78	60	18	11.3
Bank				
STS-BWC-2011-9	54	50	4	--
STS-BWC-2011-12	75	70	5	--
STS-BWC-2011-7	86	85	1	--
STS-BWC-2011-10	93	89	4	--

Average upland	77	61	16
Average bank	77	74	3
Average Difference	10		

Average of entire bank of Drainage D3 from remote sensing:	70
Average of entire upland of Drainage D3 from remote sensing:	77



Note: transects are incomplete representation of entire bank and upland and only used to ground truth the remote sensing estimates, which is the method that will evaluate the entre banks and upland of drainage.

FREEPORT-MCMORAN CHINO MINES COMPANY
VANADIUM, NEW MEXICO

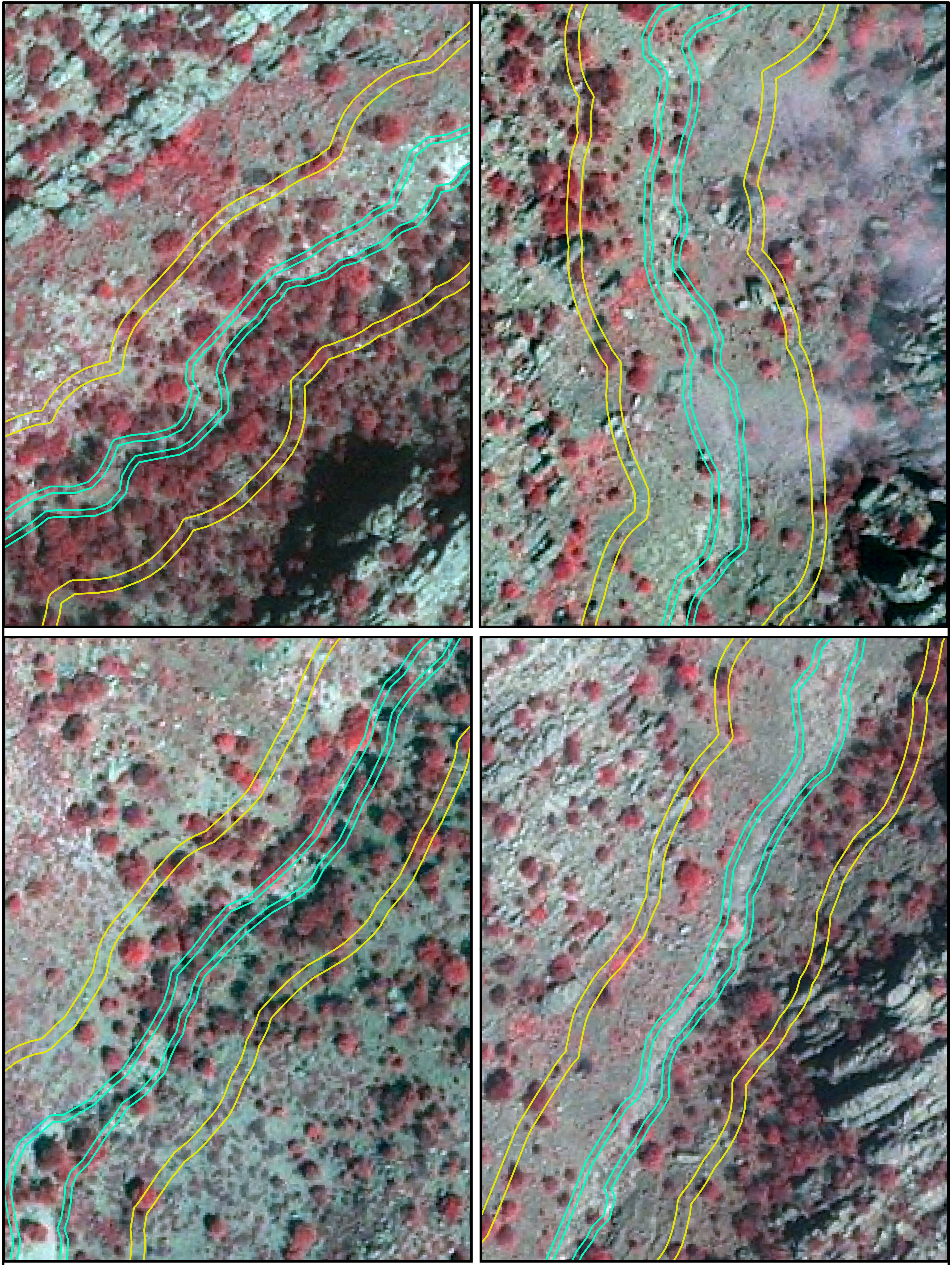
ATTACHMENT D IN APPENDIX D

ACCURACY OF REMOTE SENSING ESTIMATES OF WOODY COVER

ARCADIS

ATTACHMENT D
Figure D-D-1

OFFICE: LAKEWOOD DB: MLM TM: MB PM: AT
PROJECT# B0063543.0000
T:_ENV\Chino\2022\MXD\FS\D-D-02_WoodyVegetationClass.mxd



LEGEND:

🟦 Bank
🟨 Upland

NOTE:
Percent cover estimated from classification of
IKONOS imagery (dated 09/04/2011).

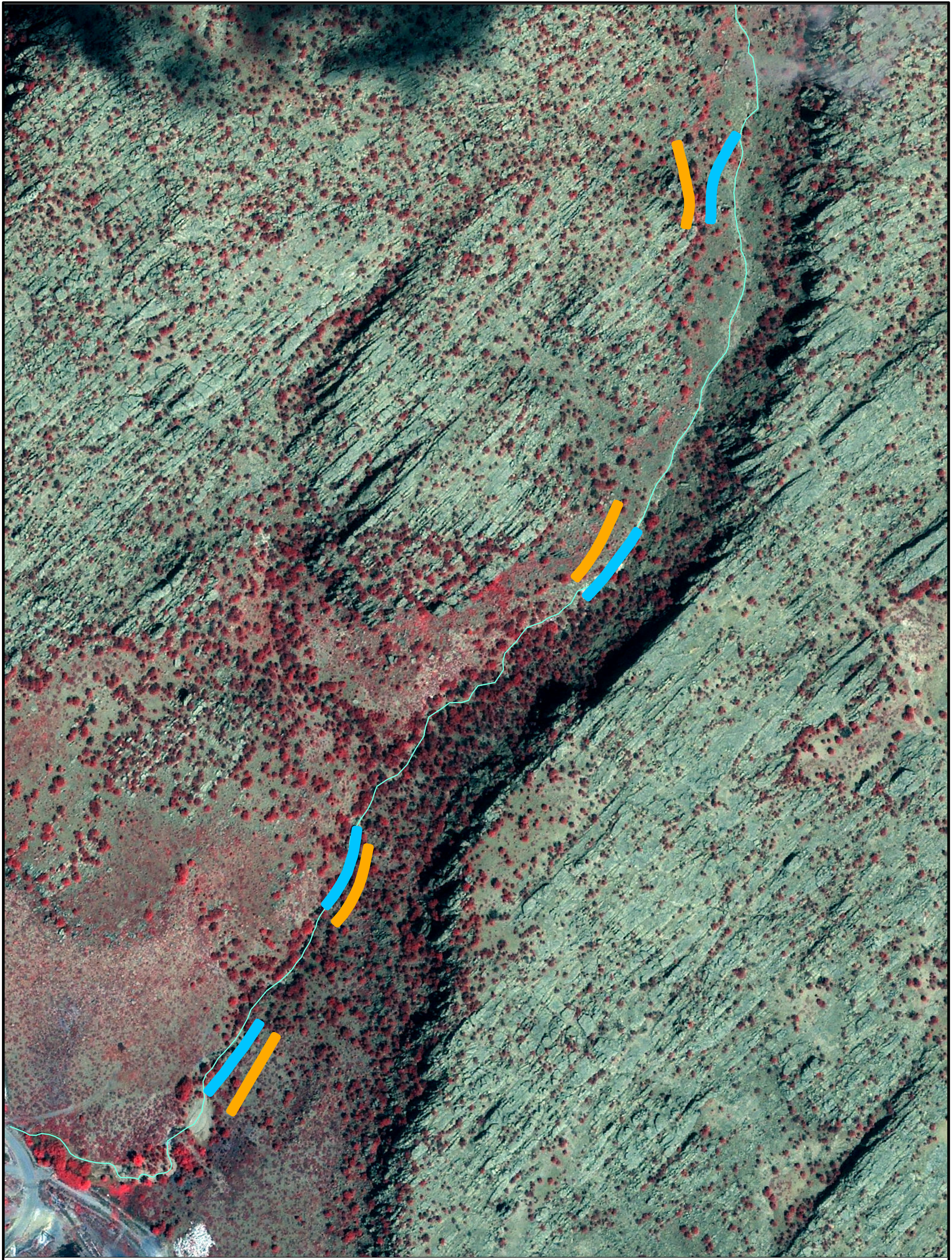
FREEPORT-MCMORAN CHINO MINES COMPANY
VANADIUM, NEW MEXICO
SMELTER/TAILINGS SOILS IU FS, APPENDIX D, ATTACHMENT D

BUFFERS ON WOODY VEGETATION CLASSIFICATION

ARCADIS

FIGURE
D-D-2

OFFICE: LAKEWOOD DB: MLM TM: MB PM: AT
PROJECT# B0063543.0000
T:_ENV\Chino\2022\MXD\FS\D-D-03_Drainage_Transects.mxd



LEGEND:

▬ Bank Transect
▬ Upland Transect
— Approximate Drainage Centerline

0 300 600 Feet
GRAPHIC SCALE

Imagery Source: Ikonos, dated 09/04/2011.

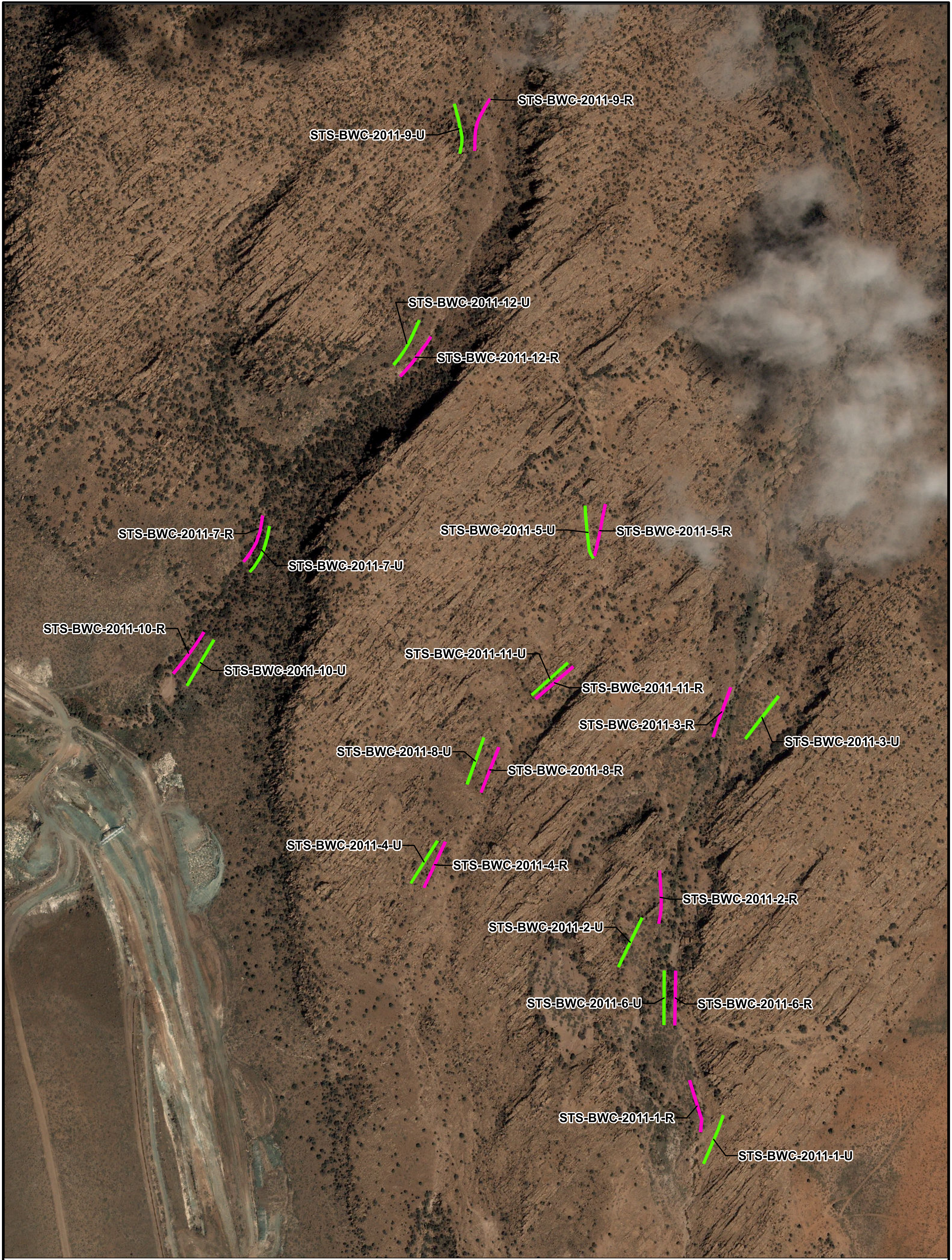
FREEPORT-MCMORAN CHINO MINES COMPANY
VANADIUM, NEW MEXICO
SMELTER/TAILINGS SOILS IU FS, APPENDIX D, ATTACHMENT D

FIELD TRANSECTS OF UPLAND AND BANK TRANSECTS FOR DRAINAGE D3

ARCADIS

FIGURE
D-D-3

OFFICE: LAKEWOOD DB: MLM TM: MB PM: AT
PROJECT# B0063543.0000
T:_ENV\Chino\2022\MXD\FS\D-04_Woody Vegetation Stream Transects.mxd



LEGEND:

🟪 Bank Transect

🟩 Upland Transect

0 500 1,000 Feet

GRAPHIC SCALE

Imagery Source: Ikonos, dated 09/04/2011.

FREEPORT-MCMORAN CHINO MINES COMPANY
VANADIUM, NEW MEXICO
SMELTER/TAILINGS SOILS IU FS, APPENDIX D, ATTACHMENT D

LOCATION OF FIELD TRANSECTS MEASURING WOODY COVER

ARCADIS

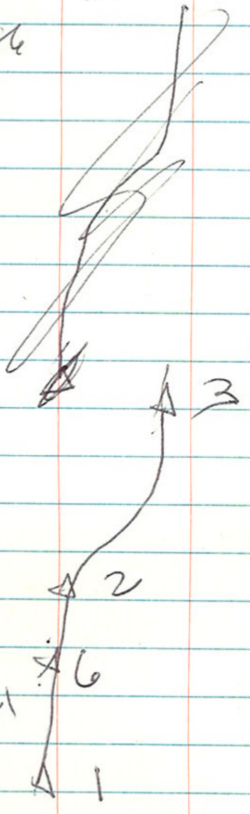
FIGURE
D-D-4

AOC
Sampling
at Chino

Rangeland Condition
(COAT)
Wildlife Habitat
condition —
richness +
cover

Woody Cover on
drainages vs.
nearby upland

Photo
102-0684 – other areas
to around site ~~@~~ RWA-9
102-0686



frog–site BWC-1
= photo
102-0692

Photo
102-0688 = upland near
site BWC-1

Photos
102-0691 = between channels
0694, 0693 – exposure and
& banks

9-14-11 Site 1 cm

Bank on ephem. drainage water in places

Veg & Soil Sampling

Line Intercept

Bank

~~249~~
~~296 8"~~ mostly oak
21'7" – 25,7" ~~open~~ 21,7 fuel
~~85~~ 23.3
48,10" to 84,8" manzanita 7,17
62,3" – ~~66,8"~~ oak
~~65,2~~ – 93,9" 3,4
97,1 – 127,5 13,2
140,7 to 261,5 38.7

photo 102-0687, 0689, 0690

642

300' tape

site BWC-2011-1 = site 1
~~apron~~ bank

exposure unit is wide between
~~Upland~~ many channel
between channel
< middle
area ~~0 woody cover~~
lots mesquite
1 [illegible]
lots of ——— Shrub

GPS beg/end of upland
+ middle

Upland Site 1 BWC1

tape { BWC1US south end tape
BWC1UM M middle
BWC1UN N – north end tape

0 woody for site 1 upland – bedrock
on upland photo 102-0688

0%

Tx load out – mussed
few oak trees in upland bedrock

3 samples 5 cm composite 1 [illegible] → BWC-2011-1
~~BWC~~
Bank-1

Collected by Vic, Phil + Fred, Pam

15' wide strip

Site ~~0~~ 2 9/14/11
10:05

BWC – ~~bank~~
bank

3 steps either side
~10' strip
on either side

open ft

0 – 18'
20.9 – 24.0 2.9
17.6
41.6 – ~~98~~ 106.10
4.2
111 – 115 ~~0~~
~~3.0~~ 3.8
118.8' – ~~178~~ ~~199~~ 199'
not true C.C oak
201' – 257' willow
2
268 – 300 ~~80%~~ site 6 R 85% ~~0~~14

photo 102-0695: 696
to 0697

upland open ft
31' – 66 mesquite misty 31
.3
66.3 – 97 on flats 1.2
98.2 – 111 2

photo 693-694
102-~~0695~~ ~~to 0699~~

113 – ~~128~~

~~[illegible]~~ – 143,2

~~143,5 – [illegible]~~ 7,80

151 – 153,6 10,41

164,5 – ~~[illegible]~~ 239 3

246 – 300' 812

Site 3 Bank 1:35 cm vm pH pp JA

lots Carex sunburnt grass

0-21' 18

45'-63' oak

14

77'-95' 3

98'-108' juniper 4

trees – oak

Photo 0020200

---

112 – 122' 4

126' – 132' 13

145' – 175' 15

190' – 214' 5

219' – 229' 5

5

234' – 238' 662

240' – 269' 2

13 [illegible]

282' – 299'

9/14 Site 3 2:50 pm cm, vm etc.

BWC – 3 Upland

13

0 – 14' mesquite

27 – 57' 13

70' – 89'

	open (ft)
95 – 113	6
115 – 126	2
132 – 144'	6
148 – 151'	1
155' – 174'	4
175' – 188'	1
190' – 205'	2
209 – 214	4
215 – 219	1
221 – 226	2
234 – 245.5	8

3 paces small
other side included

293.5 – 295 48

632

Dun 698 – 702

– Site 3 banks

~~3 before~~ – riparian & 2
700 – 702
then upland types
698, 699 ST & in mesquite

Site 6
bank

	open ft.
	3.5
296.5 – 276 mesquite	5
271 – 265	14
251 – 243 oak	12
231 – 159	4

862

155 - 62 oak ? Dup/ 102-0204 102-0703

61 - 59 - mesquite 1

57 - 0 2 open pit

upland

~~300-284~~ ?

300-299 oak

257 - 256 island between channel 42

~~23~~ 250 - ~~23~~ 227 6

4

mesquite

223-179 9

170-162 95-31 6

25-

156-135 Mub/ 102-0708 10

125 - 109 7

102 - 49 ~~24~~ 24

Dup at Site Awc 6 -DUP

25 - 0 sage mesquite

1.42

Whirlpack - soil

9-15-11 Cm

Drainage bank sampling

Photo 707-709

Site 10

Bank woody cover

line intercept' - 300' tape

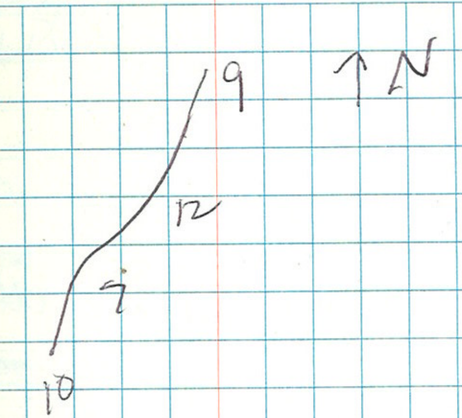
Gap ft
0-51
10 61-99 oak - dow
7 106-~~133~~ 159 juniper
16 ~~132~~ soapbe
mesquite
1 175-268 (892)
269-300

Upland

mesquite ← dow
oak

	Open (ft)
300-274	8
268-260	28
232-211	1
210-196	19
177-164	2

9-15-11 Cm



Upland cont'd Site 10
162-157
6 ~~14~~
5 151-126 Photo 710-711
6 121-117
111-104
11 93-91
22 69-45
8 37-24 (602)
5 21-0

Con Site 7 9-15-11
8:40 am

Open ft Bank Photo
712-713

1 0-14
2 15-89
4 91 - ~~87~~ 131 all
5 oak
2 135 - ~~139~~ 143 ~~little~~
148 - 213 one
jungle
215 - 227 & mesquite
7 234 - ~~236~~ ~~242~~ 268
~~242~~
20 288-292 oak
3 295-300

855

Con Site 7 10:05 9-15-11

Upland Photo

714-716
Open (ft) 717 =
across
~~[illegible]~~ drainage
upland slot -
3 300-285 oak
259
282 - ~~278~~ ~~274~~ oak - ~~small~~
Slymh-lily
2 ~~270-268~~
1 258-252
2 250-209 oak
4 205-199
12 187-184
4 180-177 oak
4 173-140
11 129-76 oak - jungle
4 72-62
1 61-059
1 58-45 oak
1
1 44 11 10-4
3

833

no water

9-15-11 Site 12 cm
9:40 am

photo
718-720

Bank

open ft		
10	10 - 38	oak
3	41 - 51	
32	83 - 130	
7	137 - 142	oak
6	148 - 163	
10	173 - 234	
15	249 - 280	small mahogany
7	287 - 380	
	44 -	

70%

~7' on each side
15' swath

Upland

Open ft		
29	271 - 243	oak
11	232 - 224	mesquite
8	216 - 194	oak/[illegible] some mesq.
7	187 - 168	mesq.
90	78 - 61	
	~~82~~	
14	45 - 37	

photo
721-723

46%

[illegible]

9-15-11 Site 9 Can

Bank

Open ct

13-33 13

12

45-61 oak 8

6

69-78 4

94-135

Photos
724-725

139-160 73

233-246 juniper 26

272-291

oak 9

~~54-0 mesquite~~

OK

50%

9-15-11 Site 9 Can

Upland

Photos
726-727

0-2928 3

289-288 oak 17

271-263 17

246-224 mesquite 30

194-187 18

169-161 5

156-124 oak 23

101-80 26

54-0 mesquite

54%

728-731
photos of
cliffs around

Site 9

BWC-4
CM Site 4 9-16-11
pp
Nick Lemme Bank

Line intercept for % woody cover

749-751

~~701~~
750-751
are down
then upstream
pics

open ft
45
45-92 45
oak
156-171 64
185-195 14
210-220 15
17
237-246 12
25
249-265
290-300

~~223-212~~
207-199
~~166-175~~

36%

Jumper at RWC-7 BWC-4 Site 4

9-16-11

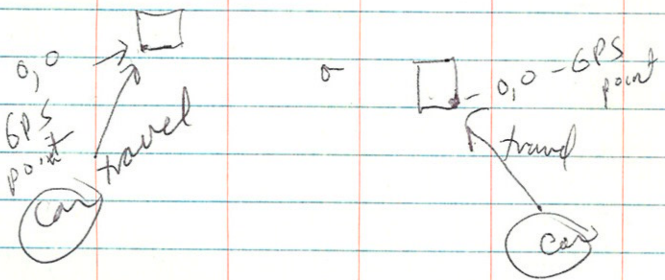
Upland
16
284-268 17
2
251-237 5
bag
235-212 13
~~182~~ 15 photos
752-754
~~223-212~~ 48
207-199 29
166-175
160-153
~~164~~
106-91
62-41

52%

Direction of photos
Note 1st photos South
are ~~do~~ ends + 2nd
set are northern ends for bank + opposite for upland
~~for drainage~~
~~photos~~ of those
BWC locations

for 9/12–9/16

Note direction of photos of ~~veg~~ wildlife plots is usually from NE or NW corner 1st established as GPS point – plot set up depends on direction came from to access site.



other photos close-ups of vegetation condition or landscape panorama photo – see air photo for direction + aspect of latter photos.

OAT scores for polygons are those score given for 200 m – similar when looked around.

Did not have time to ground truth whole polygon – but observed as walked/drove into areas to access the GPS point.

Pam Pinson – helped 9/12–9/16
Senior Environmental Engineer
Nick Lemme) helped 9/14/11
Environmental Technician
Candy Meyer – 9/12–9/16
Principal Ecologist

Phil Harrigan
Chin ADC manager } helped from 9/12-9/15
Joe Allen } helped from 9/13-9/15

Victor Meyer } helped from 9/12-9/14

Site BWC-8

9/16/11

Bank

63-76' 63
oak 45
121-140 34
174-~~194~~ 202 3
3
28
~~202~~- 11
205 - 215
Photos
~~255~~-256
N end tape
5,6 = S end tape
2~~1~~8-234
262-284
295-300
℄ riparian → BWC8RP - GPS
N end tape
BWC8RS S end tape
38

Site 8 9/16/11 Cm

Upland

295-286 5

21

38

4

265 - ~~245~~ 234 oak 18

119

~~225~~ -

photos

196 - 187 757-758

1 N

183 - 177 5

159 - 154

37 - ~~[illegible]~~ 0

322

upland ↓ BWC8UN north end

BWC8US ↑ south end tape

BWC Site 11 9/16/11 Cm

Bank

19 - 36 19

61

14

97 - 110 oak 7

3

124 - 185 49

192 - 211

214 - 243

292 - 300

Photos

759-742

1

p

2nd

1st 2

2

N. end (looking S)

S. end (looking N)

493

Site 11 9/16/11 Cm

Upland

Photos

743 – 765
Need Send

764
4
middle
today
down
on
river

300 – 290
3 287 – 240
40 200 – ~~161~~ 169 oak
9 ~~169 – 161~~
30 161 – 150
2
71 120 – 95
93 – 71

48%

9/16/11 Site 5 BLUC-5 Cm

Bank

open (ft)
4
21
53
73

Photos
766 Need r.pam
747-748 Send

296 – 282
255 – 233
150 – 161 oak
88 – 64

Upland
10 – 27 10 150 100 oak
177 – 200

Photos
769 – Need ~30
Soil is from water on upland TX in S.

69%

Photos
769 – 770
N end lost one Send

Photos
771-775
Notes on Site 5
see rain effect on flow

RWU - rangeland

Site 2 photos

776 looking up plot

777 looking to right

778 looking behind
down valley.

132

~~BU~~C

See wildlife habitat forms for cover & richness data.

See OAT score forms for OAT scores

Attachment E: Laboratory Data Collected for the FS

Table E-2 Relative Percent Difference of Duplicate Pairs

Sample ID	Copper (mg/kg)			pH		
	Parent Sample	Duplicate	RPD	Parent Sample	Duplicate	RPD
STS-CG-2011-28	606	528	0.14	--	--	--
STS-PCUG-2011-7	387	613	0.45	7.7	--	--
STS-PCUG-2011-19	1210	1310	0.08	3.9	4	0.03
STS-CG-2011-43	626	567	0.10	--	--	--
STS-CG-2011-10	1930	2450	0.24	--	--	--
STS-CG-2011-42	958	1050	0.09	--	--	--
STS-PCUG-2011-29	671	555	0.19	5.2	4.9	0.06
STS-PCUG-2011-14	354	372	0.05	5.9	5.9	0.00
STS-PCUG-2011-31	304	261	0.15	22.5	22.3	0.01
STS-CG-2011-1	274	248	0.10	--	--	--

Notes:

Parent and duplicate laboratory analytical results are presented in Table E-1.

mg/kg = milligrams per kilogram

RPD = relative percent difference, calculated as the difference between the parent and duplicate samples divided by the average of the two samples.

ACZ Laboratories, Inc.
2773 Downhill Drive Steamboat Springs, CO 80487 (800) 334-5493

Analytical Report

October 21, 2011

Report to:	Bill to:
Pam Pinson	Pam Pinson
Freeport-McMoRan - Chino Mines Company	Freeport-McMoRan - Chino Mines Company
PO Box 10	P.O. Box 13308
Bayard, NM 88023	Phoenix, AZ 85002-3308

cc: Matthew Barkley, Sheri Fling

Project ID: ZN000000J8
ACZ Project ID: L90608

Pam Pinson:

Enclosed are the analytical results for sample(s) submitted to ACZ Laboratories, Inc. (ACZ) on September 20, 2011. This project has been assigned to ACZ's project number, L90608. Please reference this number in all future inquiries.

All analyses were performed according to ACZ's Quality Assurance Plan. The enclosed results relate only to the samples received under L90608. Each section of this report has been reviewed and approved by the appropriate Laboratory Supervisor, or a qualified substitute.

Except as noted, the test results for the methods and parameters listed on ACZ's current NELAC certificate letter (#ACZ) meet all requirements of NELAC.

This report shall be used or copied only in its entirety. ACZ is not responsible for the consequences arising from the use of a partial report.

All samples and sub-samples associated with this project will be disposed of after November 21, 2011. If the samples are determined to be hazardous, additional charges apply for disposal (typically less than $10/sample). If you would like the samples to be held longer than ACZ's stated policy or to be returned, please contact your Project Manager or Customer Service Representative for further details and associated costs. ACZ retains analytical reports for five years.

If you have any questions or other needs, please contact your Project Manager.

S. Habermehl

Scott Habermehl has reviewed
and approved this report.

Freeport-McMoRan - Chino Mines Company

Project ID:	ZN000000J8
Sample ID:	STS-BWC-2011-3
ACZ Sample ID:	***L90608-01***
Date Sampled:	*09/14/11 14:00*
Date Received:	*09/20/11*
Sample Matrix:	*Soil*

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010B ICP	622		*	mg/Kg	1	5	10/07/11 10:57	jjc

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
pH, Saturated Paste	USDA No. 60 (21A)	5.4		*	units	0.1	0.1	10/19/11 10:32	zsh
Solids, Percent	CLPSOW390, PART F, D-98	87.6		*	%	0.1	0.5	10/19/11 16:35	ndj

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							10/04/11 11:30	cra
Digestion - Hot Plate	M3050B ICP							10/06/11 13:52	mss2/nd
Saturated Paste Extraction	USDA No. 60 (2)							10/17/11 13:15	zsh
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							10/06/11 11:45	thf
Sieve-250 um (60 mesh)	ASA No.9, 15-4.2.2							10/06/11 11:45	thf

** Please refer to Qualifier Reports for details.*

Inorganic Analytical Results

Freeport-McMoRan - Chino Mines Company

Project ID:	ZN000000J8	ACZ Sample ID:	***L90608-02***
Sample ID:	STS-BWC-2011-4	Date Sampled:	*09/16/11 10:00*
		Date Received:	*09/20/11*
		Sample Matrix:	*Soil*

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010B ICP	521		*	mg/Kg	1	5	10/07/11 11:07	jjc

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
pH, Saturated Paste	USDA No. 60 (21A)	4.9		*	units	0.1	0.1	10/19/11 10:36	zsh
Solids, Percent	CLPSOW390, PART F, D-98	86.9		*	%	0.1	0.5	10/19/11 17:52	ndj

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							10/04/11 11:32	cra
Digestion - Hot Plate	M3050B ICP							10/06/11 14:45	mss2/nd
Saturated Paste Extraction	USDA No. 60 (2)							10/17/11 13:21	zsh
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							10/06/11 11:52	thf
Sieve-250 um (60 mesh)	ASA No.9, 15-4.2.2							10/06/11 11:52	thf

** Please refer to Qualifier Reports for details.*

Freeport-McMoRan - Chino Mines Company

Project ID:	ZN000000J8	ACZ Sample ID:	***L90608-03***
Sample ID:	STS-BWC-2011-5	Date Sampled:	*09/16/11 13:00*
		Date Received:	*09/20/11*
		Sample Matrix:	*Soil*

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010B ICP	975		*	mg/Kg	1	5	10/07/11 11:10	jjc

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
pH, Saturated Paste	USDA No. 60 (21A)	4.9		*	units	0.1	0.1	10/19/11 10:37	zsh
Solids, Percent	CLPSOW390, PART F, D-98	82.7		*	%	0.1	0.5	10/19/11 19:09	ndj

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							10/04/11 11:34	cra
Digestion - Hot Plate	M3050B ICP							10/06/11 15:02	mss2/nd
Saturated Paste Extraction	USDA No. 60 (2)							10/17/11 13:25	zsh
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							10/06/11 11:59	thf
Sieve-250 um (60 mesh)	ASA No.9, 15-4.2.2							10/06/11 11:59	thf

** Please refer to Qualifier Reports for details.*

Freeport-McMoRan - Chino Mines Company

Project ID:	ZN000000J8	ACZ Sample ID:	***L90608-04***
Sample ID:	STS-BWC-2011-6	Date Sampled:	*09/14/11 14:45*
		Date Received:	*09/20/11*
		Sample Matrix:	*Soil*

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010B ICP	426		*	mg/Kg	1	5	10/07/11 11:13	jjc

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
pH, Saturated Paste	USDA No. 60 (21A)	5.6		*	units	0.1	0.1	10/19/11 10:39	zsh
Solids, Percent	CLPSOW390, PART F, D-98	93.5		*	%	0.1	0.5	10/19/11 20:27	ndj

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							10/04/11 11:36	cra
Digestion - Hot Plate	M3050B ICP							10/06/11 15:20	mss2/nd
Saturated Paste Extraction	USDA No. 60 (2)							10/17/11 13:28	zsh
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							10/06/11 12:06	thf
Sieve-250 um (60 mesh)	ASA No.9, 15-4.2.2							10/06/11 12:06	thf

** Please refer to Qualifier Reports for details.*

Freeport-McMoRan - Chino Mines Company
Project ID: ZN000000J8
Sample ID: STS-BWC-2011-7

ACZ Sample ID: ***L90608-05***
Date Sampled: *09/15/11 09:10*
Date Received: *09/20/11*
Sample Matrix: *Soil*

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010B ICP	2110		*	mg/Kg	1	5	10/07/11 11:25	jjc

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
pH, Saturated Paste	USDA No. 60 (21A)	5.5		*	units	0.1	0.1	10/19/11 10:41	zsh
Solids, Percent	CLPSOW390, PART F, D-98	82.4		*	%	0.1	0.5	10/19/11 21:44	ndj

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							10/04/11 11:38	cra
Digestion - Hot Plate	M3050B ICP							10/06/11 15:37	mss2/nd
Saturated Paste Extraction	USDA No. 60 (2)							10/17/11 13:32	zsh
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							10/06/11 12:13	thf
Sieve-250 um (60 mesh)	ASA No.9, 15-4.2.2							10/06/11 12:13	thf

** Please refer to Qualifier Reports for details.*

Inorganic Analytical Results

Freeport-McMoRan - Chino Mines Company

Project ID: ZN000000J8
Sample ID: STS-BWC-2011-8

ACZ Sample ID: ***L90608-06***
Date Sampled: *09/16/11 11:00*
Date Received: *09/20/11*
Sample Matrix: *Soil*

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010B ICP	691		*	mg/Kg	1	5	10/07/11 11:29	jjc

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
pH, Saturated Paste	USDA No. 60 (21A)	4.5		*	units	0.1	0.1	10/19/11 10:43	zsh
Solids, Percent	CLPSOW390, PART F, D-98	87.8		*	%	0.1	0.5	10/19/11 23:01	ndj

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							10/04/11 11:41	cra
Digestion - Hot Plate	M3050B ICP							10/06/11 15:55	mss2/nd
Saturated Paste Extraction	USDA No. 60 (2)							10/17/11 13:35	zsh
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							10/06/11 12:20	thf
Sieve-250 um (60 mesh)	ASA No.9, 15-4.2.2							10/06/11 12:20	thf

** Please refer to Qualifier Reports for details.*

Freeport-McMoRan - Chino Mines Company

Project ID:	ZN000000J8	ACZ Sample ID:	***L90608-07***
Sample ID:	STS-BWC-2011-9	Date Sampled:	*09/15/11 10:45*
		Date Received:	*09/20/11*
		Sample Matrix:	*Soil*

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010B ICP	610		*	mg/Kg	1	5	10/07/11 11:32	jjc

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
pH, Saturated Paste	USDA No. 60 (21A)	4.8		*	units	0.1	0.1	10/19/11 10:45	zsh
Solids, Percent	CLPSOW390, PART F, D-98	93.9		*	%	0.1	0.5	10/20/11 0:18	ndj

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							10/04/11 11:43	cra
Digestion - Hot Plate	M3050B ICP							10/06/11 16:12	mss2/nd
Saturated Paste Extraction	USDA No. 60 (2)							10/17/11 13:39	zsh
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							10/06/11 12:27	thf
Sieve-250 um (60 mesh)	ASA No.9, 15-4.2.2							10/06/11 12:27	thf

** Please refer to Qualifier Reports for details.*

Inorganic Analytical Results

Freeport-McMoRan - Chino Mines Company
Project ID: ZN000000J8
Sample ID: STS-BWC-2011-10

ACZ Sample ID: ***L90608-08***
Date Sampled: *09/15/11 08:00*
Date Received: *09/20/11*
Sample Matrix: *Soil*

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010B ICP	972		*	mg/Kg	1	5	10/07/11 11:35	jjc

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
pH, Saturated Paste	USDA No. 60 (21A)	5.6		*	units	0.1	0.1	10/19/11 10:47	zsh
Solids, Percent	CLPSOW390, PART F, D-98	89.8		*	%	0.1	0.5	10/20/11 1:36	ndj

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							10/04/11 11:45	cra
Digestion - Hot Plate	M3050B ICP							10/06/11 16:30	mss2/nd
Saturated Paste Extraction	USDA No. 60 (2)							10/17/11 13:42	zsh
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							10/06/11 12:34	thf
Sieve-250 um (60 mesh)	ASA No.9, 15-4.2.2							10/06/11 12:34	thf

** Please refer to Qualifier Reports for details.*

Inorganic Analytical Results

Freeport-McMoRan - Chino Mines Company
Project ID: ZN000000J8
Sample ID: STS-BWC-2011-11

ACZ Sample ID: ***L90608-09***
Date Sampled: *09/16/11 12:00*
Date Received: *09/20/11*
Sample Matrix: *Soil*

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010B ICP	1590		*	mg/Kg	1	5	10/07/11 11:38	jjc

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
pH, Saturated Paste	USDA No. 60 (21A)	4.6		*	units	0.1	0.1	10/19/11 10:49	zsh
Solids, Percent	CLPSOW390, PART F, D-98	84.4		*	%	0.1	0.5	10/20/11 2:53	ndj

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							10/04/11 11:47	cra
Digestion - Hot Plate	M3050B ICP							10/06/11 16:47	mss2/nd
Saturated Paste Extraction	USDA No. 60 (2)							10/17/11 13:46	zsh
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							10/06/11 12:41	thf
Sieve-250 um (60 mesh)	ASA No.9, 15-4.2.2							10/06/11 12:41	thf

** Please refer to Qualifier Reports for details.*

Inorganic Analytical Results

Freeport-McMoRan - Chino Mines Company

Project ID:	ZN000000J8	ACZ Sample ID:	***L90608-10***
Sample ID:	STS-BWC-2011-12	Date Sampled:	*09/15/11 10:15*
		Date Received:	*09/20/11*
		Sample Matrix:	*Soil*

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010B ICP	709		*	mg/Kg	1	5	10/07/11 11:41	jjc

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
pH, Saturated Paste	USDA No. 60 (21A)	5.2		*	units	0.1	0.1	10/19/11 10:52	zsh
Solids, Percent	CLPSOW390, PART F, D-98	94.6		*	%	0.1	0.5	10/20/11 4:10	ndj

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							10/04/11 11:50	cra
Digestion - Hot Plate	M3050B ICP							10/06/11 17:05	mss2/nd
Saturated Paste Extraction	USDA No. 60 (2)							10/17/11 13:49	zsh
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							10/06/11 12:48	thf
Sieve-250 um (60 mesh)	ASA No.9, 15-4.2.2							10/06/11 12:48	thf

** Please refer to Qualifier Reports for details.*

Freeport-McMoRan - Chino Mines Company		ACZ Sample ID:	***L90608-11***
Project ID:	ZN000000J8	Date Sampled:	*09/14/11 11:20*
Sample ID:	STS-BWC-2011-1	Date Received:	*09/20/11*
		Sample Matrix:	*Soil*

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010B ICP	766		*	mg/Kg	1	5	10/07/11 11:44	jjc

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
pH, Saturated Paste	USDA No. 60 (21A)	5.2		*	units	0.1	0.1	10/19/11 10:54	zsh
Solids, Percent	CLPSOW390, PART F, D-98	90.9		*	%	0.1	0.5	10/20/11 5:28	ndj

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							10/04/11 14:00	cra
Digestion - Hot Plate	M3050B ICP							10/06/11 17:22	mss2/nd
Saturated Paste Extraction	USDA No. 60 (2)							10/17/11 13:53	zsh
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							10/06/11 12:55	thf
Sieve-250 um (60 mesh)	ASA No.9, 15-4.2.2							10/06/11 12:55	thf

** Please refer to Qualifier Reports for details.*

Inorganic Analytical Results

Freeport-McMoRan - Chino Mines Company
Project ID: ZN000000J8
Sample ID: STS-BWC-2011-2

ACZ Sample ID: ***L90608-12***
Date Sampled: *09/14/11 12:50*
Date Received: *09/20/11*
Sample Matrix: *Soil*

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010B ICP	667		*	mg/Kg	1	5	10/07/11 11:47	jjc

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
pH, Saturated Paste	USDA No. 60 (21A)	6.0		*	units	0.1	0.1	10/19/11 10:56	zsh
Solids, Percent	CLPSOW390, PART F, D-98	90.9		*	%	0.1	0.5	10/20/11 6:45	ndj

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							10/04/11 14:01	cra
Digestion - Hot Plate	M3050B ICP							10/06/11 17:40	mss2/nd
Saturated Paste Extraction	USDA No. 60 (2)							10/17/11 13:56	zsh
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							10/06/11 13:02	thf
Sieve-250 um (60 mesh)	ASA No.9, 15-4.2.2							10/06/11 13:02	thf

** Please refer to Qualifier Reports for details.*

Inorganic Analytical Results

Freeport-McMoRan - Chino Mines Company		ACZ Sample ID:	***L90608-13***
Project ID:	ZN000000J8	Date Sampled:	*09/14/11 14:45*
Sample ID:	DUPLICATE#1STS-BWC-2	Date Received:	*09/20/11*
		Sample Matrix:	*Soil*

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010B ICP	363		*	mg/Kg	1	5	10/07/11 11:50	jjc

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
pH, Saturated Paste	USDA No. 60 (21A)	5.8		*	units	0.1	0.1	10/19/11 10:58	zsh
Solids, Percent	CLPSOW390, PART F, D-98	93.9		*	%	0.1	0.5	10/20/11 8:02	ndj

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							10/04/11 14:02	cra
Digestion - Hot Plate	M3050B ICP							10/06/11 17:57	mss2/nd
Saturated Paste Extraction	USDA No. 60 (2)							10/17/11 14:00	zsh
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							10/06/11 13:10	thf
Sieve-250 um (60 mesh)	ASA No.9, 15-4.2.2							10/06/11 13:10	thf

** Please refer to Qualifier Reports for details.*

Inorganic Reference

Report Header Explanations

Batch	A distinct set of samples analyzed at a specific time
Found	Value of the QC Type of interest
Limit	Upper limit for RPD, in %.
Lower	Lower Recovery Limit, in % (except for LCSS, mg/Kg)
MDL	Method Detection Limit. Same as Minimum Reporting Limit. Allows for instrument and annual fluctuations.
PCN/SCN	A number assigned to reagents/standards to trace to the manufacturer's certificate of analysis
PQL	Practical Quantitation Limit, typically 5 times the MDL.
QC	True Value of the Control Sample or the amount added to the Spike
Rec	Amount of the true value or spike added recovered, in % (except for LCSS, mg/Kg)
RPD	Relative Percent Difference, calculation used for Duplicate QC Types
Upper	Upper Recovery Limit, in % (except for LCSS, mg/Kg)
Sample	Value of the Sample of interest

QC Sample Types

AS	Analytical Spike (Post Digestion)	*LCSWD*	Laboratory Control Sample - Water Duplicate
ASD	Analytical Spike (Post Digestion) Duplicate	*LFB*	Laboratory Fortified Blank
CCB	Continuing Calibration Blank	*LFM*	Laboratory Fortified Matrix
CCV	Continuing Calibration Verification standard	*LFMD*	Laboratory Fortified Matrix Duplicate
DUP	Sample Duplicate	*LRB*	Laboratory Reagent Blank
ICB	Initial Calibration Blank	*MS*	Matrix Spike
ICV	Initial Calibration Verification standard	*MSD*	Matrix Spike Duplicate
ICSAB	Inter-element Correction Standard - A plus B solutions	*PBS*	Prep Blank - Soil
LCSS	Laboratory Control Sample - Soil	*PBW*	Prep Blank - Water
LCSSD	Laboratory Control Sample - Soil Duplicate	*PQV*	Practical Quantitation Verification standard
LCSW	Laboratory Control Sample - Water	*SDL*	Serial Dilution

QC Sample Type Explanations

Blanks	Verifies that there is no or minimal contamination in the prep method or calibration procedure.
Control Samples	Verifies the accuracy of the method, including the prep procedure.
Duplicates	Verifies the precision of the instrument and/or method.
Spikes/Fortified Matrix	Determines sample matrix interferences, if any.
Standard	Verifies the validity of the calibration.

ACZ Qualifiers (Qual)

B	Analyte concentration detected at a value between MDL and PQL. The associated value is an estimated quantity.
H	Analysis exceeded method hold time. pH is a field test with an immediate hold time.
L	Target analyte response was below the laboratory defined negative threshold.
U	The material was analyzed for, but was not detected above the level of the associated value. The associated value is either the sample quantitation limit or the sample detection limit.

Method References

(1) EPA 600/4-83-020. Methods for Chemical Analysis of Water and Wastes, March 1983.
(2) EPA 600/R-93-100. Methods for the Determination of Inorganic Substances in Environmental Samples, August 1993.
(3) EPA 600/R-94-111. Methods for the Determination of Metals in Environmental Samples - Supplement I, May 1994.
(4) EPA SW-846. Test Methods for Evaluating Solid Waste, Third Edition with Update III, December 1996.
(5) Standard Methods for the Examination of Water and Wastewater, 19th edition, 1995 & 20th edition (1998).

Comments

(1) QC results calculated from raw data. Results may vary slightly if the rounded values are used in the calculations.
(2) Soil, Sludge, and Plant matrices for Inorganic analyses are reported on a dry weight basis.
(3) Animal matrices for Inorganic analyses are reported on an "as received" basis.
(4) An asterisk in the "XQ" column indicates there is an extended qualifier and/or certification qualifier associated with the result.

For a complete list of ACZ's Extended Qualifiers, please click: http://www.acz.com/public/extquallist.pdf

Freeport-McMoRan - Chino Mines Company
Project ID: ZN000000J8

ACZ Project ID: ***L90608***

Copper, total (3050) M6010B ICP

ACZ ID	Type	Analyzed	PCN/SCN	QC	Sample	Found	Units	Rec	Lower	Upper	RPD	Limit	Qual
WG311108													
WG311108ICV	ICV	10/07/11 10:33	II110816-2	2		1.947	mg/L	97.4	90	110			
WG311108ICB	ICB	10/07/11 10:36				U	mg/L		-0.03	0.03			
WG311108PQV	PQV	10/07/11 10:39	II110923-2	.05		.052	mg/L	104	70	130			
WG311108ICSAB	ICSAB	10/07/11 10:42	II110922-1	.255		.256	mg/L	100.4	80	120			
WG311046PBS	PBS	10/07/11 10:48				U	mg/Kg		-3	3			
WG311046LCSS	LCSS	10/07/11 10:51	PCN38229	117		125.6	mg/Kg		98	136			
WG311046LCSSD	LCSSD	10/07/11 10:54	PCN38229	117		121.6	mg/Kg		98	136	3.2	20	
L90608-01MS	MS	10/07/11 11:01	II110914-5	50.5	622	628.1	mg/Kg	12.1	75	125			M3
L90608-01MSD	MSD	10/07/11 11:04	II110914-5	50.5	622	639	mg/Kg	33.7	75	125	1.72	20	M3
L90608-04SDL	SDL	10/07/11 11:16			426	422.5	mg/Kg				0.8	10	
WG311108CCV1	CCV	10/07/11 11:19	II110816-3	1		.974	mg/L	97.4	90	110			
WG311108CCB1	CCB	10/07/11 11:22				U	mg/L		-0.03	0.03			
WG311108CCV2	CCV	10/07/11 11:53	II110816-3	1		.969	mg/L	96.9	90	110			
WG311108CCB2	CCB	10/07/11 11:56				U	mg/L		-0.03	0.03			

pH, Saturated Paste USDA No. 60 (21A)

ACZ ID	Type	Analyzed	PCN/SCN	QC	Sample	Found	Units	Rec	Lower	Upper	RPD	Limit	Qual
WG311692													
WG311692ICV	ICV	10/19/11 10:30	PCN36616	4		4.05	units	101.3	97	103			
L90608-01DUP	DUP	10/19/11 10:34			5.4	5.4	units				0	20	
WG311692CCV1	CCV	10/19/11 10:50	PCN36616	4		4.04	units	101	97	103			
WG311692CCV2	CCV	10/19/11 11:00	PCN36616	4		4.07	units	101.8	97	103			

Solids, Percent CLPSOW390, PART F, D-98

ACZ ID	Type	Analyzed	PCN/SCN	QC	Sample	Found	Units	Rec	Lower	Upper	RPD	Limit	Qual
WG311894													
WG311894PBS	PBS	10/19/11 15:18				U	%		99.9	100.1			
L90608-13DUP	DUP	10/20/11 9:19			93.9	93.82	%				0.1	20	

ACZ ID	WORKNUM	PARAMETER	METHOD	QUAL	DESCRIPTION
L90608-01	WG311108	Copper, total (3050)	M6010B ICP	M3	The spike recovery value is unusable since the analyte concentration in the sample is disproportionate to the spike level. The recovery of the associated control sample (LCS or LFB) was acceptable.
L90608-02	WG311108	Copper, total (3050)	M6010B ICP	M3	The spike recovery value is unusable since the analyte concentration in the sample is disproportionate to the spike level. The recovery of the associated control sample (LCS or LFB) was acceptable.
L90608-03	WG311108	Copper, total (3050)	M6010B ICP	M3	The spike recovery value is unusable since the analyte concentration in the sample is disproportionate to the spike level. The recovery of the associated control sample (LCS or LFB) was acceptable.
L90608-04	WG311108	Copper, total (3050)	M6010B ICP	M3	The spike recovery value is unusable since the analyte concentration in the sample is disproportionate to the spike level. The recovery of the associated control sample (LCS or LFB) was acceptable.
L90608-05	WG311108	Copper, total (3050)	M6010B ICP	M3	The spike recovery value is unusable since the analyte concentration in the sample is disproportionate to the spike level. The recovery of the associated control sample (LCS or LFB) was acceptable.
L90608-06	WG311108	Copper, total (3050)	M6010B ICP	M3	The spike recovery value is unusable since the analyte concentration in the sample is disproportionate to the spike level. The recovery of the associated control sample (LCS or LFB) was acceptable.
L90608-07	WG311108	Copper, total (3050)	M6010B ICP	M3	The spike recovery value is unusable since the analyte concentration in the sample is disproportionate to the spike level. The recovery of the associated control sample (LCS or LFB) was acceptable.
L90608-08	WG311108	Copper, total (3050)	M6010B ICP	M3	The spike recovery value is unusable since the analyte concentration in the sample is disproportionate to the spike level. The recovery of the associated control sample (LCS or LFB) was acceptable.
L90608-09	WG311108	Copper, total (3050)	M6010B ICP	M3	The spike recovery value is unusable since the analyte concentration in the sample is disproportionate to the spike level. The recovery of the associated control sample (LCS or LFB) was acceptable.
L90608-10	WG311108	Copper, total (3050)	M6010B ICP	M3	The spike recovery value is unusable since the analyte concentration in the sample is disproportionate to the spike level. The recovery of the associated control sample (LCS or LFB) was acceptable.
L90608-11	WG311108	Copper, total (3050)	M6010B ICP	M3	The spike recovery value is unusable since the analyte concentration in the sample is disproportionate to the spike level. The recovery of the associated control sample (LCS or LFB) was acceptable.
L90608-12	WG311108	Copper, total (3050)	M6010B ICP	M3	The spike recovery value is unusable since the analyte concentration in the sample is disproportionate to the spike level. The recovery of the associated control sample (LCS or LFB) was acceptable.
L90608-13	WG311108	Copper, total (3050)	M6010B ICP	M3	The spike recovery value is unusable since the analyte concentration in the sample is disproportionate to the spike level. The recovery of the associated control sample (LCS or LFB) was acceptable.

Soil Analysis

The following parameters are not offered for certification or are not covered by NELAC certificate #ACZ.

pH, Saturated Paste	USDA No. 60 (21A)
Solids, Percent	CLPSOW390, PART F, D-98

ACZ Laboratories, Inc.
2773 Downhill Drive Steamboat Springs, CO 80487 (800) 334-5493

Sample Receipt

Freeport-McMoRan - Chino Mines Company
ZN000000J8

ACZ Project ID: L90608
Date Received: 09/20/2011 09:16
Received By: ksj
Date Printed: 9/21/2011

Receipt Verification

	YES	NO	NA
1) Does this project require special handling procedures such as CLP protocol?			X
2) Are the custody seals on the cooler intact?	X		
3) Are the custody seals on the sample containers intact?			X
4) Is there a Chain of Custody or other directive shipping papers present?	X		
5) Is the Chain of Custody complete?	X		
6) Is the Chain of Custody in agreement with the samples received?	X		
7) Is there enough sample for all requested analyses?	X		
8) Are all samples within holding times for requested analyses?	X		
9) Were all sample containers received intact?	X		
10) Are the temperature blanks present?			X
11) Are the trip blanks (VOA and/or Cyanide) present?			X
12) Are samples requiring no headspace, headspace free?			X
13) Do the samples that require a Foreign Soils Permit have one?			X

Exceptions: If you answered no to any of the above questions, please describe

N/A

Contact (For any discrepancies, the client must be contacted)

N/A

Shipping Containers

Cooler Id		Temp (°C)	Rad (µR/hr)
Na13908		21.8	23

Client must contact ACZ Project Manager if analysis should not proceed for samples received outside of thermal preservation acceptance criteria.

Notes

Sample Receipt

Freeport-McMoRan - Chino Mines Company
ZN000000J8

ACZ Project ID:	L90608
Date Received:	09/20/2011 09:16
Received By:	ksj
Date Printed:	9/21/2011

Sample Container Preservation

SAMPLE	CLIENT ID	R < 2	G < 2	BK < 2	Y< 2	YG< 2	B< 2	O < 2	T >12	N/A	RAD	ID
L90608-01	STS-BWC-2011-3									X		☐
L90608-02	STS-BWC-2011-4									X		☐
L90608-03	STS-BWC-2011-5									X		☐
L90608-04	STS-BWC-2011-6									X		☐
L90608-05	STS-BWC-2011-7									X		☐
L90608-06	STS-BWC-2011-8									X		☐
L90608-07	STS-BWC-2011-9									X		☐
L90608-08	STS-BWC-2011-10									X		☐
L90608-09	STS-BWC-2011-11									X		☐
L90608-10	STS-BWC-2011-12									X		☐
L90608-11	STS-BWC-2011-1									X		☐
L90608-12	STS-BWC-2011-2									X		☐
L90608-13	DUPLICATE#1STS-BWC-2									X		☐

Sample Container Preservation Legend

Abbreviation	**Description**	**Container Type**	**Preservative/Limits**
R	Raw/Nitric	RED	pH must be < 2
B	Filtered/Sulfuric	BLUE	pH must be < 2
BK	Filtered/Nitric	BLACK	pH must be < 2
G	Filtered/Nitric	GREEN	pH must be < 2
O	Raw/Sulfuric	ORANGE	pH must be < 2
P	Raw/NaOH	PURPLE	pH must be > 12 *
T	Raw/NaOH Zinc Acetate	TAN	pH must be > 12
Y	Raw/Sulfuric	YELLOW	pH must be < 2
YG	Raw/Sulfuric	YELLOW GLASS	pH must be < 2
N/A	No preservative needed	Not applicable	
RAD	Gamma/Beta dose rate	Not applicable	must be < 250 µR/hr

* pH check performed by analyst prior to sample preparation

Sample IDs Reviewed By: ksj

ACZ Laboratories, Inc. L90608

2773 Downhill Drive Steamboat Springs, CO 80487 (800) 334-5493

CHAIN of CUSTODY

Name: Pam Pinson
Company: Chino Mines Company
E-mail: Pamela_Pinson@FMI.com

Address: P.O. Box 10
Bayard, NM 88023
Telephone: 575-912-5213

Name: Matthew Barkley
Company: ARCADIS

E-mail: Matthew.Barkley@arcadis-us.com
Telephone: 303-231-9115 ext 157

Name: Pam Pinson
Company: Chino Mines Company
E-mail: Pamela_Pinson@FMI.com

Address: P.O. Box 10
Bayard, NM 88023
Telephone: 575-912-5213

If sample(s) received past holding time (HT), or if insufficient HT remains to complete analysis before expiration, shall ACZ proceed with requested short HT analyses? YES ☒ NO ☐

If "NO" then ACZ will contact client for further instruction. If neither "YES" nor "NO" is indicated, ACZ will proceed with the requested analyses, even if HT is expired, and data will be qualified.

Are samples for CO DW Compliance Monitoring? YES ☐ NO ☒

If yes, please include state forms. Results will be reported to PQL.

Quote #:
Project/PO #: See below
Reporting state for compliance testing:
Sampler's Name: Carolyn Meyer
Are any samples NRC licensable material? Yes No

SAMPLE IDENTIFICATION	DATE:TIME	Matrix	# of Containers	soil sieved to < 2mm	pH	Total CU					
STS-BWC-2011-3	9-14-11 2:00pm	SO	1	x	x	x					
STS-BWC-2011-4	9-16-11 10:00am	SO	1	x	x	x					
STS-BWC-2011-5	9-16-11 13:00	SO	1	x	x	x					
STS-BWC-2011-6	9-14-11 2:[illegible]	SO	1	x	x	x					
STS-BWC-2011-7	9-15-11 9:10am	SO	1	X	X	X					
STS-BWC 2011-8	9-16-11 11:00am	SO	1	X	X	X					
STS-BWC-2011-9	9-15-11 10:45am	SO	1	X	X	X					
STS-BWC-2011-10	9-15-11 8:00am	SO	1	X	X	X					
STS-BWC-2011-11	9-16-11 12:00pm	SO	1	X	X	X					
STS-BWC-2011-12	9-15-11 10:15	SO	1	X	X	X					

Matrix: SW (Surface Water) · GW (Ground Water) · WW (Waste Water) · DW (Drinking Water) · SL (Sludge) · SO (Soil) · OL (Oil) · Other (Specify)

REMARKS

Please send to Sheri Fling at URS for validation. Please sieve to <2 mm before analysis.

PO#2N00000JB

Please refer to ACZ's terms & conditions located on the reverse side of this COC.

RELINQUISHED BY	DATE:TIME	RECEIVED BY	DATE:TIME
Pam Pinson	9-19-11 / 3:00pm		
		WGS	9/20/11 09:20

L90608 Chain of Custody

FRMAD050.01.15.09 White - Return with sample. Yellow - Retain for your records.

ACZ Laboratories, Inc. 190608

2773 Downhill Drive Steamboat Springs, CO 80487 (800) 334-5493

CHAIN of CUSTODY

Report to:

Name: Pam Pinson
Company: Chino Mines Company
E-mail: Pamela_Pinson@FMI.com

Address: P.O. Box 10
Bayard, NM 88023
Telephone: 575-912-5213

Copy of Report to:

Name: Matthew Barkley
Company: ARCADIS

E-mail: Matthew.Barkley@arcadis-us.com
Telephone: 303-231-9115 ext 157

Invoice to:

Name: Pam Pinson
Company: Chino Mines Company
E-mail: Pamela_Pinson@FMI.com

Address: P.O. Box 10
Bayard, NM 88023
Telephone: 575-912-5213

If sample(s) received past holding time (HT), or if insufficient HT remains to complete analysis before expiration, shall ACZ proceed with requested short HT analyses? YES ☒ NO ☐
If "NO" then ACZ will contact client for further instruction. If neither "YES" nor "NO" is indicated, ACZ will proceed with the requested analyses, even if HT is expired, and data will be qualified.

Are samples for CO DW Compliance Monitoring? YES ☐ NO ☒
If yes, please include state forms. Results will be reported to PQL.

PROJECT INFORMATION

Quote #:
Project/PO #:
Reporting state for compliance testing:
Sampler's Name: Carolyn Meyer
Are any samples NRC licensable material? Yes No

SAMPLE IDENTIFICATION	DATE:TIME	Matrix	# of Containers	soil sieved to < 2mm	pH	Total CU
STS-BWC-2011-1	9-19-11 11:20am	SO	1	x	x	x
STS-BWC-2011-2	9-14-11 12:50pm	SO	1	x	x	x
~~STS-BWC-2011-5~~		~~SO~~	~~1~~	~~x~~	~~x~~	~~x~~
~~STS-BWC-2011-6~~		~~SO~~	~~1~~	~~x~~	~~x~~	~~x~~

Matrix SW (Surface Water) · GW (Ground Water) · WW (Waste Water) · DW (Drinking Water) · SL (Sludge) · SO (Soil) · OL (Oil) · Other (Specify)

REMARKS

Please sent to Sheri Fling at URS for validation. Please sieve to <2mm before analysis.

Please refer to ACZ's terms & conditions located on the reverse side of this COC.

RELINQUISHED BY:	DATE:TIME	RECEIVED BY:	DATE:TIME
Pam Pinson	9-19-11/3pm		
		WGS	9/20/11

2

FRMAD050.01.15.09 White - Return with sample. Yellow - Retain for your records.

09:20

ACZ Laboratories, Inc. L90608

2773 Downhill Drive Steamboat Springs, CO 80487 (800) 334-5493

CHAIN of CUSTODY

Report to

Name: Pam Pinson
Company: Chino Mines Company
E-mail: Pamela_Pinson@FMI.com

Address: P.O. Box 10
Bayard, NM 88023
Telephone: 575-912-5213

Copy of Report to

Name: Matthew Barkley
Company: ARCADIS

E-mail: Matthew.Barkley@arcadis-us.com
Telephone: 303-231-9115 ext 157

Invoice to

Name: Pam Pinson
Company: Chino Mines Company
E-mail: Pamela_Pinson@FMI.com

Address: P.O. Box 10
Bayard, NM 88023
Telephone: 575-912-5213

If sample(s) received past holding time (HT), or if insufficient HT remains to complete analysis before expiration, shall ACZ proceed with requested short HT analyses? If "NO" then ACZ will contact client for further instruction. If neither "YES" nor "NO" is indicated, ACZ will proceed with the requested analyses, even if HT is expired, and data will be qualified. YES ☒ NO ☐

Are samples for CO DW Compliance Monitoring? If yes, please include state forms. Results will be reported to PQL. YES ☐ NO ☒

PROJECT INFORMATION

Quote #:
Project/PO #:
Reporting state for compliance testing:
Sampler's Name: Carolyn Meyer
Are any samples NRC licensable material? Yes No

SAMPLE IDENTIFICATION	DATE:TIME	Matrix	# of Containers	soil sieved to < 2mm	pH	Total CU					
Rinsate Blank #1	9/14/2011 2:45	SW	1		x	x					
Duplicate #1 SSTS BWC2011	9/14/2011 2:45pm	SO	1	x	x	x					
-6	Dup										

Matrix: SW (Surface Water) · GW (Ground Water) · WW (Waste Water) · DW (Drinking Water) · SL (Sludge) · SO (Soil) · OL (Oil) · Other (Specify)

REMARKS

Please sent to Sheri Fling at URS for validation. Sieve all soil samples to <2 mm prior to analysis. Soil should be reported on a dry weigh basis.

Please refer to ACZ's terms & conditions located on the reverse side of this COC.

RELINQUISHED BY	DATE:TIME	RECEIVED BY	DATE:TIME
Pam Pinson	9-19-2011/3:00pm		
		WGS	9/20/11 09:20

FRMAD050.01.15.09 White - Return with sample. Yellow - Retain for your records.

3

ACZ Laboratories, Inc.
2773 Downhill Drive Steamboat Springs, CO 80487 (800) 334-5493

Analytical Report

September 28, 2011

Report to:
Pam Pinson
Freeport-McMoRan - Chino Mines Company
PO Box 10
Bayard, NM 88023

Bill to:
Pam Pinson
Freeport-McMoRan - Chino Mines Company
P.O. Box 13308
Phoenix, AZ 85002-3308

cc: Matthew Barkley, Sheri Fling

Project ID: ZN000000J8
ACZ Project ID: L90609

Pam Pinson:

Enclosed are the analytical results for sample(s) submitted to ACZ Laboratories, Inc. (ACZ) on September 20, 2011. This project has been assigned to ACZ's project number, L90609. Please reference this number in all future inquiries.

All analyses were performed according to ACZ's Quality Assurance Plan. The enclosed results relate only to the samples received under L90609. Each section of this report has been reviewed and approved by the appropriate Laboratory Supervisor, or a qualified substitute.

Except as noted, the test results for the methods and parameters listed on ACZ's current NELAC certificate letter (#ACZ) meet all requirements of NELAC.

This report shall be used or copied only in its entirety. ACZ is not responsible for the consequences arising from the use of a partial report.

All samples and sub-samples associated with this project will be disposed of after October 28, 2011. If the samples are determined to be hazardous, additional charges apply for disposal (typically less than $10/sample). If you would like the samples to be held longer than ACZ's stated policy or to be returned, please contact your Project Manager or Customer Service Representative for further details and associated costs. ACZ retains analytical reports for five years.

If you have any questions or other needs, please contact your Project Manager.

S. Habermehl

Scott Habermehl has reviewed
and approved this report.

ACZ Laboratories, Inc.

2773 Downhill Drive Steamboat Springs, CO 80487 (800) 334-5493

Inorganic Analytical Results

Freeport-McMoRan - Chino Mines Company

Project ID:	ZN000000J8	ACZ Sample ID:	***L90609-01***
Sample ID:	RINSATE BLANK #1	Date Sampled:	*09/14/11 14:45*
		Date Received:	*09/20/11*
		Sample Matrix:	*Surface Water*

Inorganic Prep

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Total Hot Plate Digestion	M200.2 ICP-MS							09/26/11 8:52	mfm

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total	M200.8 ICP-MS	0.0048			mg/L	0.0005	0.003	09/27/11 0:52	msh

Inorganic Reference

Report Header Explanations

Batch	A distinct set of samples analyzed at a specific time
Found	Value of the QC Type of interest
Limit	Upper limit for RPD, in %.
Lower	Lower Recovery Limit, in % (except for LCSS, mg/Kg)
MDL	Method Detection Limit. Same as Minimum Reporting Limit. Allows for instrument and annual fluctuations.
PCN/SCN	A number assigned to reagents/standards to trace to the manufacturer's certificate of analysis
PQL	Practical Quantitation Limit, typically 5 times the MDL.
QC	True Value of the Control Sample or the amount added to the Spike
Rec	Amount of the true value or spike added recovered, in % (except for LCSS, mg/Kg)
RPD	Relative Percent Difference, calculation used for Duplicate QC Types
Upper	Upper Recovery Limit, in % (except for LCSS, mg/Kg)
Sample	Value of the Sample of interest

QC Sample Types

AS	Analytical Spike (Post Digestion)	LCSWD	Laboratory Control Sample - Water Duplicate
ASD	Analytical Spike (Post Digestion) Duplicate	LFB	Laboratory Fortified Blank
CCB	Continuing Calibration Blank	LFM	Laboratory Fortified Matrix
CCV	Continuing Calibration Verification standard	LFMD	Laboratory Fortified Matrix Duplicate
DUP	Sample Duplicate	LRB	Laboratory Reagent Blank
ICB	Initial Calibration Blank	MS	Matrix Spike
ICV	Initial Calibration Verification standard	MSD	Matrix Spike Duplicate
ICSAB	Inter-element Correction Standard - A plus B solutions	PBS	Prep Blank - Soil
LCSS	Laboratory Control Sample - Soil	PBW	Prep Blank - Water
LCSSD	Laboratory Control Sample - Soil Duplicate	PQV	Practical Quantitation Verification standard
LCSW	Laboratory Control Sample - Water	SDL	Serial Dilution

QC Sample Type Explanations

Blanks	Verifies that there is no or minimal contamination in the prep method or calibration procedure.
Control Samples	Verifies the accuracy of the method, including the prep procedure.
Duplicates	Verifies the precision of the instrument and/or method.
Spikes/Fortified Matrix	Determines sample matrix interferences, if any.
Standard	Verifies the validity of the calibration.

ACZ Qualifiers (Qual)

B	Analyte concentration detected at a value between MDL and PQL. The associated value is an estimated quantity.
H	Analysis exceeded method hold time. pH is a field test with an immediate hold time.
U	The material was analyzed for, but was not detected above the level of the associated value. The associated value is either the sample quantitation limit or the sample detection limit.

Method References

(1) EPA 600/4-83-020. Methods for Chemical Analysis of Water and Wastes, March 1983.

(2) EPA 600/R-93-100. Methods for the Determination of Inorganic Substances in Environmental Samples, August 1993.

(3) EPA 600/R-94-111. Methods for the Determination of Metals in Environmental Samples - Supplement I, May 1994.

(5) EPA SW-846. Test Methods for Evaluating Solid Waste, Third Edition with Update III, December 1996.

(6) Standard Methods for the Examination of Water and Wastewater, 19th edition, 1995 & 20th edition (1998).

Comments

(1) QC results calculated from raw data. Results may vary slightly if the rounded values are used in the calculations.

(2) Soil, Sludge, and Plant matrices for Inorganic analyses are reported on a dry weight basis.

(3) Animal matrices for Inorganic analyses are reported on an "as received" basis.

(4) An asterisk in the "XQ" column indicates there is an extended qualifier and/or certification qualifier associated with the result.

For a complete list of ACZ's Extended Qualifiers, please click: http://www.acz.com/public/extquallist.pdf

Freeport-McMoRan - Chino Mines Company
Project ID: ZN000000J8

ACZ Project ID: ***L90609***

Copper, total M200.8 ICP-MS

ACZ ID	Type	Analyzed	PCN/SCN	QC	Sample	Found	Units	Rec	Lower	Upper	RPD	Limit	Qual
WG310201													
WG310201ICV	ICV	09/27/11 0:35	MS110912-5	.05		.04861	mg/L	97.2	90	110			
WG310201ICB	ICB	09/27/11 0:38				U	mg/L		-0.0015	0.0015			
WG310092LRB	LRB	09/27/11 0:41				U	mg/L		-0.0011	0.0011			
WG310092LFB	LFB	09/27/11 0:45	MS110913-2	.05005		.04755	mg/L	95	85	115			
L90673-03LFM	LFM	09/27/11 1:06	MS110913-2	.05005	U	.04335	mg/L	86.6	70	130			
L90673-03LFMD	LFMD	09/27/11 1:09	MS110913-2	.05005	U	.04517	mg/L	90.2	70	130	4.11	20	
WG310201CCV1	CCV	09/27/11 1:12	MS110919-5	.25025		.2641	mg/L	105.5	90	110			
WG310201CCB1	CCB	09/27/11 1:15				U	mg/L		-0.0015	0.0015			
WG310201CCV2	CCV	09/27/11 1:54	MS110919-5	.25025		.2629	mg/L	105.1	90	110			
WG310201CCB2	CCB	09/27/11 1:57				U	mg/L		-0.0015	0.0015			
WG310201CCV3	CCV	09/27/11 2:24	MS110919-5	.25025		.2485	mg/L	99.3	90	110			
WG310201CCB3	CCB	09/27/11 2:28				U	mg/L		-0.0015	0.0015			

Inorganic Extended Qualifier Report

Freeport-McMoRan - Chino Mines Company

ACZ Project ID: ***L90609***

ACZ ID	WORKNUM	PARAMETER	METHOD	QUAL	DESCRIPTION

No extended qualifiers associated with this analysis

Certification Qualifiers

Freeport-McMoRan - Chino Mines Company

ACZ Project ID: ***L90609***

No certification qualifiers associated with this analysis

ACZ Laboratories, Inc.
2773 Downhill Drive Steamboat Springs, CO 80487 (800) 334-5493

Sample Receipt

Freeport-McMoRan - Chino Mines Company
ZN000000J8

ACZ Project ID: L90609
Date Received: 09/20/2011 09:16
Received By: ksj
Date Printed: 9/21/2011

Receipt Verification

	YES	NO	NA
1) Does this project require special handling procedures such as CLP protocol?			X
2) Are the custody seals on the cooler intact?	X		
3) Are the custody seals on the sample containers intact?			X
4) Is there a Chain of Custody or other directive shipping papers present?	X		
5) Is the Chain of Custody complete?	X		
6) Is the Chain of Custody in agreement with the samples received?	X		
7) Is there enough sample for all requested analyses?		X	
8) Are all samples within holding times for requested analyses?	X		
9) Were all sample containers received intact?	X		
10) Are the temperature blanks present?			X
11) Are the trip blanks (VOA and/or Cyanide) present?			X
12) Are samples requiring no headspace, headspace free?			X
13) Do the samples that require a Foreign Soils Permit have one?			X

Exceptions: If you answered no to any of the above questions, please describe

The pH could not be entered as the proper container was not received.

Contact (For any discrepancies, the client must be contacted)

The client was not contacted.

Shipping Containers

Cooler Id		Temp (°C)	Rad (µR/hr)
Na13908		21.8	23

Client must contact ACZ Project Manager if analysis should not proceed for samples received outside of thermal preservation acceptance criteria.

Notes

ACZ Laboratories, Inc.
2773 Downhill Drive Steamboat Springs, CO 80487 (800) 334-5493

Sample Receipt

Freeport-McMoRan - Chino Mines Company
ZN000000J8

ACZ Project ID: L90609
Date Received: 09/20/2011 09:16
Received By: ksj
Date Printed: 9/21/2011

Sample Container Preservation

SAMPLE	CLIENT ID	R < 2	G < 2	BK < 2	Y< 2	YG< 2	B< 2	O < 2	T >12	N/A	RAD	ID
L90609-01	RINSATE BLANK #1	Y										▣

Sample Container Preservation Legend

Abbreviation	Description	Container Type	Preservative/Limits
R	Raw/Nitric	RED	pH must be < 2
B	Filtered/Sulfuric	BLUE	pH must be < 2
BK	Filtered/Nitric	BLACK	pH must be < 2
G	Filtered/Nitric	GREEN	pH must be < 2
O	Raw/Sulfuric	ORANGE	pH must be < 2
P	Raw/NaOH	PURPLE	pH must be > 12 *
T	Raw/NaOH Zinc Acetate	TAN	pH must be > 12
Y	Raw/Sulfuric	YELLOW	pH must be < 2
YG	Raw/Sulfuric	YELLOW GLASS	pH must be < 2
N/A	No preservative needed	Not applicable	
RAD	Gamma/Beta dose rate	Not applicable	must be < 250 µR/hr

* pH check performed by analyst prior to sample preparation

Sample IDs Reviewed By: ksj

ACZ Laboratories, Inc. L90609

2773 Downhill Drive Steamboat Springs, CO 80487 (800) 334-5493

CHAIN of CUSTODY

COPY

Report to:

Name: Pam Pinson
Company: Chino Mines Company
E-mail: Pamela_Pinson@FMI.com

Address: P.O. Box 10
Bayard, NM 88023
Telephone: 575-912-5213

Copy of Report to:

Name: Matthew Barkley
Company: ARCADIS

E-mail: Matthew.Barkley@arcadis-us.com
Telephone: 303-231-9115 ext 157

Invoice to:

Name: Pam Pinson
Company: Chino Mines Company
E-mail: Pamela_Pinson@FMI.com

Address: P.O. Box 10
Bayard, NM 88023
Telephone: 575-912-5213

If sample(s) received past holding time (HT), or if insufficient HT remains to complete analysis before expiration, shall ACZ proceed with requested short HT analyses? YES ☒ NO ☐
If "NO" then ACZ will contact client for further instruction. If neither "YES" nor "NO" is indicated, ACZ will proceed with the requested analyses, even if HT is expired, and data will be qualified.

Are samples for CO DW Compliance Monitoring? YES ☐ NO ☒
If yes, please include state forms. Results will be reported to PQL.

PROJECT INFORMATION

Quote #:
Project/PO #:
Reporting state for compliance testing:
Sampler's Name: Carolyn Meyer
Are any samples NRC licensable material? Yes No

ANALYSES REQUESTED *(attach list or use quote number)*

SAMPLE IDENTIFICATION	DATE:TIME	Matrix	# of Containers	soil sieved to < 2mm	pH	Total CU					
Rinsate Blank #1	9/14/2011 2:45	SW	1		x	x					
Duplicate #1 STS BWC2011-6 Dup	9/14/2011 2:45pm	SO	1	x	x	x					

Matrix: SW (Surface Water) · GW (Ground Water) · WW (Waste Water) · DW (Drinking Water) · SL (Sludge) · SO (Soil) · OL (Oil) · Other (Specify)

REMARKS

Please sent to Sheri Fling at URS for validation. Sieve all soil samples to <2 mm prior to analysis. Soil should be reported on a dry weigh basis.

Please refer to ACZ's terms & conditions located on the reverse side of this COC.

RELINQUISHED BY:	DATE:TIME	RECEIVED BY:	DATE:TIME
Pam Pinson	9-19-2011/3:00pm		
		WGS	9/20/11 09:10

FRMAD050.01.15.09 White - Return with sample. Yellow - Retain for your records.

L90609 Chain of Custody

ACZ Laboratories, Inc.
2773 Downhill Drive Steamboat Springs, CO 80487 (800) 334-5493

Analytical Report

November 18, 2011

Report to:
Pam Pinson
Freeport-McMoRan - Chino Mines Company
PO Box 10
Bayard, NM 88023

Bill to:
Pam Pinson
Freeport-McMoRan - Chino Mines Company
P.O. Box 13308
Phoenix, AZ 85002-3308

cc: Matthew Barkley, Sheri Fling

Project ID: ZN000000J8
ACZ Project ID: L91355

Pam Pinson:

Enclosed are the analytical results for sample(s) submitted to ACZ Laboratories, Inc. (ACZ) on October 18, 2011. This project has been assigned to ACZ's project number, L91355. Please reference this number in all future inquiries.

All analyses were performed according to ACZ's Quality Assurance Plan. The enclosed results relate only to the samples received under L91355. Each section of this report has been reviewed and approved by the appropriate Laboratory Supervisor, or a qualified substitute.

Except as noted, the test results for the methods and parameters listed on ACZ's current NELAC certificate letter (#ACZ) meet all requirements of NELAC.

This report shall be used or copied only in its entirety. ACZ is not responsible for the consequences arising from the use of a partial report.

All samples and sub-samples associated with this project will be disposed of after December 18, 2011. If the samples are determined to be hazardous, additional charges apply for disposal (typically less than $10/sample). If you would like the samples to be held longer than ACZ's stated policy or to be returned, please contact your Project Manager or Customer Service Representative for further details and associated costs. ACZ retains analytical reports for five years.

If you have any questions or other needs, please contact your Project Manager.

S. Habermehl

Scott Habermehl has reviewed
and approved this report.

Freeport-McMoRan - Chino Mines Company

Project ID:	ZN000000J8	ACZ Sample ID:	***L91355-01***
Sample ID:	STS-PCUG-2011-21	Date Sampled:	*10/11/11 09:05*
		Date Received:	*10/18/11*
		Sample Matrix:	*Soil*

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010B ICP	558			mg/Kg	1	5	11/14/11 10:58	aeb

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
pH, Saturated Paste	USDA No. 60 (21A)	4.8		*	units	0.1	0.1	11/14/11 17:28	thf
Solids, Percent	CLPSOW390, PART F, D-98	93.7		*	%	0.1	0.5	11/16/11 15:00	ndj

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/04/11 11:00	nrc
Digestion - Hot Plate	M3050B ICP							11/11/11 10:52	nrc
Saturated Paste Extraction	USDA No. 60 (2)							11/14/11 14:45	thf
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/09/11 11:00	lwt

** Please refer to Qualifier Reports for details.*

Freeport-McMoRan - Chino Mines Company

Project ID:	ZN000000J8	ACZ Sample ID:	***L91355-02***
Sample ID:	STS-PCUG-2011-22	Date Sampled:	*10/10/11 15:00*
		Date Received:	*10/18/11*
		Sample Matrix:	*Soil*

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010B ICP	976			mg/Kg	1	5	11/14/11 11:07	aeb

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
pH, Saturated Paste	USDA No. 60 (21A)	7.4		*	units	0.1	0.1	11/14/11 18:50	thf
Solids, Percent	CLPSOW390, PART F, D-98	93.5		*	%	0.1	0.5	11/16/11 15:00	ndj

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/04/11 11:06	nrc
Digestion - Hot Plate	M3050B ICP							11/11/11 11:45	nrc
Saturated Paste Extraction	USDA No. 60 (2)							11/14/11 16:36	thf
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/09/11 11:02	lwt

** Please refer to Qualifier Reports for details.*

Inorganic Analytical Results

Freeport-McMoRan - Chino Mines Company

Project ID:	ZN000000J8	ACZ Sample ID:	***L91355-03***
Sample ID:	STS-PCUG-2011-23	Date Sampled:	*10/11/11 13:35*
		Date Received:	*10/18/11*
		Sample Matrix:	*Soil*

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010B ICP	551			mg/Kg	1	5	11/14/11 11:10	aeb

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
pH, Saturated Paste	USDA No. 60 (21A)	5.8		*	units	0.1	0.1	11/14/11 19:31	thf
Solids, Percent	CLPSOW390, PART F, D-98	93.5		*	%	0.1	0.5	11/16/11 15:00	ndj

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/04/11 11:12	nrc
Digestion - Hot Plate	M3050B ICP							11/11/11 12:02	nrc
Saturated Paste Extraction	USDA No. 60 (2)							11/14/11 17:31	thf
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/09/11 11:04	lwt

** Please refer to Qualifier Reports for details.*

Freeport-McMoRan - Chino Mines Company

Project ID:	ZN000000J8	ACZ Sample ID:	***L91355-04***
Sample ID:	STS-PCUG-2011-24	Date Sampled:	*10/08/11 14:50*
		Date Received:	*10/18/11*
		Sample Matrix:	*Soil*

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010B ICP	1000			mg/Kg	1	5	11/14/11 11:14	aeb

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
pH, Saturated Paste	USDA No. 60 (21A)	4.2		*	units	0.1	0.1	11/14/11 20:12	thf
Solids, Percent	CLPSOW390, PART F, D-98	90.5		*	%	0.1	0.5	11/16/11 15:00	ndj

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/04/11 11:18	nrc
Digestion - Hot Plate	M3050B ICP							11/11/11 12:20	nrc
Saturated Paste Extraction	USDA No. 60 (2)							11/14/11 18:27	thf
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/09/11 11:07	lwt

** Please refer to Qualifier Reports for details.*

Freeport-McMoRan - Chino Mines Company

Project ID:	ZN000000J8	ACZ Sample ID:	***L91355-05***
Sample ID:	STS-PCUG-2011-25	Date Sampled:	*10/10/11 09:50*
		Date Received:	*10/18/11*
		Sample Matrix:	*Soil*

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010B ICP	706			mg/Kg	1	5	11/14/11 11:17	aeb

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
pH, Saturated Paste	USDA No. 60 (21A)	4.6		*	units	0.1	0.1	11/14/11 20:53	thf
Solids, Percent	CLPSOW390, PART F, D-98	92.2		*	%	0.1	0.5	11/16/11 15:00	ndj

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/04/11 11:25	nrc
Digestion - Hot Plate	M3050B ICP							11/11/11 12:37	nrc
Saturated Paste Extraction	USDA No. 60 (2)							11/14/11 19:23	thf
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/09/11 11:09	lwt

** Please refer to Qualifier Reports for details.*

Inorganic Analytical Results

Freeport-McMoRan - Chino Mines Company

Project ID:	ZN000000J8	ACZ Sample ID:	***L91355-06***
Sample ID:	DUP1	Date Sampled:	*10/06/11 00:00*
		Date Received:	*10/18/11*
		Sample Matrix:	*Soil*

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010B ICP	1310			mg/Kg	1	5	11/14/11 11:26	aeb

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
pH, Saturated Paste	USDA No. 60 (21A)	4.0		*	units	0.1	0.1	11/14/11 21:34	thf
Solids, Percent	CLPSOW390, PART F, D-98	92.5		*	%	0.1	0.5	11/16/11 15:00	ndj

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/04/11 11:31	nrc
Digestion - Hot Plate	M3050B ICP							11/11/11 12:55	nrc
Saturated Paste Extraction	USDA No. 60 (2)							11/14/11 20:18	thf
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/09/11 11:12	lwt

** Please refer to Qualifier Reports for details.*

Freeport-McMoRan - Chino Mines Company

Project ID:	ZN000000J8	ACZ Sample ID:	***L91355-07***
Sample ID:	DUP2	Date Sampled:	*10/11/11 00:00*
		Date Received:	*10/18/11*
		Sample Matrix:	*Soil*

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010B ICP	555			mg/Kg	1	5	11/14/11 11:29	aeb

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
pH, Saturated Paste	USDA No. 60 (21A)	4.9		*	units	0.1	0.1	11/14/11 22:15	thf
Solids, Percent	CLPSOW390, PART F, D-98	94.5		*	%	0.1	0.5	11/16/11 15:00	ndj

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/04/11 11:37	nrc
Digestion - Hot Plate	M3050B ICP							11/11/11 13:12	nrc
Saturated Paste Extraction	USDA No. 60 (2)							11/14/11 21:14	thf
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/09/11 11:14	lwt

** Please refer to Qualifier Reports for details.*

Inorganic Analytical Results

Freeport-McMoRan - Chino Mines Company		ACZ Sample ID:	***L91355-08***
Project ID:	ZN000000J8	Date Sampled:	*10/09/11 16:45*
Sample ID:	STS-PCUG-2011-28	Date Received:	*10/18/11*
		Sample Matrix:	*Soil*

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010B ICP	959			mg/Kg	1	5	11/14/11 11:35	aeb

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
pH, Saturated Paste	USDA No. 60 (21A)	7.5		*	units	0.1	0.1	11/14/11 22:56	thf
Solids, Percent	CLPSOW390, PART F, D-98	94.3		*	%	0.1	0.5	11/16/11 15:00	ndj

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/04/11 11:44	nrc
Digestion - Hot Plate	M3050B ICP							11/11/11 13:30	nrc
Saturated Paste Extraction	USDA No. 60 (2)							11/14/11 22:10	thf
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/09/11 11:16	lwt

** Please refer to Qualifier Reports for details.*

Inorganic Analytical Results

Freeport-McMoRan - Chino Mines Company

Project ID:	ZN000000J8	ACZ Sample ID:	***L91355-09***
Sample ID:	STS-PCUG-2011-29	Date Sampled:	*10/11/11 14:25*
		Date Received:	*10/18/11*
		Sample Matrix:	*Soil*

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010B ICP	671			mg/Kg	1	5	11/14/11 11:38	aeb

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
pH, Saturated Paste	USDA No. 60 (21A)	5.2		*	units	0.1	0.1	11/14/11 23:37	thf
Solids, Percent	CLPSOW390, PART F, D-98	94.2		*	%	0.1	0.5	11/16/11 15:00	ndj

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/04/11 11:50	nrc
Digestion - Hot Plate	M3050B ICP							11/11/11 13:47	nrc
Saturated Paste Extraction	USDA No. 60 (2)							11/14/11 23:05	thf
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/09/11 11:19	lwt

** Please refer to Qualifier Reports for details.*

Freeport-McMoRan - Chino Mines Company		ACZ Sample ID:	***L91355-10***
Project ID:	ZN000000J8	Date Sampled:	*10/09/11 16:10*
Sample ID:	STS-PCUG-2011-30	Date Received:	*10/18/11*
		Sample Matrix:	*Soil*

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010B ICP	1500			mg/Kg	1	5	11/14/11 11:42	aeb

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
pH, Saturated Paste	USDA No. 60 (21A)	7.4		*	units	0.1	0.1	11/15/11 0:59	thf
Solids, Percent	CLPSOW390, PART F, D-98	94.6		*	%	0.1	0.5	11/16/11 15:00	ndj

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/04/11 11:56	nrc
Digestion - Hot Plate	M3050B ICP							11/11/11 14:05	nrc
Saturated Paste Extraction	USDA No. 60 (2)							11/15/11 0:01	thf
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/09/11 11:21	lwt

** Please refer to Qualifier Reports for details.*

Inorganic Analytical Results

Freeport-McMoRan - Chino Mines Company

Project ID: ZN000000J8
Sample ID: DUP7

ACZ Sample ID: ***L91355-11***
Date Sampled: *10/06/11 00:00*
Date Received: *10/18/11*
Sample Matrix: *Soil*

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010B ICP	567			mg/Kg	1	5	11/14/11 11:45	aeb

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Solids, Percent	CLPSOW390, PART F, D-98	91.0		*	%	0.1	0.5	11/16/11 15:00	ndj

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/04/11 12:03	nrc
Digestion - Hot Plate	M3050B ICP							11/11/11 14:22	nrc
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/09/11 11:24	lwt

** Please refer to Qualifier Reports for details.*

Freeport-McMoRan - Chino Mines Company

Project ID: ZN000000J8

Sample ID: STS-CG-2011-42

ACZ Sample ID: ***L91355-12***

Date Sampled: *10/09/11 10:00*

Date Received: *10/18/11*

Sample Matrix: *Soil*

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010B ICP	958			mg/Kg	1	5	11/14/11 11:48	aeb

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Solids, Percent	CLPSOW390, PART F, D-98	90.8		*	%	0.1	0.5	11/16/11 15:00	ndj

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/04/11 12:09	nrc
Digestion - Hot Plate	M3050B ICP							11/11/11 14:40	nrc
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/09/11 11:26	lwt

** Please refer to Qualifier Reports for details.*

Freeport-McMoRan - Chino Mines Company

Project ID: ZN000000J8
Sample ID: STS-CG-2011-43

ACZ Sample ID: ***L91355-13***
Date Sampled: *10/06/11 16:00*
Date Received: *10/18/11*
Sample Matrix: *Soil*

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010B ICP	626			mg/Kg	1	5	11/14/11 11:51	aeb

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Solids, Percent	CLPSOW390, PART F, D-98	90.4		*	%	0.1	0.5	11/16/11 15:00	ndj

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/04/11 12:15	nrc
Digestion - Hot Plate	M3050B ICP							11/11/11 14:57	nrc
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/09/11 11:28	lwt

** Please refer to Qualifier Reports for details.*

Freeport-McMoRan - Chino Mines Company

Project ID:	ZN000000J8	ACZ Sample ID:	***L91355-14***
Sample ID:	DUP8	Date Sampled:	*10/07/11 00:00*
		Date Received:	*10/18/11*
		Sample Matrix:	*Soil*

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010B ICP	2450			mg/Kg	1	5	11/14/11 11:54	aeb

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Solids, Percent	CLPSOW390, PART F, D-98	89.8		*	%	0.1	0.5	11/16/11 15:00	ndj

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/04/11 12:22	nrc
Digestion - Hot Plate	M3050B ICP							11/11/11 15:15	nrc
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/09/11 11:31	lwt

** Please refer to Qualifier Reports for details.*

Inorganic Analytical Results

Freeport-McMoRan - Chino Mines Company
Project ID: ZN000000J8
Sample ID: STS-CG-2011-45

ACZ Sample ID: ***L91355-15***
Date Sampled: *10/06/11 14:50*
Date Received: *10/18/11*
Sample Matrix: *Soil*

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010B ICP	668			mg/Kg	1	5	11/14/11 12:03	aeb

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Solids, Percent	CLPSOW390, PART F, D-98	92.3		*	%	0.1	0.5	11/16/11 15:00	ndj

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/04/11 12:28	nrc
Digestion - Hot Plate	M3050B ICP							11/11/11 15:32	nrc
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/09/11 11:33	lwt

** Please refer to Qualifier Reports for details.*

Freeport-McMoRan - Chino Mines Company

Project ID:	ZN000000J8
Sample ID:	STS-CG-2011-46
ACZ Sample ID:	***L91355-16***
Date Sampled:	*10/09/11 13:40*
Date Received:	*10/18/11*
Sample Matrix:	*Soil*

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010B ICP	1100			mg/Kg	1	5	11/14/11 12:06	aeb

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Solids, Percent	CLPSOW390, PART F, D-98	90.6		*	%	0.1	0.5	11/16/11 15:00	ndj

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/04/11 12:34	nrc
Digestion - Hot Plate	M3050B ICP							11/11/11 15:50	nrc
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/09/11 11:36	lwt

** Please refer to Qualifier Reports for details.*

Freeport-McMoRan - Chino Mines Company

Project ID:	ZN000000J8	ACZ Sample ID:	***L91355-17***
Sample ID:	DUP9	Date Sampled:	*10/09/11 00:00*
		Date Received:	*10/18/11*
		Sample Matrix:	*Soil*

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010B ICP	1050			mg/Kg	1	5	11/14/11 12:09	aeb

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Solids, Percent	CLPSOW390, PART F, D-98	90.6		*	%	0.1	0.5	11/16/11 15:00	ndj

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/04/11 12:41	nrc
Digestion - Hot Plate	M3050B ICP							11/11/11 16:07	nrc
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/09/11 11:38	lwt

** Please refer to Qualifier Reports for details.*

Freeport-McMoRan - Chino Mines Company

Project ID:	ZN000000J8	ACZ Sample ID:	***L91355-18***
Sample ID:	DUP3	Date Sampled:	*10/13/11 00:00*
		Date Received:	*10/18/11*
		Sample Matrix:	*Soil*

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010B ICP	372			mg/Kg	1	5	11/14/11 12:12	aeb

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
pH, Saturated Paste	USDA No. 60 (21A)	5.9		*	units	0.1	0.1	11/15/11 1:40	thf
Solids, Percent	CLPSOW390, PART F, D-98	97.0		*	%	0.1	0.5	11/16/11 15:00	ndj

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/04/11 12:47	nrc
Digestion - Hot Plate	M3050B ICP							11/11/11 16:25	nrc
Saturated Paste Extraction	USDA No. 60 (2)							11/15/11 0:57	thf
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/09/11 11:40	lwt

** Please refer to Qualifier Reports for details.*

Freeport-McMoRan - Chino Mines Company		ACZ Sample ID:	***L91355-19***
Project ID:	ZN000000J8	Date Sampled:	*10/09/11 11:55*
Sample ID:	STS-CG-2011-49	Date Received:	*10/18/11*
		Sample Matrix:	*Soil*

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010B ICP	733			mg/Kg	1	5	11/14/11 12:16	aeb

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Solids, Percent	CLPSOW390, PART F, D-98	93.8		*	%	0.1	0.5	11/16/11 15:00	ndj

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/04/11 12:53	nrc
Digestion - Hot Plate	M3050B ICP							11/11/11 16:42	nrc
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/09/11 11:43	lwt

** Please refer to Qualifier Reports for details.*

Inorganic Analytical Results

Freeport-McMoRan - Chino Mines Company

Project ID: ZN000000J8
Sample ID: STS-CG-2011-50

ACZ Sample ID: ***L91355-20***
Date Sampled: *10/09/11 11:10*
Date Received: *10/18/11*
Sample Matrix: *Soil*

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010B ICP	620			mg/Kg	1	5	11/14/11 12:19	aeb

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Solids, Percent	CLPSOW390, PART F, D-98	92.4		*	%	0.1	0.5	11/16/11 15:00	ndj

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/04/11 13:00	nrc
Digestion - Hot Plate	M3050B ICP							11/11/11 17:00	nrc
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/09/11 11:45	lwt

** Please refer to Qualifier Reports for details.*

Inorganic Reference

Report Header Explanations

Batch	A distinct set of samples analyzed at a specific time
Found	Value of the QC Type of interest
Limit	Upper limit for RPD, in %.
Lower	Lower Recovery Limit, in % (except for LCSS, mg/Kg)
MDL	Method Detection Limit. Same as Minimum Reporting Limit. Allows for instrument and annual fluctuations.
PCN/SCN	A number assigned to reagents/standards to trace to the manufacturer's certificate of analysis
PQL	Practical Quantitation Limit, typically 5 times the MDL.
QC	True Value of the Control Sample or the amount added to the Spike
Rec	Amount of the true value or spike added recovered, in % (except for LCSS, mg/Kg)
RPD	Relative Percent Difference, calculation used for Duplicate QC Types
Upper	Upper Recovery Limit, in % (except for LCSS, mg/Kg)
Sample	Value of the Sample of interest

QC Sample Types

AS	Analytical Spike (Post Digestion)	*LCSWD*	Laboratory Control Sample - Water Duplicate
ASD	Analytical Spike (Post Digestion) Duplicate	*LFB*	Laboratory Fortified Blank
CCB	Continuing Calibration Blank	*LFM*	Laboratory Fortified Matrix
CCV	Continuing Calibration Verification standard	*LFMD*	Laboratory Fortified Matrix Duplicate
DUP	Sample Duplicate	*LRB*	Laboratory Reagent Blank
ICB	Initial Calibration Blank	*MS*	Matrix Spike
ICV	Initial Calibration Verification standard	*MSD*	Matrix Spike Duplicate
ICSAB	Inter-element Correction Standard - A plus B solutions	*PBS*	Prep Blank - Soil
LCSS	Laboratory Control Sample - Soil	*PBW*	Prep Blank - Water
LCSSD	Laboratory Control Sample - Soil Duplicate	*PQV*	Practical Quantitation Verification standard
LCSW	Laboratory Control Sample - Water	*SDL*	Serial Dilution

QC Sample Type Explanations

Blanks	Verifies that there is no or minimal contamination in the prep method or calibration procedure.
Control Samples	Verifies the accuracy of the method, including the prep procedure.
Duplicates	Verifies the precision of the instrument and/or method.
Spikes/Fortified Matrix	Determines sample matrix interferences, if any.
Standard	Verifies the validity of the calibration.

ACZ Qualifiers (Qual)

B	Analyte concentration detected at a value between MDL and PQL. The associated value is an estimated quantity.
H	Analysis exceeded method hold time. pH is a field test with an immediate hold time.
L	Target analyte response was below the laboratory defined negative threshold.
U	The material was analyzed for, but was not detected above the level of the associated value. The associated value is either the sample quantitation limit or the sample detection limit.

Method References

(1) EPA 600/4-83-020. Methods for Chemical Analysis of Water and Wastes, March 1983.
(2) EPA 600/R-93-100. Methods for the Determination of Inorganic Substances in Environmental Samples, August 1993.
(3) EPA 600/R-94-111. Methods for the Determination of Metals in Environmental Samples - Supplement I, May 1994.
(4) EPA SW-846. Test Methods for Evaluating Solid Waste, Third Edition with Update III, December 1996.
(5) Standard Methods for the Examination of Water and Wastewater, 19th edition, 1995 & 20th edition (1998).

Comments

(1) QC results calculated from raw data. Results may vary slightly if the rounded values are used in the calculations.
(2) Soil, Sludge, and Plant matrices for Inorganic analyses are reported on a dry weight basis.
(3) Animal matrices for Inorganic analyses are reported on an "as received" basis.
(4) An asterisk in the "XQ" column indicates there is an extended qualifier and/or certification qualifier associated with the result.

For a complete list of ACZ's Extended Qualifiers, please click: http://www.acz.com/public/extquallist.pdf

Freeport-McMoRan - Chino Mines Company
Project ID: ZN000000J8

ACZ Project ID: ***L91355***

Copper, total (3050) M6010B ICP

ACZ ID	Type	Analyzed	PCN/SCN	QC	Sample	Found	Units	Rec	Lower	Upper	RPD	Limit	Qual
WG313493													
WG313493ICV	ICV	11/14/11 10:33	II111012-2	2		1.992	mg/L	99.6	90	110			
WG313493ICB	ICB	11/14/11 10:36				U	mg/L		-0.03	0.03			
WG313493PQV	PQV	11/14/11 10:39	II111024-4	.05		.048	mg/L	96	70	130			
WG313493ICSAB	ICSAB	11/14/11 10:43	II110922-1	.255		.251	mg/L	98.4	80	120			
WG313416PBS	PBS	11/14/11 10:49				U	mg/Kg		-3	3			
WG313416LCSS	LCSS	11/14/11 10:52	PCN38231	117		124.1	mg/Kg		98	136			
WG313416LCSSD	LCSSD	11/14/11 10:55	PCN38231	117		120.7	mg/Kg		98	136	2.8	20	
L91355-01MS	MS	11/14/11 11:01	II111104-3	50.5	558	596.3	mg/Kg	75.8	75	125			
L91355-01MSD	MSD	11/14/11 11:04	II111104-3	50.5	558	601.3	mg/Kg	85.7	75	125	0.84	20	
WG313493CCV1	CCV	11/14/11 11:20	II111031-1	1		.99	mg/L	99	90	110			
WG313493CCB1	CCB	11/14/11 11:23				U	mg/L		-0.03	0.03			
L91355-07SDL	SDL	11/14/11 11:32			555	576.5	mg/Kg				3.9	10	
WG313493CCV2	CCV	11/14/11 11:57	II111031-1	1		.986	mg/L	98.6	90	110			
WG313493CCB2	CCB	11/14/11 12:00				U	mg/L		-0.03	0.03			
WG313493CCV3	CCV	11/14/11 12:22	II111031-1	1		.976	mg/L	97.6	90	110			
WG313493CCB3	CCB	11/14/11 12:25				U	mg/L		-0.03	0.03			

pH, Saturated Paste USDA No. 60 (21A)

ACZ ID	Type	Analyzed	PCN/SCN	QC	Sample	Found	Units	Rec	Lower	Upper	RPD	Limit	Qual
WG313542													
WG313542ICV	ICV	11/14/11 16:47	PCN36616	4		4.01	units	100.3	97	103			
L91355-01DUP	DUP	11/14/11 18:09			4.8	4.74	units				1.3	20	
WG313542CCV1	CCV	11/15/11 0:18	PCN36616	4		3.99	units	99.8	97	103			
WG313542CCV2	CCV	11/15/11 7:49	PCN36616	4		3.99	units	99.8	97	103			
WG313542CCV3	CCV	11/15/11 9:11	PCN36616	4		3.98	units	99.5	97	103			

Solids, Percent CLPSOW390, PART F, D-98

ACZ ID	Type	Analyzed	PCN/SCN	QC	Sample	Found	Units	Rec	Lower	Upper	RPD	Limit	Qual
WG313733													
WG313733PBS	PBS	11/16/11 15:00				U	%		99.9	100.1			
L91355-01DUP	DUP	11/16/11 15:00			93.7	93.77	%				0.1	20	

ACZ ID	WORKNUM	PARAMETER	METHOD	QUAL	DESCRIPTION

No extended qualifiers associated with this analysis

Soil Analysis

The following parameters are not offered for certification or are not covered by NELAC certificate #ACZ.

pH, Saturated Paste	USDA No. 60 (21A)
Solids, Percent	CLPSOW390, PART F, D-98

ACZ Laboratories, Inc.
2773 Downhill Drive Steamboat Springs, CO 80487 (800) 334-5493

Sample Receipt

Freeport-McMoRan - Chino Mines Company
ZN000000J8

ACZ Project ID: L91355
Date Received: 10/18/2011 09:23
Received By: ksj
Date Printed: 10/19/2011

Receipt Verification

	YES	NO	NA
1) Does this project require special handling procedures such as CLP protocol?			X
2) Are the custody seals on the cooler intact?	X		
3) Are the custody seals on the sample containers intact?			X
4) Is there a Chain of Custody or other directive shipping papers present?	X		
5) Is the Chain of Custody complete?	X		
6) Is the Chain of Custody in agreement with the samples received?	X		
7) Is there enough sample for all requested analyses?	X		
8) Are all samples within holding times for requested analyses?	X		
9) Were all sample containers received intact?	X		
10) Are the temperature blanks present?			X
11) Are the trip blanks (VOA and/or Cyanide) present?			X
12) Are samples requiring no headspace, headspace free?			X
13) Do the samples that require a Foreign Soils Permit have one?			X

Exceptions: If you answered no to any of the above questions, please describe

N/A

Contact (For any discrepancies, the client must be contacted)

N/A

Shipping Containers

Cooler Id		Temp (℃)	Rad (µR/hr)
3282		9.2	18
3164		10.4	18
2316		13.3	22
3045		13.6	20

Client must contact ACZ Project Manager if analysis should not proceed for samples received outside of thermal preservation acceptance criteria.

Notes

ACZ Laboratories, Inc.
2773 Downhill Drive Steamboat Springs, CO 80487 (800) 334-5493

Sample Receipt

Freeport-McMoRan - Chino Mines Company
ZN000000J8

ACZ Project ID: L91355
Date Received: 10/18/2011 09:23
Received By: ksj
Date Printed: 10/19/2011

Sample Container Preservation

SAMPLE	CLIENT ID	R < 2	G < 2	BK < 2	Y< 2	YG< 2	B< 2	O < 2	T >12	N/A	RAD	ID
L91355-01	STS-PCUG-2011-21									X		☐
L91355-02	STS-PCUG-2011-22									X		☐
L91355-03	STS-PCUG-2011-23									X		☐
L91355-04	STS-PCUG-2011-24									X		☐
L91355-05	STS-PCUG-2011-25									X		☐
L91355-06	DUP1									X		☐
L91355-07	DUP2									X		☐
L91355-08	STS-PCUG-2011-28									X		☐
L91355-09	STS-PCUG-2011-29									X		☐
L91355-10	STS-PCUG-2011-30									X		☐
L91355-11	DUP7									X		☐
L91355-12	STS-CG-2011-42									X		☐
L91355-13	STS-CG-2011-43									X		☐
L91355-14	DUP8									X		☐
L91355-15	STS-CG-2011-45									X		☐
L91355-16	STS-CG-2011-46									X		☐
L91355-17	DUP9									X		☐
L91355-18	DUP3									X		☐
L91355-19	STS-CG-2011-49									X		☐
L91355-20	STS-CG-2011-50									X		☐

Sample Container Preservation Legend

Abbreviation	Description	Container Type	Preservative/Limits
R	Raw/Nitric	RED	pH must be < 2
B	Filtered/Sulfuric	BLUE	pH must be < 2
BK	Filtered/Nitric	BLACK	pH must be < 2
G	Filtered/Nitric	GREEN	pH must be < 2
O	Raw/Sulfuric	ORANGE	pH must be < 2
P	Raw/NaOH	PURPLE	pH must be > 12 *
T	Raw/NaOH Zinc Acetate	TAN	pH must be > 12
Y	Raw/Sulfuric	YELLOW	pH must be < 2
YG	Raw/Sulfuric	YELLOW GLASS	pH must be < 2
N/A	No preservative needed	Not applicable	
RAD	Gamma/Beta dose rate	Not applicable	must be < 250 µR/hr

* pH check performed by analyst prior to sample preparation

Sample IDs Reviewed By: ksj

ACZ Laboratories, Inc.
2773 Downhill Drive Steamboat Springs, CO 80487 (800) 334-5493

L91355

CHAIN of CUSTODY

Report to:

Name: Pam Pinson	Address: P.O. Box 10
Company: Chino Mines Company	Bayard, NM 88023
E-mail: Pamela_Pinson@FMI.com	Telephone: 575-912-5213

Copy of Report to:

Name: Matthew Barkley	E-mail: Matthew.Barkley@arcadis-us.com
Company: ARCADIS	Telephone: 303-231-9115 ext 157

Invoice to:

Name: Pam Pinson	Address: P.O. Box 10
Company: Chino Mines Company	Bayard, NM 88023
E-mail: Pamela_Pinson@FMI.com	Telephone: 575-912-5213

If sample(s) received past holding time (HT), or if insufficient HT remains to complete analysis before expiration, shall ACZ proceed with requested short HT analyses? YES ☒ NO ☐

If "NO" then ACZ will contact client for further instruction. If neither "YES" nor "NO" is indicated, ACZ will proceed with the requested analyses, even if HT is expired, and data will be qualified.

Are samples for CO DW Compliance Monitoring? YES ☐ NO ☒

If yes, please include state forms. Results will be reported to PQL.

PROJECT INFORMATION

Quote #:

Project/PO #:

Reporting state for compliance testing:

Sampler's Name: Carolyn Meyer

Are any samples NRC licensable material? Yes No

ANALYSES REQUESTED

SAMPLE IDENTIFICATION	DATE:TIME	Matrix	# of Containers	soil sieved to < 2mm	pH	Total CU					
STS-PCUG-2011-21	10.11.11 : 09:05"	SO	1	x	x	x					
STS-PCUG-2011-22	10.10.11 : 15:00"	SO	1	x	x	x					
STS-PCUG-2011-23	10.11.11 : 13:35"	SO	1	x	x	x					
STS-PCUG-2011-24	10.8.11 : 14:50"	SO	1	x	x	x					
STS-PCUG-2011-25	10.10.11 : 09:50"	SO	1	x	x	x					
DUP1	10.6.11 : ---"	SO	1	x	x	x					
DUP2	10.11.11 : ---"	SO	1	x	x	x					
STS-PCUG-2011-28	10.9.11 : 16:45"	SO	1	x	x	x					
STS-PCUG-2011-29	10.11.11 : 14:25"	SO	1	x	x	x					
STS-PCUG-2011-30	10.9.11 : 16:10"	SO	1	x	x	x					

Matrix SW (Surface Water) · GW (Ground Water) · WW (Waste Water) · DW (Drinking Water) · SL (Sludge) · SO (Soil) · OL (Oil) · Other (Specify)

REMARKS

Please send to Sheri Fling at URS for validation. Sieve all soil samples to <2 mm prior to analysis. Soil should be reported on a dry weight basis.
Methods:
pH - 9045C and Copper - 6010B

Please refer to ACZ's terms & conditions located on the reverse side of this COC.

RELINQUISHED BY:	DATE:TIME	RECEIVED BY:	DATE:TIME
	10.14.11 10:30		10-18-11 9:42

①

L91355 Chain of Custody

FRMAD050.01.15.09 White - Return with sample. Yellow - Retain for your records.

ACZ Laboratories, Inc. L91355

2773 Downhill Drive Steamboat Springs, CO 80487 (800) 334-5493

CHAIN of CUSTODY

Name: Pam Pinson
Company: Chino Mines Company
E-mail: Pamela_Pinson@FMI.com

Address: P.O. Box 10
Bayard, NM 88023
Telephone: 575-912-5213

Name: Matthew Barkley
Company: ARCADIS

E-mail: Matthew.Barkley@arcadis-us.com
Telephone: 303-231-9115 ext 157

Name: Pam Pinson
Company: Chino Mines Company
E-mail: Pamela_Pinson@FMI.com

Address: P.O. Box 10
Bayard, NM 88023
Telephone: 575-912-5213

If sample(s) received past holding time (HT), or if insufficient HT remains to complete analysis before expiration, shall ACZ proceed with requested short HT analyses? YES ☒ NO ☐
If "NO" then ACZ will contact client for further instruction. If neither "YES" nor "NO" is indicated, ACZ will proceed with the requested analyses, even if HT is expired, and data will be qualified.

Are samples for CO DW Compliance Monitoring? YES ☐ NO ☒
If yes, please include state forms. Results will be reported to PQL.

Quote #:
Project/PO #:
Reporting state for compliance testing:
Sampler's Name: Carolyn Meyer
Are any samples NRC licensable material? Yes No

			# of Containers	soil sieved to < 2mm	Total Copper	pH
DUP7	10.6.11 : ---	SO	1	x	x	
STS-CG-2011-42	10.9.11 : 10:00	SO	1	x	x	
STS-CG-2011-43	10.6.11 : 16:00	SO	1	x	x	
DUP8	10.7.11 : ---	SO	1	x	x	
STS-CG-2011-45	10.6.11 : 14:50	SO	1	x	x	
STS-CG-2011-46	10.9.11 : 13:40	SO	1	x	x	
DUP9	10.9.11 : ---	SO	1	x	x	
DUP3	10.13.11 : ---	SO	1	x	x	x
STS-CG-2011-49	10.9.11 : 11:55	SO	1	x	x	
STS-CG-2011-50	10.9.11 : 11:10	SO	1	x	x	

Matrix SW (Surface Water) · GW (Ground Water) · WW (Waste Water) · DW (Drinking Water) · SL (Sludge) · SO (Soil) · OL (Oil) · Other (Specify)

Please send to Sheri Fling at URS for validation. Sieve all soil samples to <2 mm prior to analysis. Soil should be reported on a dry weight basis.
Methods:
Copper - 6010B

(2)

Please refer to ACZ's terms & conditions located on the reverse side of this COC.

10.14.11 10:3

10-14-11 9:2

FRMAD050.01.15.09 White - Return with sample. Yellow - Retain for your records.

ACZ Laboratories, Inc.
2773 Downhill Drive Steamboat Springs, CO 80487 (800) 334-5493

Analytical Report

November 18, 2011

Report to:	Bill to:
Pam Pinson	Pam Pinson
Freeport-McMoRan - Chino Mines Company	Freeport-McMoRan - Chino Mines Company
PO Box 10	P.O. Box 13308
Bayard, NM 88023	Phoenix, AZ 85002-3308

cc: Matthew Barkley, Sheri Fling

Project ID: ZN000000J8
ACZ Project ID: L91357

Pam Pinson:

Enclosed are the analytical results for sample(s) submitted to ACZ Laboratories, Inc. (ACZ) on October 18, 2011. This project has been assigned to ACZ's project number, L91357. Please reference this number in all future inquiries.

All analyses were performed according to ACZ's Quality Assurance Plan. The enclosed results relate only to the samples received under L91357. Each section of this report has been reviewed and approved by the appropriate Laboratory Supervisor, or a qualified substitute.

Except as noted, the test results for the methods and parameters listed on ACZ's current NELAC certificate letter (#ACZ) meet all requirements of NELAC.

This report shall be used or copied only in its entirety. ACZ is not responsible for the consequences arising from the use of a partial report.

All samples and sub-samples associated with this project will be disposed of after December 18, 2011. If the samples are determined to be hazardous, additional charges apply for disposal (typically less than $10/sample). If you would like the samples to be held longer than ACZ's stated policy or to be returned, please contact your Project Manager or Customer Service Representative for further details and associated costs. ACZ retains analytical reports for five years.

If you have any questions or other needs, please contact your Project Manager.

S. Habermehl

Scott Habermehl has reviewed
and approved this report.

Freeport-McMoRan - Chino Mines Company

Project ID:	ZN000000J8	ACZ Sample ID:	***L91357-01***
Sample ID:	STS-PCUG-2011-11	Date Sampled:	*10/13/11 17:30*
		Date Received:	*10/18/11*
		Sample Matrix:	*Soil*

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010B ICP	254		*	mg/Kg	1	5	11/15/11 18:27	aeb

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
pH, Saturated Paste	USDA No. 60 (21A)	4.6		*	units	0.1	0.1	11/14/11 22:53	thf
Solids, Percent	CLPSOW390, PART F, D-98	94.3		*	%	0.1	0.5	11/15/11 15:33	thf/nrc

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/10/11 14:45	thf/nrc
Digestion - Hot Plate	M3050B ICP							11/14/11 11:00	ndj
Saturated Paste Extraction	USDA No. 60 (2)							11/14/11 19:48	thf
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/14/11 10:30	thf

** Please refer to Qualifier Reports for details.*

Inorganic Analytical Results

Freeport-McMoRan - Chino Mines Company

Project ID:	ZN000000J8	ACZ Sample ID:	***L91357-02***
Sample ID:	STS-PCUG-2011-12	Date Sampled:	*10/12/11 12:20*
		Date Received:	*10/18/11*
		Sample Matrix:	*Soil*

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010B ICP	536		*	mg/Kg	1	5	11/15/11 18:36	aeb

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
pH, Saturated Paste	USDA No. 60 (21A)	6.7		*	units	0.1	0.1	11/14/11 23:56	thf
Solids, Percent	CLPSOW390, PART F, D-98	93.3		*	%	0.1	0.5	11/15/11 16:28	thf/nrc

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/10/11 14:48	thf/nrc
Digestion - Hot Plate	M3050B ICP							11/14/11 11:00	ndj
Saturated Paste Extraction	USDA No. 60 (2)							11/14/11 21:25	thf
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/14/11 10:32	thf

** Please refer to Qualifier Reports for details.*

Freeport-McMoRan - Chino Mines Company

Project ID:	ZN000000J8	ACZ Sample ID:	***L91357-03***
Sample ID:	STS-PCUG-2011-13	Date Sampled:	*10/11/11 13:55*
		Date Received:	*10/18/11*
		Sample Matrix:	*Soil*

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010B ICP	602		*	mg/Kg	1	5	11/15/11 18:39	aeb

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
pH, Saturated Paste	USDA No. 60 (21A)	5.1		*	units	0.1	0.1	11/15/11 0:59	thf
Solids, Percent	CLPSOW390, PART F, D-98	94.2		*	%	0.1	0.5	11/15/11 17:24	thf/nrc

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/10/11 14:51	thf/nrc
Digestion - Hot Plate	M3050B ICP							11/14/11 11:00	ndj
Saturated Paste Extraction	USDA No. 60 (2)							11/14/11 23:02	thf
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/14/11 10:35	thf

** Please refer to Qualifier Reports for details.*

Inorganic Analytical Results

Freeport-McMoRan - Chino Mines Company
Project ID: ZN000000J8
Sample ID: STS-PCUG-2011-14

ACZ Sample ID: ***L91357-04***
Date Sampled: *10/13/11 10:00*
Date Received: *10/18/11*
Sample Matrix: *Soil*

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010B ICP	354		*	mg/Kg	1	5	11/15/11 18:42	aeb

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
pH, Saturated Paste	USDA No. 60 (21A)	5.9		*	units	0.1	0.1	11/15/11 2:03	thf
Solids, Percent	CLPSOW390, PART F, D-98	97.2		*	%	0.1	0.5	11/15/11 18:19	thf/nrc

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/10/11 14:54	thf/nrc
Digestion - Hot Plate	M3050B ICP							11/14/11 11:00	ndj
Saturated Paste Extraction	USDA No. 60 (2)							11/15/11 0:39	thf
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/14/11 10:38	thf

** Please refer to Qualifier Reports for details.*

Inorganic Analytical Results

Freeport-McMoRan - Chino Mines Company

Project ID: ZN000000J8
Sample ID: STS-PCUG-2011-41

ACZ Sample ID: ***L91357-05***
Date Sampled: *10/13/11 08:40*
Date Received: *10/18/11*
Sample Matrix: *Soil*

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010B ICP	587		*	mg/Kg	1	5	11/15/11 18:45	aeb

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
pH, Saturated Paste	USDA No. 60 (21A)	3.3		*	units	0.1	0.1	11/15/11 3:06	thf
Solids, Percent	CLPSOW390, PART F, D-98	96.7		*	%	0.1	0.5	11/15/11 19:14	thf/nrc

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/10/11 14:58	thf/nrc
Digestion - Hot Plate	M3050B ICP							11/14/11 11:00	ndj
Saturated Paste Extraction	USDA No. 60 (2)							11/15/11 2:16	thf
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/14/11 10:41	thf

** Please refer to Qualifier Reports for details.*

Freeport-McMoRan - Chino Mines Company

Project ID:	ZN000000J8	ACZ Sample ID:	***L91357-06***
Sample ID:	STS-PCUG-2011-16	Date Sampled:	*10/09/11 12:55*
		Date Received:	*10/18/11*
		Sample Matrix:	*Soil*

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010B ICP	864		*	mg/Kg	1	5	11/15/11 18:54	aeb

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
pH, Saturated Paste	USDA No. 60 (21A)	5.2		*	units	0.1	0.1	11/15/11 4:09	thf
Solids, Percent	CLPSOW390, PART F, D-98	89.1		*	%	0.1	0.5	11/15/11 20:10	thf/nrc

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/10/11 15:01	thf/nrc
Digestion - Hot Plate	M3050B ICP							11/14/11 11:00	ndj
Saturated Paste Extraction	USDA No. 60 (2)							11/15/11 3:53	thf
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/14/11 10:44	thf

** Please refer to Qualifier Reports for details.*

Freeport-McMoRan - Chino Mines Company		ACZ Sample ID:	***L91357-07***
Project ID:	ZN000000J8	Date Sampled:	*10/10/11 10:50*
Sample ID:	STS-PCUG-2011-17	Date Received:	*10/18/11*
		Sample Matrix:	*Soil*

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010B ICP	994		*	mg/Kg	1	5	11/15/11 18:57	aeb

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
pH, Saturated Paste	USDA No. 60 (21A)	5.1		*	units	0.1	0.1	11/15/11 5:12	thf
Solids, Percent	CLPSOW390, PART F, D-98	94.2		*	%	0.1	0.5	11/15/11 21:05	thf/nrc

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/10/11 15:04	thf/nrc
Digestion - Hot Plate	M3050B ICP							11/14/11 11:00	ndj
Saturated Paste Extraction	USDA No. 60 (2)							11/15/11 5:30	thf
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/14/11 10:47	thf

** Please refer to Qualifier Reports for details.*

Freeport-McMoRan - Chino Mines Company		ACZ Sample ID:	***L91357-08***
Project ID:	ZN000000J8	Date Sampled:	*10/09/11 14:50*
Sample ID:	STS-PCUG-2011-18	Date Received:	*10/18/11*
		Sample Matrix:	*Soil*

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010B ICP	1540		*	mg/Kg	1	5	11/15/11 19:00	aeb

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
pH, Saturated Paste	USDA No. 60 (21A)	5.3		*	units	0.1	0.1	11/15/11 6:15	thf
Solids, Percent	CLPSOW390, PART F, D-98	93.3		*	%	0.1	0.5	11/15/11 22:00	thf/nrc

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/10/11 15:08	thf/nrc
Digestion - Hot Plate	M3050B ICP							11/14/11 11:00	ndj
Saturated Paste Extraction	USDA No. 60 (2)							11/15/11 7:07	thf
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/14/11 10:49	thf

** Please refer to Qualifier Reports for details.*

Freeport-McMoRan - Chino Mines Company

Project ID:	ZN000000J8	ACZ Sample ID:	***L91357-09***
Sample ID:	STS-PCUG-2011-19	Date Sampled:	*10/06/11 12:00*
		Date Received:	*10/18/11*
		Sample Matrix:	*Soil*

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010B ICP	1210		*	mg/Kg	1	5	11/15/11 19:03	aeb

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
pH, Saturated Paste	USDA No. 60 (21A)	3.9		*	units	0.1	0.1	11/15/11 8:21	thf
Solids, Percent	CLPSOW390, PART F, D-98	92.4		*	%	0.1	0.5	11/15/11 22:56	thf/nrc

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/10/11 15:11	thf/nrc
Digestion - Hot Plate	M3050B ICP							11/14/11 11:00	ndj
Saturated Paste Extraction	USDA No. 60 (2)							11/15/11 8:44	thf
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/14/11 10:52	thf

** Please refer to Qualifier Reports for details.*

Freeport-McMoRan - Chino Mines Company

Project ID:	ZN000000J8	ACZ Sample ID:	***L91357-10***
Sample ID:	STS-PCUG-2011-20	Date Sampled:	*10/12/11 15:00*
		Date Received:	*10/18/11*
		Sample Matrix:	*Soil*

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010B ICP	520		*	mg/Kg	1	5	11/15/11 19:06	aeb

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
pH, Saturated Paste	USDA No. 60 (21A)	4.1		*	units	0.1	0.1	11/15/11 9:24	thf
Solids, Percent	CLPSOW390, PART F, D-98	92.9		*	%	0.1	0.5	11/15/11 23:51	thf/nrc

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/10/11 15:14	thf/nrc
Digestion - Hot Plate	M3050B ICP							11/14/11 11:00	ndj
Saturated Paste Extraction	USDA No. 60 (2)							11/15/11 10:21	thf
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/14/11 10:55	thf

** Please refer to Qualifier Reports for details.*

Inorganic Analytical Results

Freeport-McMoRan - Chino Mines Company

Project ID:	ZN000000J8	ACZ Sample ID:	***L91357-11***
Sample ID:	STS-CG-2011-21	Date Sampled:	*10/05/11 15:50*
		Date Received:	*10/18/11*
		Sample Matrix:	*Soil*

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010B ICP	448		*	mg/Kg	1	5	11/15/11 19:09	aeb

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Solids, Percent	CLPSOW390, PART F, D-98	90.4		*	%	0.1	0.5	11/16/11 0:46	thf/nrc

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/10/11 15:18	thf/nrc
Digestion - Hot Plate	M3050B ICP							11/14/11 11:00	ndj
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/14/11 10:58	thf

** Please refer to Qualifier Reports for details.*

Freeport-McMoRan - Chino Mines Company

Project ID:	ZN000000J8	ACZ Sample ID:	***L91357-12***
Sample ID:	STS-CG-2011-9	Date Sampled:	*10/04/11 12:50*
		Date Received:	*10/18/11*
		Sample Matrix:	*Soil*

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010B ICP	646		*	mg/Kg	1	5	11/15/11 19:12	aeb

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Solids, Percent	CLPSOW390, PART F, D-98	93.6		*	%	0.1	0.5	11/16/11 1:42	thf/nrc

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/10/11 15:21	thf/nrc
Digestion - Hot Plate	M3050B ICP							11/14/11 11:00	ndj
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/14/11 11:01	thf

** Please refer to Qualifier Reports for details.*

Freeport-McMoRan - Chino Mines Company

Project ID:	ZN000000J8	ACZ Sample ID:	***L91357-13***
Sample ID:	STS-CG-2011-10	Date Sampled:	*10/07/11 13:23*
		Date Received:	*10/18/11*
		Sample Matrix:	*Soil*

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010B ICP	1930		*	mg/Kg	1	5	11/15/11 19:15	aeb

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Solids, Percent	CLPSOW390, PART F, D-98	89.8		*	%	0.1	0.5	11/16/11 2:37	thf/nrc

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/10/11 15:24	thf/nrc
Digestion - Hot Plate	M3050B ICP							11/14/11 11:00	ndj
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/14/11 11:04	thf

** Please refer to Qualifier Reports for details.*

Inorganic Analytical Results

Freeport-McMoRan - Chino Mines Company

Project ID:	ZN000000J8	ACZ Sample ID:	***L91357-14***
Sample ID:	STS-CG-2011-24	Date Sampled:	*10/05/11 17:20*
		Date Received:	*10/18/11*
		Sample Matrix:	*Soil*

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010B ICP	917		*	mg/Kg	1	5	11/15/11 19:21	aeb

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Solids, Percent	CLPSOW390, PART F, D-98	91.4		*	%	0.1	0.5	11/16/11 3:32	thf/nrc

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/10/11 15:28	thf/nrc
Digestion - Hot Plate	M3050B ICP							11/14/11 11:00	ndj
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/14/11 11:07	thf

** Please refer to Qualifier Reports for details.*

Inorganic Analytical Results

Freeport-McMoRan - Chino Mines Company

Project ID:	ZN000000J8	ACZ Sample ID:	***L91357-15***
Sample ID:	STS-CG-2011-25	Date Sampled:	*10/10/11 17:00*
		Date Received:	*10/18/11*
		Sample Matrix:	*Soil*

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010B ICP	1640		*	mg/Kg	1	5	11/15/11 19:31	aeb

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Solids, Percent	CLPSOW390, PART F, D-98	95.0		*	%	0.1	0.5	11/16/11 4:28	thf/nrc

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/10/11 15:31	thf/nrc
Digestion - Hot Plate	M3050B ICP							11/14/11 11:00	ndj
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/14/11 11:09	thf

** Please refer to Qualifier Reports for details.*

Freeport-McMoRan - Chino Mines Company		ACZ Sample ID:	***L91357-16***
Project ID:	ZN000000J8	Date Sampled:	*10/08/11 15:45*
Sample ID:	STS-CG-2011-26	Date Received:	*10/18/11*
		Sample Matrix:	*Soil*

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010B ICP	416		*	mg/Kg	1	5	11/15/11 19:34	aeb

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Solids, Percent	CLPSOW390, PART F, D-98	91.4		*	%	0.1	0.5	11/16/11 5:23	thf/nrc

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/10/11 15:34	thf/nrc
Digestion - Hot Plate	M3050B ICP							11/14/11 11:00	ndj
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/14/11 11:12	thf

** Please refer to Qualifier Reports for details.*

Inorganic Analytical Results

Freeport-McMoRan - Chino Mines Company

Project ID: ZN000000J8
Sample ID: STS-CG-2011-27

ACZ Sample ID: ***L91357-17***
Date Sampled: *10/08/11 10:00*
Date Received: *10/18/11*
Sample Matrix: *Soil*

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010B ICP	1870		*	mg/Kg	1	5	11/15/11 19:37	aeb

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Solids, Percent	CLPSOW390, PART F, D-98	92.3		*	%	0.1	0.5	11/16/11 6:18	thf/nrc

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/10/11 15:38	thf/nrc
Digestion - Hot Plate	M3050B ICP							11/14/11 11:00	ndj
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/14/11 11:15	thf

** Please refer to Qualifier Reports for details.*

Inorganic Analytical Results

Freeport-McMoRan - Chino Mines Company

Project ID:	ZN000000J8	ACZ Sample ID:	***L91357-18***
Sample ID:	STS-CG-2011-28	Date Sampled:	*10/05/11 16:35*
		Date Received:	*10/18/11*
		Sample Matrix:	*Soil*

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010B ICP	606		*	mg/Kg	1	5	11/15/11 19:40	aeb

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Solids, Percent	CLPSOW390, PART F, D-98	88.2		*	%	0.1	0.5	11/16/11 7:14	thf/nrc

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/10/11 15:41	thf/nrc
Digestion - Hot Plate	M3050B ICP							11/14/11 11:00	ndj
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/14/11 11:18	thf

** Please refer to Qualifier Reports for details.*

Inorganic Analytical Results

Freeport-McMoRan - Chino Mines Company

Project ID:	ZN000000J8	ACZ Sample ID:	***L91357-19***
Sample ID:	STS-CG-2011-29	Date Sampled:	*10/10/11 14:15*
		Date Received:	*10/18/11*
		Sample Matrix:	*Soil*

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010B ICP	1390		*	mg/Kg	1	5	11/15/11 19:43	aeb

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Solids, Percent	CLPSOW390, PART F, D-98	93.6		*	%	0.1	0.5	11/16/11 8:09	thf/nrc

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/10/11 15:44	thf/nrc
Digestion - Hot Plate	M3050B ICP							11/14/11 11:00	ndj
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/14/11 11:21	thf

** Please refer to Qualifier Reports for details.*

Inorganic Analytical Results

Freeport-McMoRan - Chino Mines Company

Project ID: ZN000000J8

Sample ID: STS-CG-2011-30

ACZ Sample ID: ***L91357-20***

Date Sampled: *10/08/11 10:50*

Date Received: *10/18/11*

Sample Matrix: *Soil*

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010B ICP	575		*	mg/Kg	1	5	11/15/11 19:46	aeb

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Solids, Percent	CLPSOW390, PART F, D-98	93.0		*	%	0.1	0.5	11/16/11 9:04	thf/nrc

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/10/11 15:48	thf/nrc
Digestion - Hot Plate	M3050B ICP							11/14/11 11:00	ndj
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/14/11 11:24	thf

** Please refer to Qualifier Reports for details.*

Inorganic Reference

Report Header Explanations

Batch	A distinct set of samples analyzed at a specific time
Found	Value of the QC Type of interest
Limit	Upper limit for RPD, in %.
Lower	Lower Recovery Limit, in % (except for LCSS, mg/Kg)
MDL	Method Detection Limit. Same as Minimum Reporting Limit. Allows for instrument and annual fluctuations.
PCN/SCN	A number assigned to reagents/standards to trace to the manufacturer's certificate of analysis
PQL	Practical Quantitation Limit, typically 5 times the MDL.
QC	True Value of the Control Sample or the amount added to the Spike
Rec	Amount of the true value or spike added recovered, in % (except for LCSS, mg/Kg)
RPD	Relative Percent Difference, calculation used for Duplicate QC Types
Upper	Upper Recovery Limit, in % (except for LCSS, mg/Kg)
Sample	Value of the Sample of interest

QC Sample Types

AS	Analytical Spike (Post Digestion)	*LCSWD*	Laboratory Control Sample - Water Duplicate
ASD	Analytical Spike (Post Digestion) Duplicate	*LFB*	Laboratory Fortified Blank
CCB	Continuing Calibration Blank	*LFM*	Laboratory Fortified Matrix
CCV	Continuing Calibration Verification standard	*LFMD*	Laboratory Fortified Matrix Duplicate
DUP	Sample Duplicate	*LRB*	Laboratory Reagent Blank
ICB	Initial Calibration Blank	*MS*	Matrix Spike
ICV	Initial Calibration Verification standard	*MSD*	Matrix Spike Duplicate
ICSAB	Inter-element Correction Standard - A plus B solutions	*PBS*	Prep Blank - Soil
LCSS	Laboratory Control Sample - Soil	*PBW*	Prep Blank - Water
LCSSD	Laboratory Control Sample - Soil Duplicate	*PQV*	Practical Quantitation Verification standard
LCSW	Laboratory Control Sample - Water	*SDL*	Serial Dilution

QC Sample Type Explanations

Blanks	Verifies that there is no or minimal contamination in the prep method or calibration procedure.
Control Samples	Verifies the accuracy of the method, including the prep procedure.
Duplicates	Verifies the precision of the instrument and/or method.
Spikes/Fortified Matrix	Determines sample matrix interferences, if any.
Standard	Verifies the validity of the calibration.

ACZ Qualifiers (Qual)

B	Analyte concentration detected at a value between MDL and PQL. The associated value is an estimated quantity.
H	Analysis exceeded method hold time. pH is a field test with an immediate hold time.
L	Target analyte response was below the laboratory defined negative threshold.
U	The material was analyzed for, but was not detected above the level of the associated value. The associated value is either the sample quantitation limit or the sample detection limit.

Method References

(1) EPA 600/4-83-020. Methods for Chemical Analysis of Water and Wastes, March 1983.
(2) EPA 600/R-93-100. Methods for the Determination of Inorganic Substances in Environmental Samples, August 1993.
(3) EPA 600/R-94-111. Methods for the Determination of Metals in Environmental Samples - Supplement I, May 1994.
(4) EPA SW-846. Test Methods for Evaluating Solid Waste, Third Edition with Update III, December 1996.
(5) Standard Methods for the Examination of Water and Wastewater, 19th edition, 1995 & 20th edition (1998).

Comments

(1) QC results calculated from raw data. Results may vary slightly if the rounded values are used in the calculations.
(2) Soil, Sludge, and Plant matrices for Inorganic analyses are reported on a dry weight basis.
(3) Animal matrices for Inorganic analyses are reported on an "as received" basis.
(4) An asterisk in the "XQ" column indicates there is an extended qualifier and/or certification qualifier associated with the result.

For a complete list of ACZ's Extended Qualifiers, please click: http://www.acz.com/public/extquallist.pdf

Freeport-McMoRan - Chino Mines Company
Project ID: ZN000000J8

ACZ Project ID: ***L91357***

Copper, total (3050) M6010B ICP

WG313604

ACZ ID	Type	Analyzed	PCN/SCN	QC	Sample	Found	Units	Rec	Lower	Upper	RPD	Limit	Qual
WG313604ICV	ICV	11/15/11 18:03	II111012-2	2		1.982	mg/L	99.1	90	110			
WG313604ICB	ICB	11/15/11 18:06				U	mg/L		-0.03	0.03			
WG313604PQV	PQV	11/15/11 18:09	II111024-4	.05		.046	mg/L	92	70	130			
WG313604ICSAB	ICSAB	11/15/11 18:12	II110922-1	.255		.264	mg/L	103.5	80	120			
WG313517PBS	PBS	11/15/11 18:18				U	mg/Kg		-3	3			
WG313517LCSS	LCSS	11/15/11 18:21	PCN38231	117		124.1	mg/Kg		98	136			
WG313517LCSSD	LCSSD	11/15/11 18:24	PCN38231	117		122.1	mg/Kg		98	136	1.6	20	
L91357-01MS	MS	11/15/11 18:30	II111104-3	50.5	254	286.6	mg/Kg	64.6	75	125			M3
L91357-01MSD	MSD	11/15/11 18:33	II111104-3	50.5	254	280.2	mg/Kg	51.9	75	125	2.26	20	M3
WG313604CCV1	CCV	11/15/11 18:48	II111031-1	1		.988	mg/L	98.8	90	110			
WG313604CCB1	CCB	11/15/11 18:51				U	mg/L		-0.03	0.03			
L91357-13SDL	SDL	11/15/11 19:18			1930	2042	mg/Kg				5.8	10	
WG313604CCV2	CCV	11/15/11 19:24	II111031-1	1		.964	mg/L	96.4	90	110			
WG313604CCB2	CCB	11/15/11 19:27				U	mg/L		-0.03	0.03			
WG313604CCV3	CCV	11/15/11 19:49	II111031-1	1		.981	mg/L	98.1	90	110			
WG313604CCB3	CCB	11/15/11 19:52				U	mg/L		-0.03	0.03			

pH, Saturated Paste USDA No. 60 (21A)

WG313553

ACZ ID	Type	Analyzed	PCN/SCN	QC	Sample	Found	Units	Rec	Lower	Upper	RPD	Limit	Qual
WG313553ICV	ICV	11/14/11 19:44	PCN36616	4		3.96	units	99	97	103			
L91312-01DUP	DUP	11/14/11 21:50			5.8	5.8	units				0	20	
WG313553CCV1	CCV	11/15/11 7:18	PCN36616	4		3.96	units	99	97	103			
WG313553CCV2	CCV	11/15/11 10:27	PCN36616	4		4.01	units	100.3	97	103			

Solids, Percent CLPSOW390, PART F, D-98

WG313360

ACZ ID	Type	Analyzed	PCN/SCN	QC	Sample	Found	Units	Rec	Lower	Upper	RPD	Limit	Qual
WG313360PBS	PBS	11/15/11 14:38				U	%		99.9	100.1			
L91357-20DUP	DUP	11/16/11 10:00			93	92.77	%				0.2	20	

ACZ ID	WORKNUM	PARAMETER	METHOD	QUAL	DESCRIPTION
L91357-01	WG313604	Copper, total (3050)	M6010B ICP	M3	The spike recovery value is unusable since the analyte concentration in the sample is disproportionate to the spike level. The recovery of the associated control sample (LCS or LFB) was acceptable.
L91357-02	WG313604	Copper, total (3050)	M6010B ICP	M3	The spike recovery value is unusable since the analyte concentration in the sample is disproportionate to the spike level. The recovery of the associated control sample (LCS or LFB) was acceptable.
L91357-03	WG313604	Copper, total (3050)	M6010B ICP	M3	The spike recovery value is unusable since the analyte concentration in the sample is disproportionate to the spike level. The recovery of the associated control sample (LCS or LFB) was acceptable.
L91357-04	WG313604	Copper, total (3050)	M6010B ICP	M3	The spike recovery value is unusable since the analyte concentration in the sample is disproportionate to the spike level. The recovery of the associated control sample (LCS or LFB) was acceptable.
L91357-05	WG313604	Copper, total (3050)	M6010B ICP	M3	The spike recovery value is unusable since the analyte concentration in the sample is disproportionate to the spike level. The recovery of the associated control sample (LCS or LFB) was acceptable.
L91357-06	WG313604	Copper, total (3050)	M6010B ICP	M3	The spike recovery value is unusable since the analyte concentration in the sample is disproportionate to the spike level. The recovery of the associated control sample (LCS or LFB) was acceptable.
L91357-07	WG313604	Copper, total (3050)	M6010B ICP	M3	The spike recovery value is unusable since the analyte concentration in the sample is disproportionate to the spike level. The recovery of the associated control sample (LCS or LFB) was acceptable.
L91357-08	WG313604	Copper, total (3050)	M6010B ICP	M3	The spike recovery value is unusable since the analyte concentration in the sample is disproportionate to the spike level. The recovery of the associated control sample (LCS or LFB) was acceptable.
L91357-09	WG313604	Copper, total (3050)	M6010B ICP	M3	The spike recovery value is unusable since the analyte concentration in the sample is disproportionate to the spike level. The recovery of the associated control sample (LCS or LFB) was acceptable.
L91357-10	WG313604	Copper, total (3050)	M6010B ICP	M3	The spike recovery value is unusable since the analyte concentration in the sample is disproportionate to the spike level. The recovery of the associated control sample (LCS or LFB) was acceptable.
L91357-11	WG313604	Copper, total (3050)	M6010B ICP	M3	The spike recovery value is unusable since the analyte concentration in the sample is disproportionate to the spike level. The recovery of the associated control sample (LCS or LFB) was acceptable.
L91357-12	WG313604	Copper, total (3050)	M6010B ICP	M3	The spike recovery value is unusable since the analyte concentration in the sample is disproportionate to the spike level. The recovery of the associated control sample (LCS or LFB) was acceptable.
L91357-13	WG313604	Copper, total (3050)	M6010B ICP	M3	The spike recovery value is unusable since the analyte concentration in the sample is disproportionate to the spike level. The recovery of the associated control sample (LCS or LFB) was acceptable.
L91357-14	WG313604	Copper, total (3050)	M6010B ICP	M3	The spike recovery value is unusable since the analyte concentration in the sample is disproportionate to the spike level. The recovery of the associated control sample (LCS or LFB) was acceptable.

ACZ ID	WORKNUM	PARAMETER	METHOD	QUAL	DESCRIPTION
L91357-15	WG313604	Copper, total (3050)	M6010B ICP	M3	The spike recovery value is unusable since the analyte concentration in the sample is disproportionate to the spike level. The recovery of the associated control sample (LCS or LFB) was acceptable.
L91357-16	WG313604	Copper, total (3050)	M6010B ICP	M3	The spike recovery value is unusable since the analyte concentration in the sample is disproportionate to the spike level. The recovery of the associated control sample (LCS or LFB) was acceptable.
L91357-17	WG313604	Copper, total (3050)	M6010B ICP	M3	The spike recovery value is unusable since the analyte concentration in the sample is disproportionate to the spike level. The recovery of the associated control sample (LCS or LFB) was acceptable.
L91357-18	WG313604	Copper, total (3050)	M6010B ICP	M3	The spike recovery value is unusable since the analyte concentration in the sample is disproportionate to the spike level. The recovery of the associated control sample (LCS or LFB) was acceptable.
L91357-19	WG313604	Copper, total (3050)	M6010B ICP	M3	The spike recovery value is unusable since the analyte concentration in the sample is disproportionate to the spike level. The recovery of the associated control sample (LCS or LFB) was acceptable.
L91357-20	WG313604	Copper, total (3050)	M6010B ICP	M3	The spike recovery value is unusable since the analyte concentration in the sample is disproportionate to the spike level. The recovery of the associated control sample (LCS or LFB) was acceptable.

Soil Analysis

The following parameters are not offered for certification or are not covered by NELAC certificate #ACZ.

pH, Saturated Paste	USDA No. 60 (21A)
Solids, Percent	CLPSOW390, PART F, D-98

Sample Receipt

Freeport-McMoRan - Chino Mines Company
ZN000000J8

ACZ Project ID: L91357
Date Received: 10/18/2011 09:24
Received By: ksj
Date Printed: 10/19/2011

Receipt Verification

	YES	NO	NA
1) Does this project require special handling procedures such as CLP protocol?			X
2) Are the custody seals on the cooler intact?	X		
3) Are the custody seals on the sample containers intact?			X
4) Is there a Chain of Custody or other directive shipping papers present?	X		
5) Is the Chain of Custody complete?	X		
6) Is the Chain of Custody in agreement with the samples received?	X		
7) Is there enough sample for all requested analyses?	X		
8) Are all samples within holding times for requested analyses?	X		
9) Were all sample containers received intact?	X		
10) Are the temperature blanks present?			X
11) Are the trip blanks (VOA and/or Cyanide) present?			X
12) Are samples requiring no headspace, headspace free?			X
13) Do the samples that require a Foreign Soils Permit have one?			X

Exceptions: If you answered no to any of the above questions, please describe

N/A

Contact (For any discrepancies, the client must be contacted)

N/A

Shipping Containers

Cooler Id		Temp (°C)	Rad (µR/hr)
3045		13.6	20
2316		13.3	22
3164		10.4	18
3282		9.2	18

Client must contact ACZ Project Manager if analysis should not proceed for samples received outside of thermal preservation acceptance criteria.

Notes

ACZ Laboratories, Inc.
2773 Downhill Drive Steamboat Springs, CO 80487 (800) 334-5493

Sample Receipt

Freeport-McMoRan - Chino Mines Company
ZN000000J8

ACZ Project ID: L91357
Date Received: 10/18/2011 09:24
Received By: ksj
Date Printed: 10/19/2011

Sample Container Preservation

SAMPLE	CLIENT ID	R < 2	G < 2	BK < 2	Y< 2	YG< 2	B< 2	O < 2	T >12	N/A	RAD	ID
L91357-01	STS-PCUG-2011-11									X		☐
L91357-02	STS-PCUG-2011-12									X		☐
L91357-03	STS-PCUG-2011-13									X		☐
L91357-04	STS-PCUG-2011-14									X		☐
L91357-05	STS-PCUG-2011-41									X		☐
L91357-06	STS-PCUG-2011-16									X		☐
L91357-07	STS-PCUG-2011-17									X		☐
L91357-08	STS-PCUG-2011-18									X		☐
L91357-09	STS-PCUG-2011-19									X		☐
L91357-10	STS-PCUG-2011-20									X		☐
L91357-11	STS-CG-2011-21									X		☐
L91357-12	STS-CG-2011-9									X		☐
L91357-13	STS-CG-2011-10									X		☐
L91357-14	STS-CG-2011-24									X		☐
L91357-15	STS-CG-2011-25									X		☐
L91357-16	STS-CG-2011-26									X		☐
L91357-17	STS-CG-2011-27									X		☐
L91357-18	STS-CG-2011-28									X		☐
L91357-19	STS-CG-2011-29									X		☐
L91357-20	STS-CG-2011-30									X		☐

Sample Container Preservation Legend

Abbreviation	Description	Container Type	Preservative/Limits
R	Raw/Nitric	RED	pH must be < 2
B	Filtered/Sulfuric	BLUE	pH must be < 2
BK	Filtered/Nitric	BLACK	pH must be < 2
G	Filtered/Nitric	GREEN	pH must be < 2
O	Raw/Sulfuric	ORANGE	pH must be < 2
P	Raw/NaOH	PURPLE	pH must be > 12 *
T	Raw/NaOH Zinc Acetate	TAN	pH must be > 12
Y	Raw/Sulfuric	YELLOW	pH must be < 2
YG	Raw/Sulfuric	YELLOW GLASS	pH must be < 2
N/A	No preservative needed	Not applicable	
RAD	Gamma/Beta dose rate	Not applicable	must be < 250 µR/hr

* pH check performed by analyst prior to sample preparation

Sample IDs Reviewed By: ksj

ACZ Laboratories, Inc. L91357

2773 Downhill Drive Steamboat Springs, CO 80487 (800) 334-5493

CHAIN of CUSTODY

Name: Pam Pinson
Company: Chino Mines Company
E-mail: Pamela_Pinson@FMI.com

Address: P.O. Box 10
Bayard, NM 88023
Telephone: 575-912-5213

Name: Matthew Barkley
Company: ARCADIS

E-mail: Matthew.Barkley@arcadis-us.com
Telephone: 303-231-9115 ext 157

Name: Pam Pinson
Company: Chino Mines Company
E-mail: Pamela_Pinson@FMI.com

Address: P.O. Box 10
Bayard, NM 88023
Telephone: 575-912-5213

If sample(s) received past holding time (HT), or if insufficient HT remains to complete analysis before expiration, shall ACZ proceed with requested short HT analyses? YES ☒ NO ☐

If "NO" then ACZ will contact client for further instruction. If neither "YES" nor "NO" is indicated, ACZ will proceed with the requested analyses, even if HT is expired, and data will be qualified.

Are samples for CO DW Compliance Monitoring? YES ☐ NO ☒

If yes, please include state forms. Results will be reported to PQL.

PROJECT INFORMATION

Quote #:
Project/PO #:
Reporting state for compliance testing:
Sampler's Name: Carolyn Meyer
Are any samples NRC licensable material? Yes No

SAMPLE IDENTIFICATION	DATE:TIME	Matrix	# of Containers	soil sieved to < 2mm	pH	Total CU						
STS-PCUG-2011-11	10.13.11 : 17:30"	SO	1	✗	✗	✗						
STS-PCUG-2011-12•	10.12.11 : 12:20"	SO	1	✗	✗	✗						
STS-PCUG-2011-13•	10.11.11 : 13:55'	SO	1	✗	✗	✗						
STS-PCUG-2011-14	10.13.11 : 10:00"	SO	1	✗	✗	✗						
STS-PCUG-2011-41•	10.13.11 : 08:40'	SO	1	✗	✗	✗						
STS-PCUG-2011-16	10.9.11 : 12:55"	SO	1	✗	✗	✗						
STS-PCUG-2011-17	10.10.11 : 10:50"	SO	1	✗	✗	✗						
STS-PCUG-2011-18	10.9.11 : 14:50"	SO	1	✗	✗	✗						
STS-PCUG-2011-19•	10.6.11 : 12:00"	SO	1	✗	✗	✗						
STS-PCUG-2011-20•	10.12.11 : 15:00"	SO	1	✗	✗	✗						

Matrix SW (Surface Water) · GW (Ground Water) · WW (Waste Water) · DW (Drinking Water) · SL (Sludge) · SO (Soil) · OL (Oil) · Other (Specify)

REMARKS

Please send to Sheri Fling at URS for validation. Sieve all soil samples to <2 mm prior to analysis. Soil should be reported on a dry weight basis.
Methods:
pH - 9045C and Copper - 6010B

Please refer to ACZ's terms & conditions located on the reverse side of this COC.

RELINQUISHED BY	DATE:TIME	RECEIVED BY	DATE:TIME
	10.14.11 10:30		10-15-11 9:05

①

L91357 Chain of Custody

FRMAD050.01.15.09 White - Return with sample. Yellow - Retain for your records.

ACZ Laboratories, Inc. L91357

2773 Downhill Drive Steamboat Springs, CO 80487 (800) 334-5493

CHAIN of CUSTODY

Report to

Name: Pam Pinson
Company: Chino Mines Company
E-mail: Pamela_Pinson@FMI.com

Address: P.O. Box 10
Bayard, NM 88023
Telephone: 575-912-5213

Copy of Report to

Name: Matthew Barkley
Company: ARCADIS

E-mail: Matthew.Barkley@arcadis-us.com
Telephone: 303-231-9115 ext 157

Invoice to

Name: Pam Pinson
Company: Chino Mines Company
E-mail: Pamela_Pinson@FMI.com

Address: P.O. Box 10
Bayard, NM 88023
Telephone: 575-912-5213

If sample(s) received past holding time (HT), or if insufficient HT remains to complete analysis before expiration, shall ACZ proceed with requested short HT analyses? YES ☒ NO ☐
If "NO" then ACZ will contact client for further instruction. If neither "YES" nor "NO" is indicated, ACZ will proceed with the requested analyses, even if HT is expired, and data will be qualified.

Are samples for CO DW Compliance Monitoring? YES ☐ NO ☒
If yes, please include state forms. Results will be reported to PQL.

PROJECT INFORMATION

Quote #:
Project/PO #:
Reporting state for compliance testing:
Sampler's Name: Carolyn Meyer
Are any samples NRC licensable material? Yes No

SAMPLE IDENTIFICATION	DATE:TIME	Matrix	# of Containers	soil sieved to < 2mm	Total Copper
STS-CG-2011-21	10.5.11 : 15:50	SO	1	X	X
STS-CG-2011-9	10.4.11 : 12:50	SO	1	X	X
STS-CG-2011-10	10.7.11 : 13:23	SO	1	X	X
STS-CG-2011-24	10.5.11 : 17:20	SO	1	X	X
STS-CG-2011-25	10.10.11 : 17:00	SO	1	X	X
STS-CG-2011-26	10.8.11 : 15:45	SO	1	X	X
STS-CG-2011-27	10.8.11 : 10:00	SO	1	X	X
STS-CG-2011-28	10.5.11 : 16:35	SO	1	X	X
STS-CG-2011-29	10.10.11 : 14:15	SO	1	X	X
STS-CG-2011-30	10.8.11 : 10:50	SO	1	X	X

Matrix: SW (Surface Water) · GW (Ground Water) · WW (Waste Water) · DW (Drinking Water) · SL (Sludge) · SO (Soil) · OL (Oil) · Other (Specify)

REMARKS

Please send to Sheri Fling at URS for validation. Sieve all soil samples to <2 mm prior to analysis. Soil should be reported on a dry weight basis.
Methods:
Copper - 6010B

Please refer to ACZ's terms & conditions located on the reverse side of this COC.

RELINQUISHED BY	DATE:TIME	RECEIVED BY	DATE:TIME
	10.14.11 10:30		10-14-11 9:05

2

FRMAD050.01.15.09 White - Return with sample. Yellow - Retain for your records.

ACZ Laboratories, Inc.
2773 Downhill Drive Steamboat Springs, CO 80487 (800) 334-5493

Analytical Report

November 30, 2011

Report to:	Bill to:
Pam Pinson	Pam Pinson
Freeport-McMoRan - Chino Mines Company	Freeport-McMoRan - Chino Mines Company
PO Box 10	P.O. Box 13308
Bayard, NM 88023	Phoenix, AZ 85002-3308

cc: Matthew Barkley, Sheri Fling

Project ID: ZN000000J8
ACZ Project ID: L91358

Pam Pinson:

Enclosed are the analytical results for sample(s) submitted to ACZ Laboratories, Inc. (ACZ) on October 18, 2011. This project has been assigned to ACZ's project number, L91358. Please reference this number in all future inquiries.

All analyses were performed according to ACZ's Quality Assurance Plan. The enclosed results relate only to the samples received under L91358. Each section of this report has been reviewed and approved by the appropriate Laboratory Supervisor, or a qualified substitute.

Except as noted, the test results for the methods and parameters listed on ACZ's current NELAC certificate letter (#ACZ) meet all requirements of NELAC.

This report shall be used or copied only in its entirety. ACZ is not responsible for the consequences arising from the use of a partial report.

All samples and sub-samples associated with this project will be disposed of after December 30, 2011. If the samples are determined to be hazardous, additional charges apply for disposal (typically less than $10/sample). If you would like the samples to be held longer than ACZ's stated policy or to be returned, please contact your Project Manager or Customer Service Representative for further details and associated costs. ACZ retains analytical reports for five years.

If you have any questions or other needs, please contact your Project Manager.

S. Habermehl

Scott Habermehl has reviewed
and approved this report.

Freeport-McMoRan - Chino Mines Company
Project ID: ZN000000J8
Sample ID: STS-PH-2011-FID37

ACZ Sample ID: ***L91358-01***
Date Sampled: *10/11/11 09:45*
Date Received: *10/18/11*
Sample Matrix: *Soil*

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010B ICP	654		*	mg/Kg	1	5	11/17/11 9:42	aeb

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Acid Generation Potential (calc on Sulfur total)	M600/2-78-054 1.3	1	B		t CaCO3/Kt	1	5	11/30/11 10:13	calc
Acid Neutralization Potential (calc)	M600/2-78-054 1.3	1			t CaCO3/Kt	1	5	11/30/11 10:13	calc
Acid-Base Potential (calc on Sulfur total)	M600/2-78-054 1.3	0			t CaCO3/Kt	1	5	11/30/11 10:13	calc
Neutralization Potential as CaCO3	M600/2-78-054 3.2.3	0.1	B	*	%	0.1	0.5	11/17/11 0:07	brd
pH, Saturated Paste	USDA No. 60 (21A)	4.6		*	units	0.1	0.1	11/21/11 19:53	bsu
Solids, Percent	CLPSOW390, PART F, D-98	93.6		*	%	0.1	0.5	11/16/11 16:00	ndj
Sulfur Forms	M600/2-78-054 3.2.4								
Sulfur Organic Residual		0.03	B	*	%	0.01	0.1	11/16/11 0:00	bsu
Sulfur Pyritic Sulfide		0.01	B	*	%	0.01	0.1	11/16/11 0:00	bsu
Sulfur Sulfate			U	*	%	0.01	0.1	11/16/11 0:00	bsu
Sulfur Total		0.04	B	*	%	0.01	0.1	11/16/11 0:00	bsu
Total Sulfur minus Sulfate		0.04	B	*	%	0.01	0.1	11/16/11 0:00	bsu

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/11/11 11:26	zsh
Crush and Pulverize	USDA No. 1, 1972							11/15/11 13:00	cra
Digestion - Hot Plate	M3050B ICP							11/16/11 11:00	mss2
Saturated Paste Extraction	USDA No. 60 (2)							11/21/11 17:00	bsu
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/15/11 15:48	cra/thf
Sieve-250 um (60 mesh)	ASA No.9, 15-4.2.2							11/15/11 15:48	cra/thf

** Please refer to Qualifier Reports for details.*

Freeport-McMoRan - Chino Mines Company		ACZ Sample ID:	***L91358-02***
Project ID:	ZN000000J8	Date Sampled:	*10/13/11 13:55*
Sample ID:	STS-PCUG-2011-40	Date Received:	*10/18/11*
		Sample Matrix:	*Soil*

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010B ICP	312		*	mg/Kg	1	5	11/17/11 9:52	aeb

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
pH, Saturated Paste	USDA No. 60 (21A)	3.8		*	units	0.1	0.1	11/21/11 20:36	bsu
Solids, Percent	CLPSOW390, PART F, D-98	96.6		*	%	0.1	0.5	11/16/11 16:00	ndj

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/11/11 11:28	zsh
Digestion - Hot Plate	M3050B ICP							11/16/11 12:00	mss2
Saturated Paste Extraction	USDA No. 60 (2)							11/21/11 17:04	bsu
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/15/11 15:53	cra/thf
Sieve-250 um (60 mesh)	ASA No.9, 15-4.2.2							11/15/11 15:53	cra/thf

** Please refer to Qualifier Reports for details.*

Inorganic Analytical Results

Freeport-McMoRan - Chino Mines Company
Project ID: ZN000000J8
Sample ID: STS-PH-2011-FID101

ACZ Sample ID: ***L91358-03***
Date Sampled: *10/12/11 16:45*
Date Received: *10/18/11*
Sample Matrix: *Soil*

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010B ICP	272		*	mg/Kg	1	5	11/17/11 10:01	aeb

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Acid Generation Potential (calc on Sulfur total)	M600/2-78-054 1.3	6			t CaCO3/Kt	1	5	11/30/11 10:14	calc
Acid Neutralization Potential (calc)	M600/2-78-054 1.3	2			t CaCO3/Kt	1	5	11/30/11 10:14	calc
Acid-Base Potential (calc on Sulfur total)	M600/2-78-054 1.3	-4			t CaCO3/Kt	1	5	11/30/11 10:14	calc
Neutralization Potential as CaCO3	M600/2-78-054 3.2.3	0.2	B	*	%	0.1	0.5	11/17/11 4:37	brd
pH, Saturated Paste	USDA No. 60 (21A)	3.8		*	units	0.1	0.1	11/21/11 21:19	bsu
Solids, Percent	CLPSOW390, PART F, D-98	93.8		*	%	0.1	0.5	11/16/11 16:00	ndj
Sulfur Forms	M600/2-78-054 3.2.4								
Sulfur Organic Residual		0.11		*	%	0.01	0.1	11/16/11 0:00	bsu
Sulfur Pyritic Sulfide		0.02	B	*	%	0.01	0.1	11/16/11 0:00	bsu
Sulfur Sulfate		0.06	B	*	%	0.01	0.1	11/16/11 0:00	bsu
Sulfur Total		0.19		*	%	0.01	0.1	11/16/11 0:00	bsu
Total Sulfur minus Sulfate		0.13		*	%	0.01	0.1	11/16/11 0:00	bsu

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/11/11 11:31	zsh
Crush and Pulverize	USDA No. 1, 1972							11/15/11 13:17	cra
Digestion - Hot Plate	M3050B ICP							11/16/11 12:20	mss2
Saturated Paste Extraction	USDA No. 60 (2)							11/21/11 17:08	bsu
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/15/11 15:59	cra/thf
Sieve-250 um (60 mesh)	ASA No.9, 15-4.2.2							11/15/11 15:59	cra/thf

** Please refer to Qualifier Reports for details.*

Freeport-McMoRan - Chino Mines Company
Project ID: ZN000000J8
Sample ID: STS-PH-2011-REFPLOT3

ACZ Sample ID: ***L91358-04***
Date Sampled: *10/07/11 11:50*
Date Received: *10/18/11*
Sample Matrix: *Soil*

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010B ICP	1950		*	mg/Kg	1	5	11/17/11 10:04	aeb

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Acid Generation Potential (calc on Sulfur total)	M600/2-78-054 1.3	3	B		t CaCO3/Kt	1	5	11/30/11 10:14	calc
Acid Neutralization Potential (calc)	M600/2-78-054 1.3	13			t CaCO3/Kt	1	5	11/30/11 10:14	calc
Acid-Base Potential (calc on Sulfur total)	M600/2-78-054 1.3	10			t CaCO3/Kt	1	5	11/30/11 10:14	calc
Neutralization Potential as CaCO3	M600/2-78-054 3.2.3	1.3		*	%	0.1	0.5	11/17/11 2:26	brd
pH, Saturated Paste	USDA No. 60 (21A)	5.6		*	units	0.1	0.1	11/21/11 22:02	bsu
Solids, Percent	CLPSOW390, PART F, D-98	91.2		*	%	0.1	0.5	11/16/11 16:00	ndj
Sulfur Forms	M600/2-78-054 3.2.4								
Sulfur Organic Residual		0.07	B	*	%	0.01	0.1	11/16/11 0:00	bsu
Sulfur Pyritic Sulfide		0.01	B	*	%	0.01	0.1	11/16/11 0:00	bsu
Sulfur Sulfate		0.02	B	*	%	0.01	0.1	11/16/11 0:00	bsu
Sulfur Total		0.10		*	%	0.01	0.1	11/16/11 0:00	bsu
Total Sulfur minus Sulfate		0.08	B	*	%	0.01	0.1	11/16/11 0:00	bsu

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/11/11 11:33	zsh
Crush and Pulverize	USDA No. 1, 1972							11/15/11 13:35	cra
Digestion - Hot Plate	M3050B ICP							11/16/11 12:40	mss2
Saturated Paste Extraction	USDA No. 60 (2)							11/21/11 17:13	bsu
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/15/11 16:05	cra/thf
Sieve-250 um (60 mesh)	ASA No.9, 15-4.2.2							11/15/11 16:05	cra/thf

** Please refer to Qualifier Reports for details.*

Freeport-McMoRan - Chino Mines Company		ACZ Sample ID:	***L91358-05***
Project ID:	ZN000000J8	Date Sampled:	*10/06/11 10:39*
Sample ID:	STS-PH-2011-REFPLOT4	Date Received:	*10/18/11*
		Sample Matrix:	*Soil*

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010B ICP	1130		*	mg/Kg	1	5	11/17/11 10:07	aeb

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Acid Generation Potential (calc on Sulfur total)	M600/2-78-054 1.3	7			t CaCO3/Kt	1	5	11/30/11 10:14	calc
Acid Neutralization Potential (calc)	M600/2-78-054 1.3	0.0			t CaCO3/Kt	1	5	11/30/11 10:14	calc
Acid-Base Potential (calc on Sulfur total)	M600/2-78-054 1.3	-7			t CaCO3/Kt	1	5	11/30/11 10:14	calc
Neutralization Potential as CaCO3	M600/2-78-054 3.2.3		U	*	%	0.1	0.5	11/28/11 14:33	mss2
pH, Saturated Paste	USDA No. 60 (21A)	5.4		*	units	0.1	0.1	11/21/11 22:46	bsu
Solids, Percent	CLPSOW390, PART F, D-98	90.8		*	%	0.1	0.5	11/16/11 16:00	ndj
Sulfur Forms	M600/2-78-054 3.2.4								
Sulfur Organic Residual		0.13		*	%	0.01	0.1	11/16/11 0:00	bsu
Sulfur Pyritic Sulfide		0.03	B	*	%	0.01	0.1	11/16/11 0:00	bsu
Sulfur Sulfate		0.05	B	*	%	0.01	0.1	11/16/11 0:00	bsu
Sulfur Total		0.21		*	%	0.01	0.1	11/16/11 0:00	bsu
Total Sulfur minus Sulfate		0.16		*	%	0.01	0.1	11/16/11 0:00	bsu

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/11/11 11:35	zsh
Crush and Pulverize	USDA No. 1, 1972							11/15/11 13:52	cra
Digestion - Hot Plate	M3050B ICP							11/16/11 13:00	mss2
Saturated Paste Extraction	USDA No. 60 (2)							11/21/11 17:17	bsu
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/15/11 16:10	cra/thf
Sieve-250 um (60 mesh)	ASA No.9, 15-4.2.2							11/15/11 16:10	cra/thf

** Please refer to Qualifier Reports for details.*

Freeport-McMoRan - Chino Mines Company

Project ID:	ZN000000J8	ACZ Sample ID:	***L91358-06***
Sample ID:	DUP11	Date Sampled:	*10/12/11 00:00*
		Date Received:	*10/18/11*
		Sample Matrix:	*Soil*

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010B ICP	341		*	mg/Kg	1	5	11/17/11 10:14	aeb

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Acid Generation Potential (calc on Sulfur total)	M600/2-78-054 1.3	6			t CaCO3/Kt	1	5	11/30/11 10:14	calc
Acid Neutralization Potential (calc)	M600/2-78-054 1.3	0.0			t CaCO3/Kt	1	5	11/30/11 10:14	calc
Acid-Base Potential (calc on Sulfur total)	M600/2-78-054 1.3	-6			t CaCO3/Kt	1	5	11/30/11 10:14	calc
Neutralization Potential as CaCO3	M600/2-78-054 3.2.3		U	*	%	0.1	0.5	11/17/11 6:35	brd
pH, Saturated Paste	USDA No. 60 (21A)	3.9		*	units	0.1	0.1	11/21/11 23:29	bsu
Solids, Percent	CLPSOW390, PART F, D-98	93.7		*	%	0.1	0.5	11/16/11 16:00	ndj
Sulfur Forms	M600/2-78-054 3.2.4								
Sulfur Organic Residual		0.13		*	%	0.01	0.1	11/17/11 0:00	bsu
Sulfur Pyritic Sulfide			U	*	%	0.01	0.1	11/17/11 0:00	bsu
Sulfur Sulfate		0.06	B	*	%	0.01	0.1	11/17/11 0:00	bsu
Sulfur Total		0.19		*	%	0.01	0.1	11/17/11 0:00	bsu
Total Sulfur minus Sulfate		0.13		*	%	0.01	0.1	11/17/11 0:00	bsu

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/11/11 11:37	zsh
Crush and Pulverize	USDA No. 1, 1972							11/15/11 14:10	cra
Digestion - Hot Plate	M3050B ICP							11/16/11 13:20	mss2
Saturated Paste Extraction	USDA No. 60 (2)							11/21/11 17:22	bsu
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/15/11 16:16	cra/thf
Sieve-250 um (60 mesh)	ASA No.9, 15-4.2.2							11/15/11 16:16	cra/thf

** Please refer to Qualifier Reports for details.*

Freeport-McMoRan - Chino Mines Company

Project ID:	ZN000000J8	ACZ Sample ID:	***L91358-07***
Sample ID:	STS-PH-2011-FID105	Date Sampled:	*10/06/11 13:30*
		Date Received:	*10/18/11*
		Sample Matrix:	*Soil*

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010B ICP	668		*	mg/Kg	1	5	11/17/11 10:17	aeb

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Acid Generation Potential (calc on Sulfur total)	M600/2-78-054 1.3	3	B		t CaCO3/Kt	1	5	11/30/11 10:14	calc
Acid Neutralization Potential (calc)	M600/2-78-054 1.3	8			t CaCO3/Kt	1	5	11/30/11 10:14	calc
Acid-Base Potential (calc on Sulfur total)	M600/2-78-054 1.3	5			t CaCO3/Kt	1	5	11/30/11 10:14	calc
Neutralization Potential as CaCO3	M600/2-78-054 3.2.3	0.8		*	%	0.1	0.5	11/17/11 8:32	brd
pH, Saturated Paste	USDA No. 60 (21A)	4.9		*	units	0.1	0.1	11/22/11 0:12	bsu
Solids, Percent	CLPSOW390, PART F, D-98	91.1		*	%	0.1	0.5	11/16/11 16:00	ndj
Sulfur Forms	M600/2-78-054 3.2.4								
Sulfur Organic Residual		0.07	B	*	%	0.01	0.1	11/17/11 0:00	bsu
Sulfur Pyritic Sulfide		0.01	B	*	%	0.01	0.1	11/17/11 0:00	bsu
Sulfur Sulfate		0.02	B	*	%	0.01	0.1	11/17/11 0:00	bsu
Sulfur Total		0.10		*	%	0.01	0.1	11/17/11 0:00	bsu
Total Sulfur minus Sulfate		0.08	B	*	%	0.01	0.1	11/17/11 0:00	bsu

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/11/11 11:39	zsh
Crush and Pulverize	USDA No. 1, 1972							11/15/11 14:27	cra
Digestion - Hot Plate	M3050B ICP							11/16/11 13:40	mss2
Saturated Paste Extraction	USDA No. 60 (2)							11/21/11 17:26	bsu
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/15/11 16:22	cra/thf
Sieve-250 um (60 mesh)	ASA No.9, 15-4.2.2							11/15/11 16:22	cra/thf

** Please refer to Qualifier Reports for details.*

Freeport-McMoRan - Chino Mines Company

Project ID:	ZN000000J8
Sample ID:	DUP12
ACZ Sample ID:	***L91358-08***
Date Sampled:	*10/13/11 00:00*
Date Received:	*10/18/11*
Sample Matrix:	*Soil*

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010B ICP	467		*	mg/Kg	1	5	11/17/11 10:20	aeb

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Acid Generation Potential (calc on Sulfur total)	M600/2-78-054 1.3	6			t CaCO3/Kt	1	5	11/30/11 10:14	calc
Acid Neutralization Potential (calc)	M600/2-78-054 1.3	26			t CaCO3/Kt	1	5	11/30/11 10:14	calc
Acid-Base Potential (calc on Sulfur total)	M600/2-78-054 1.3	20			t CaCO3/Kt	1	5	11/30/11 10:14	calc
Neutralization Potential as CaCO3	M600/2-78-054 3.2.3	2.6		*	%	0.1	0.5	11/17/11 10:30	brd
pH, Saturated Paste	USDA No. 60 (21A)	6.3		*	units	0.1	0.1	11/22/11 0:55	bsu
Solids, Percent	CLPSOW390, PART F, D-98	95.3		*	%	0.1	0.5	11/16/11 16:00	ndj
Sulfur Forms	M600/2-78-054 3.2.4								
Sulfur Organic Residual		0.12		*	%	0.01	0.1	11/17/11 0:00	bsu
Sulfur Pyritic Sulfide		0.03	B	*	%	0.01	0.1	11/17/11 0:00	bsu
Sulfur Sulfate		0.04	B	*	%	0.01	0.1	11/17/11 0:00	bsu
Sulfur Total		0.19		*	%	0.01	0.1	11/17/11 0:00	bsu
Total Sulfur minus Sulfate		0.15		*	%	0.01	0.1	11/17/11 0:00	bsu

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/11/11 11:42	zsh
Crush and Pulverize	USDA No. 1, 1972							11/15/11 14:45	cra
Digestion - Hot Plate	M3050B ICP							11/16/11 14:00	mss2
Saturated Paste Extraction	USDA No. 60 (2)							11/21/11 17:30	bsu
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/15/11 16:27	cra/thf
Sieve-250 um (60 mesh)	ASA No.9, 15-4.2.2							11/15/11 16:27	cra/thf

** Please refer to Qualifier Reports for details.*

Freeport-McMoRan - Chino Mines Company

Project ID:	ZN000000J8
Sample ID:	STS-PH-2011-REFPLOT1
ACZ Sample ID:	***L91358-09***
Date Sampled:	*10/04/11 11:09*
Date Received:	*10/18/11*
Sample Matrix:	*Soil*

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010B ICP	597		*	mg/Kg	1	5	11/17/11 10:23	aeb

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Acid Generation Potential (calc on Sulfur total)	M600/2-78-054 1.3	2	B		t CaCO3/Kt	1	5	11/30/11 10:14	calc
Acid Neutralization Potential (calc)	M600/2-78-054 1.3	101			t CaCO3/Kt	1	5	11/30/11 10:14	calc
Acid-Base Potential (calc on Sulfur total)	M600/2-78-054 1.3	99			t CaCO3/Kt	1	5	11/30/11 10:14	calc
Neutralization Potential as CaCO3	M600/2-78-054 3.2.3	10.1		*	%	0.1	0.5	11/17/11 7:05	brd
pH, Saturated Paste	USDA No. 60 (21A)	7.5		*	units	0.1	0.1	11/22/11 1:39	bsu
Solids, Percent	CLPSOW390, PART F, D-98	92.7		*	%	0.1	0.5	11/16/11 16:00	ndj
Sulfur Forms	M600/2-78-054 3.2.4								
Sulfur Organic Residual		0.06	B	*	%	0.01	0.1	11/17/11 0:00	bsu
Sulfur Pyritic Sulfide			U	*	%	0.01	0.1	11/17/11 0:00	bsu
Sulfur Sulfate			U	*	%	0.01	0.1	11/17/11 0:00	bsu
Sulfur Total		0.05	B	*	%	0.01	0.1	11/17/11 0:00	bsu
Total Sulfur minus Sulfate		0.05	B	*	%	0.01	0.1	11/17/11 0:00	bsu

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/11/11 11:44	zsh
Crush and Pulverize	USDA No. 1, 1972							11/15/11 15:02	cra
Digestion - Hot Plate	M3050B ICP							11/16/11 14:20	mss2
Saturated Paste Extraction	USDA No. 60 (2)							11/21/11 17:35	bsu
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/15/11 16:33	cra/thf
Sieve-250 um (60 mesh)	ASA No.9, 15-4.2.2							11/15/11 16:33	cra/thf

** Please refer to Qualifier Reports for details.*

Freeport-McMoRan - Chino Mines Company

Project ID: ZN000000J8
Sample ID: STS-PH-2011-REFPLOT2

ACZ Sample ID: ***L91358-10***
Date Sampled: *10/05/11 12:30*
Date Received: *10/18/11*
Sample Matrix: *Soil*

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010B ICP	687		*	mg/Kg	1	5	11/17/11 10:26	aeb

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Acid Generation Potential (calc on Sulfur total)	M600/2-78-054 1.3	0			t CaCO3/Kt	1	5	11/30/11 10:14	calc
Acid Neutralization Potential (calc)	M600/2-78-054 1.3	11			t CaCO3/Kt	1	5	11/30/11 10:14	calc
Acid-Base Potential (calc on Sulfur total)	M600/2-78-054 1.3	11			t CaCO3/Kt	1	5	11/30/11 10:14	calc
Neutralization Potential as CaCO3	M600/2-78-054 3.2.3	1.1		*	%	0.1	0.5	11/17/11 12:27	brd
pH, Saturated Paste	USDA No. 60 (21A)	6.0		*	units	0.1	0.1	11/22/11 2:22	bsu
Solids, Percent	CLPSOW390, PART F, D-98	91.9		*	%	0.1	0.5	11/16/11 16:00	ndj
Sulfur Forms	M600/2-78-054 3.2.4								
Sulfur Organic Residual		0.02	B	*	%	0.01	0.1	11/17/11 0:00	bsu
Sulfur Pyritic Sulfide			U	*	%	0.01	0.1	11/17/11 0:00	bsu
Sulfur Sulfate			U	*	%	0.01	0.1	11/17/11 0:00	bsu
Sulfur Total		0.02	B	*	%	0.01	0.1	11/17/11 0:00	bsu
Total Sulfur minus Sulfate		0.02	B	*	%	0.01	0.1	11/17/11 0:00	bsu

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/11/11 11:46	zsh
Crush and Pulverize	USDA No. 1, 1972							11/15/11 15:20	cra
Digestion - Hot Plate	M3050B ICP							11/16/11 14:40	mss2
Saturated Paste Extraction	USDA No. 60 (2)							11/21/11 17:39	bsu
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/15/11 16:39	cra/thf
Sieve-250 um (60 mesh)	ASA No.9, 15-4.2.2							11/15/11 16:39	cra/thf

** Please refer to Qualifier Reports for details.*

Freeport-McMoRan - Chino Mines Company
Project ID: ZN000000J8
Sample ID: STS-PH-2011-FID22

ACZ Sample ID: ***L91358-11***
Date Sampled: *10/13/11 16:40*
Date Received: *10/18/11*
Sample Matrix: *Soil*

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010B ICP	430			mg/Kg	1	5	11/17/11 10:29	aeb

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Acid Generation Potential (calc on Sulfur total)	M600/2-78-054 1.3	6			t CaCO3/Kt	1	5	11/30/11 10:14	calc
Acid Neutralization Potential (calc)	M600/2-78-054 1.3	16			t CaCO3/Kt	1	5	11/30/11 10:14	calc
Acid-Base Potential (calc on Sulfur total)	M600/2-78-054 1.3	10			t CaCO3/Kt	1	5	11/30/11 10:14	calc
Neutralization Potential as CaCO3	M600/2-78-054 3.2.3	1.6		*	%	0.1	0.5	11/17/11 16:22	brd
pH, Saturated Paste	USDA No. 60 (21A)	6.2		*	units	0.1	0.1	11/22/11 3:49	bsu
Solids, Percent	CLPSOW390, PART F, D-98	95.4		*	%	0.1	0.5	11/16/11 16:00	ndj
Sulfur Forms	M600/2-78-054 3.2.4								
Sulfur Organic Residual		0.11		*	%	0.01	0.1	11/17/11 0:00	bsu
Sulfur Pyritic Sulfide		0.04	B	*	%	0.01	0.1	11/17/11 0:00	bsu
Sulfur Sulfate		0.04	B	*	%	0.01	0.1	11/17/11 0:00	bsu
Sulfur Total		0.19		*	%	0.01	0.1	11/17/11 0:00	bsu
Total Sulfur minus Sulfate		0.15		*	%	0.01	0.1	11/17/11 0:00	bsu

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/11/11 11:48	zsh
Crush and Pulverize	USDA No. 1, 1972							11/15/11 15:37	cra
Digestion - Hot Plate	M3050B ICP							11/16/11 15:00	mss2
Saturated Paste Extraction	USDA No. 60 (2)							11/21/11 17:44	bsu
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/15/11 16:44	cra/thf
Sieve-250 um (60 mesh)	ASA No.9, 15-4.2.2							11/15/11 16:44	cra/thf

** Please refer to Qualifier Reports for details.*

Inorganic Analytical Results

Freeport-McMoRan - Chino Mines Company
Project ID: ZN000000J8
Sample ID: STS-PH-2011-FID10

ACZ Sample ID: ***L91358-12***
Date Sampled: *10/07/11 14:35*
Date Received: *10/18/11*
Sample Matrix: *Soil*

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010B ICP	2140		*	mg/Kg	1	5	11/17/11 10:38	aeb

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Acid Generation Potential (calc on Sulfur total)	M600/2-78-054 1.3	3	B		t CaCO3/Kt	1	5	11/30/11 10:14	calc
Acid Neutralization Potential (calc)	M600/2-78-054 1.3	5			t CaCO3/Kt	1	5	11/30/11 10:14	calc
Acid-Base Potential (calc on Sulfur total)	M600/2-78-054 1.3	2			t CaCO3/Kt	1	5	11/30/11 10:14	calc
Neutralization Potential as CaCO3	M600/2-78-054 3.2.3	0.5	B	*	%	0.1	0.5	11/17/11 18:20	brd
pH, Saturated Paste	USDA No. 60 (21A)	4.8		*	units	0.1	0.1	11/22/11 4:32	bsu
Solids, Percent	CLPSOW390, PART F, D-98	91.5		*	%	0.1	0.5	11/16/11 16:00	ndj
Sulfur Forms	M600/2-78-054 3.2.4								
Sulfur Organic Residual		0.07	B	*	%	0.01	0.1	11/17/11 0:00	bsu
Sulfur Pyritic Sulfide		0.02	B	*	%	0.01	0.1	11/17/11 0:00	bsu
Sulfur Sulfate		0.01	B	*	%	0.01	0.1	11/17/11 0:00	bsu
Sulfur Total		0.10		*	%	0.01	0.1	11/17/11 0:00	bsu
Total Sulfur minus Sulfate		0.09	B	*	%	0.01	0.1	11/17/11 0:00	bsu

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/11/11 11:50	zsh
Crush and Pulverize	USDA No. 1, 1972							11/15/11 15:55	cra
Digestion - Hot Plate	M3050B ICP							11/16/11 15:20	mss2
Saturated Paste Extraction	USDA No. 60 (2)							11/21/11 17:48	bsu
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/15/11 16:50	cra/thf
Sieve-250 um (60 mesh)	ASA No.9, 15-4.2.2							11/15/11 16:50	cra/thf

** Please refer to Qualifier Reports for details.*

Freeport-McMoRan - Chino Mines Company		ACZ Sample ID:	***L91358-13***
Project ID:	ZN000000J8	Date Sampled:	*10/10/11 11:50*
Sample ID:	STS-PH-2011-FID15	Date Received:	*10/18/11*
		Sample Matrix:	*Soil*

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010B ICP	2260		*	mg/Kg	1	5	11/17/11 10:41	aeb

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Acid Generation Potential (calc on Sulfur total)	M600/2-78-054 1.3	6			t CaCO3/Kt	1	5	11/30/11 10:14	calc
Acid Neutralization Potential (calc)	M600/2-78-054 1.3	0.0			t CaCO3/Kt	1	5	11/30/11 10:14	calc
Acid-Base Potential (calc on Sulfur total)	M600/2-78-054 1.3	-6			t CaCO3/Kt	1	5	11/30/11 10:14	calc
Neutralization Potential as CaCO3	M600/2-78-054 3.2.3		U	*	%	0.1	0.5	11/17/11 20:17	brd
pH, Saturated Paste	USDA No. 60 (21A)	4.8		*	units	0.1	0.1	11/22/11 5:15	bsu
Solids, Percent	CLPSOW390, PART F, D-98	92.8		*	%	0.1	0.5	11/16/11 16:00	ndj
Sulfur Forms	M600/2-78-054 3.2.4								
Sulfur Organic Residual		0.13		*	%	0.01	0.1	11/17/11 0:00	bsu
Sulfur Pyritic Sulfide		0.04	B	*	%	0.01	0.1	11/17/11 0:00	bsu
Sulfur Sulfate		0.02	B	*	%	0.01	0.1	11/17/11 0:00	bsu
Sulfur Total		0.19		*	%	0.01	0.1	11/17/11 0:00	bsu
Total Sulfur minus Sulfate		0.17		*	%	0.01	0.1	11/17/11 0:00	bsu

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/11/11 11:53	zsh
Crush and Pulverize	USDA No. 1, 1972							11/15/11 16:12	cra
Digestion - Hot Plate	M3050B ICP							11/16/11 15:40	mss2
Saturated Paste Extraction	USDA No. 60 (2)							11/21/11 17:53	bsu
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/15/11 16:56	cra/thf
Sieve-250 um (60 mesh)	ASA No.9, 15-4.2.2							11/15/11 16:56	cra/thf

** Please refer to Qualifier Reports for details.*

Freeport-McMoRan - Chino Mines Company		ACZ Sample ID:	***L91358-14***
Project ID:	ZN000000J8	Date Sampled:	*10/10/11 12:30*
Sample ID:	STS-PH-2011-FID16	Date Received:	*10/18/11*
		Sample Matrix:	*Soil*

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010B ICP	2020		*	mg/Kg	1	5	11/17/11 10:44	aeb

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Acid Generation Potential (calc on Sulfur total)	M600/2-78-054 1.3	5	B		t CaCO3/Kt	1	5	11/30/11 10:15	calc
Acid Neutralization Potential (calc)	M600/2-78-054 1.3	0.0			t CaCO3/Kt	1	5	11/30/11 10:15	calc
Acid-Base Potential (calc on Sulfur total)	M600/2-78-054 1.3	-5			t CaCO3/Kt	1	5	11/30/11 10:15	calc
Neutralization Potential as CaCO3	M600/2-78-054 3.2.3		U	*	%	0.1	0.5	11/17/11 22:15	brd
pH, Saturated Paste	USDA No. 60 (21A)	4.5		*	units	0.1	0.1	11/22/11 5:58	bsu
Solids, Percent	CLPSOW390, PART F, D-98	90.9		*	%	0.1	0.5	11/16/11 16:00	ndj
Sulfur Forms	M600/2-78-054 3.2.4								
Sulfur Organic Residual		0.16		*	%	0.01	0.1	11/17/11 0:00	bsu
Sulfur Pyritic Sulfide			U	*	%	0.01	0.1	11/17/11 0:00	bsu
Sulfur Sulfate		0.02	B	*	%	0.01	0.1	11/17/11 0:00	bsu
Sulfur Total		0.15		*	%	0.01	0.1	11/17/11 0:00	bsu
Total Sulfur minus Sulfate		0.13		*	%	0.01	0.1	11/17/11 0:00	bsu

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/11/11 11:55	zsh
Crush and Pulverize	USDA No. 1, 1972							11/15/11 16:30	cra
Digestion - Hot Plate	M3050B ICP							11/16/11 16:00	mss2
Saturated Paste Extraction	USDA No. 60 (2)							11/21/11 17:57	bsu
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/15/11 17:01	cra/thf
Sieve-250 um (60 mesh)	ASA No.9, 15-4.2.2							11/15/11 17:01	cra/thf

** Please refer to Qualifier Reports for details.*

Inorganic Analytical Results

Freeport-McMoRan - Chino Mines Company

Project ID:	ZN000000J8	ACZ Sample ID:	***L91358-15***
Sample ID:	STS-PH-2011-FID17	Date Sampled:	*10/11/11 17:35*
		Date Received:	*10/18/11*
		Sample Matrix:	*Soil*

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010B ICP	4220		*	mg/Kg	1	5	11/17/11 10:48	aeb

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Acid Generation Potential (calc on Sulfur total)	M600/2-78-054 1.3	14			t CaCO3/Kt	1	5	11/30/11 10:15	calc
Acid Neutralization Potential (calc)	M600/2-78-054 1.3	8			t CaCO3/Kt	1	5	11/30/11 10:15	calc
Acid-Base Potential (calc on Sulfur total)	M600/2-78-054 1.3	-6			t CaCO3/Kt	1	5	11/30/11 10:15	calc
Neutralization Potential as CaCO3	M600/2-78-054 3.2.3	0.8		*	%	0.1	0.5	11/18/11 0:12	brd
pH, Saturated Paste	USDA No. 60 (21A)	6.0		*	units	0.1	0.1	11/22/11 6:42	bsu
Solids, Percent	CLPSOW390, PART F, D-98	94.0		*	%	0.1	0.5	11/16/11 16:00	ndj
Sulfur Forms	M600/2-78-054 3.2.4								
Sulfur Organic Residual		0.21		*	%	0.01	0.1	11/17/11 0:00	bsu
Sulfur Pyritic Sulfide		0.18		*	%	0.01	0.1	11/17/11 0:00	bsu
Sulfur Sulfate		0.06	B	*	%	0.01	0.1	11/17/11 0:00	bsu
Sulfur Total		0.45		*	%	0.01	0.1	11/17/11 0:00	bsu
Total Sulfur minus Sulfate		0.39		*	%	0.01	0.1	11/17/11 0:00	bsu

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/11/11 11:57	zsh
Crush and Pulverize	USDA No. 1, 1972							11/15/11 16:47	cra
Digestion - Hot Plate	M3050B ICP							11/16/11 16:20	mss2
Saturated Paste Extraction	USDA No. 60 (2)							11/21/11 18:01	bsu
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/15/11 17:07	cra/thf
Sieve-250 um (60 mesh)	ASA No.9, 15-4.2.2							11/15/11 17:07	cra/thf

** Please refer to Qualifier Reports for details.*

Inorganic Analytical Results

Freeport-McMoRan - Chino Mines Company
Project ID: ZN000000J8
Sample ID: STS-PH-2011-FID18

ACZ Sample ID: ***L91358-16***
Date Sampled: *10/12/11 15:55*
Date Received: *10/18/11*
Sample Matrix: *Soil*

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010B ICP	254		*	mg/Kg	1	5	11/17/11 10:51	aeb

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Acid Generation Potential (calc on Sulfur total)	M600/2-78-054 1.3	5			t CaCO3/Kt	1	5	11/30/11 10:15	calc
Acid Neutralization Potential (calc)	M600/2-78-054 1.3	0.0			t CaCO3/Kt	1	5	11/30/11 10:15	calc
Acid-Base Potential (calc on Sulfur total)	M600/2-78-054 1.3	-5			t CaCO3/Kt	1	5	11/30/11 10:15	calc
Neutralization Potential as CaCO3	M600/2-78-054 3.2.3		U	*	%	0.1	0.5	11/18/11 2:10	brd
pH, Saturated Paste	USDA No. 60 (21A)	4.3		*	units	0.1	0.1	11/22/11 7:25	bsu
Solids, Percent	CLPSOW390, PART F, D-98	96.5		*	%	0.1	0.5	11/16/11 16:00	ndj
Sulfur Forms	M600/2-78-054 3.2.4								
Sulfur Organic Residual		0.10		*	%	0.01	0.1	11/17/11 0:00	bsu
Sulfur Pyritic Sulfide		0.06	B	*	%	0.01	0.1	11/17/11 0:00	bsu
Sulfur Sulfate		0.01	B	*	%	0.01	0.1	11/17/11 0:00	bsu
Sulfur Total		0.17		*	%	0.01	0.1	11/17/11 0:00	bsu
Total Sulfur minus Sulfate		0.16		*	%	0.01	0.1	11/17/11 0:00	bsu

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/11/11 11:59	zsh
Crush and Pulverize	USDA No. 1, 1972							11/15/11 17:05	cra
Digestion - Hot Plate	M3050B ICP							11/16/11 16:40	mss2
Saturated Paste Extraction	USDA No. 60 (2)							11/21/11 18:06	bsu
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/15/11 17:13	cra/thf
Sieve-250 um (60 mesh)	ASA No.9, 15-4.2.2							11/15/11 17:13	cra/thf

** Please refer to Qualifier Reports for details.*

Inorganic Reference

Report Header Explanations

Batch	A distinct set of samples analyzed at a specific time
Found	Value of the QC Type of interest
Limit	Upper limit for RPD, in %.
Lower	Lower Recovery Limit, in % (except for LCSS, mg/Kg)
MDL	Method Detection Limit. Same as Minimum Reporting Limit. Allows for instrument and annual fluctuations.
PCN/SCN	A number assigned to reagents/standards to trace to the manufacturer's certificate of analysis
PQL	Practical Quantitation Limit, typically 5 times the MDL.
QC	True Value of the Control Sample or the amount added to the Spike
Rec	Amount of the true value or spike added recovered, in % (except for LCSS, mg/Kg)
RPD	Relative Percent Difference, calculation used for Duplicate QC Types
Upper	Upper Recovery Limit, in % (except for LCSS, mg/Kg)
Sample	Value of the Sample of interest

QC Sample Types

AS	Analytical Spike (Post Digestion)	*LCSWD*	Laboratory Control Sample - Water Duplicate
ASD	Analytical Spike (Post Digestion) Duplicate	*LFB*	Laboratory Fortified Blank
CCB	Continuing Calibration Blank	*LFM*	Laboratory Fortified Matrix
CCV	Continuing Calibration Verification standard	*LFMD*	Laboratory Fortified Matrix Duplicate
DUP	Sample Duplicate	*LRB*	Laboratory Reagent Blank
ICB	Initial Calibration Blank	*MS*	Matrix Spike
ICV	Initial Calibration Verification standard	*MSD*	Matrix Spike Duplicate
ICSAB	Inter-element Correction Standard - A plus B solutions	*PBS*	Prep Blank - Soil
LCSS	Laboratory Control Sample - Soil	*PBW*	Prep Blank - Water
LCSSD	Laboratory Control Sample - Soil Duplicate	*PQV*	Practical Quantitation Verification standard
LCSW	Laboratory Control Sample - Water	*SDL*	Serial Dilution

QC Sample Type Explanations

Blanks	Verifies that there is no or minimal contamination in the prep method or calibration procedure.
Control Samples	Verifies the accuracy of the method, including the prep procedure.
Duplicates	Verifies the precision of the instrument and/or method.
Spikes/Fortified Matrix	Determines sample matrix interferences, if any.
Standard	Verifies the validity of the calibration.

ACZ Qualifiers (Qual)

B	Analyte concentration detected at a value between MDL and PQL. The associated value is an estimated quantity.
H	Analysis exceeded method hold time. pH is a field test with an immediate hold time.
L	Target analyte response was below the laboratory defined negative threshold.
U	The material was analyzed for, but was not detected above the level of the associated value. The associated value is either the sample quantitation limit or the sample detection limit.

Method References

(1) EPA 600/4-83-020. Methods for Chemical Analysis of Water and Wastes, March 1983.

(2) EPA 600/R-93-100. Methods for the Determination of Inorganic Substances in Environmental Samples, August 1993.

(3) EPA 600/R-94-111. Methods for the Determination of Metals in Environmental Samples - Supplement I, May 1994.

(4) EPA SW-846. Test Methods for Evaluating Solid Waste, Third Edition with Update III, December 1996.

(5) Standard Methods for the Examination of Water and Wastewater, 19th edition, 1995 & 20th edition (1998).

Comments

(1) QC results calculated from raw data. Results may vary slightly if the rounded values are used in the calculations.

(2) Soil, Sludge, and Plant matrices for Inorganic analyses are reported on a dry weight basis.

(3) Animal matrices for Inorganic analyses are reported on an "as received" basis.

(4) An asterisk in the "XQ" column indicates there is an extended qualifier and/or certification qualifier associated with the result.

For a complete list of ACZ's Extended Qualifiers, please click: http://www.acz.com/public/extquallist.pdf

Copper, total (3050) M6010B ICP

ACZ ID	Type	Analyzed	PCN/SCN	QC	Sample	Found	Units	Rec	Lower	Upper	RPD	Limit	Qual
WG313764													
WG313764ICV	ICV	11/17/11 9:08	II111012-2	2		1.983	mg/L	99.2	90	110			
WG313764ICB	ICB	11/17/11 9:11				U	mg/L		-0.03	0.03			
WG313764PQV	PQV	11/17/11 9:15	II111024-4	.05		.052	mg/L	104	70	130			
WG313764ICSAB	ICSAB	11/17/11 9:18	II110922-1	.255		.244	mg/L	95.7	80	120			
WG313678PBS	PBS	11/17/11 9:24				U	mg/Kg		-3	3			
WG313678LCSS1	LCSS	11/17/11 9:27	PCN38231	117		120.3	mg/Kg		98	136			
WG313678LCSSD1	LCSSD	11/17/11 9:30	PCN38231	117		122	mg/Kg		98	136	1.4	20	
L91358-01MS	MS	11/17/11 9:46	II111115-2	50.5	654	690.1	mg/Kg	71.5	75	125			M3
L91358-01MSD	MSD	11/17/11 9:49	II111115-2	50.5	654	729.8	mg/Kg	150.1	75	125	5.59	20	M3
WG313764CCV1	CCV	11/17/11 9:55	II111031-1	1		.995	mg/L	99.5	90	110			
WG313764CCB1	CCB	11/17/11 9:58				U	mg/L		-0.03	0.03			
L91358-05SDL	SDL	11/17/11 10:10			1130	1187.5	mg/Kg				5.1	10	
WG313764CCV2	CCV	11/17/11 10:32	II111031-1	1		.989	mg/L	98.9	90	110			
WG313764CCB2	CCB	11/17/11 10:35				U	mg/L		-0.03	0.03			
WG313764CCV3	CCV	11/17/11 10:57	II111031-1	1		.989	mg/L	98.9	90	110			
WG313764CCB3	CCB	11/17/11 11:00				U	mg/L		-0.03	0.03			

Neutralization Potential as CaCO3 M600/2-78-054 3.2.3

ACZ ID	Type	Analyzed	PCN/SCN	QC	Sample	Found	Units	Rec	Lower	Upper	RPD	Limit	Qual
WG313690													
WG313690PBS	PBS	11/16/11 18:50				U	%		-0.1	0.1			
WG313690LCSS	LCSS	11/16/11 20:47	PCN33453	100		111.12	%	111.1	80	120			
L91597-04DUP	DUP	11/18/11 8:02			U	.13	%				200	20	RA
WG313692													
L91597-05DUP	DUP	11/17/11 16:23			5.1	5.07	%				0.6	20	
WG313692LCSS	LCSS	11/18/11 8:40	PCN33453	100		113.44	%	113.4	80	120			
WG313692PBS	PBS	11/18/11 11:00				U	%		-0.1	0.1			
WG314263													
L91350-09DUP	DUP	11/28/11 13:51			12.3	12.32	%				0.2	20	
WG314263LCSS	LCSS	11/28/11 16:39	PCN33453	100		108.26	%	108.3	80	120			
WG314263PBS	PBS	11/28/11 17:00				U	%		-0.1	0.1			

pH, Saturated Paste USDA No. 60 (21A)

ACZ ID	Type	Analyzed	PCN/SCN	QC	Sample	Found	Units	Rec	Lower	Upper	RPD	Limit	Qual
WG314045													
WG314045ICV	ICV	11/21/11 19:09	PCN36616	4		4.01	units	100.3	97	103			
WG314045CCV1	CCV	11/22/11 3:05	PCN36616	4		4.02	units	100.5	97	103			
L91396-01DUP	DUP	11/22/11 8:51			7.2	7.67	units				6.3	20	
WG314045CCV2	CCV	11/22/11 9:35	PCN36616	4		4.09	units	102.3	97	103			

Solids, Percent CLPSOW390, PART F, D-98

ACZ ID	Type	Analyzed	PCN/SCN	QC	Sample	Found	Units	Rec	Lower	Upper	RPD	Limit	Qual
WG313740													
WG313740PBS	PBS	11/16/11 16:00				U	%		99.9	100.1			
L91358-13DUP	DUP	11/16/11 16:00			92.8	92.93	%				0.1	20	

Sulfur Organic Residual
M600/2-78-054 3.2.4

ACZ ID	Type	Analyzed	PCN/SCN	QC	Sample	Found	Units	Rec	Lower	Upper	RPD	Limit	Qual
WG313719													
L91358-01DUP	DUP	11/16/11 18:17			.03	.04	%				28.6	20	RA

Sulfur Pyritic Sulfide
M600/2-78-054 3.2.4

ACZ ID	Type	Analyzed	PCN/SCN	QC	Sample	Found	Units	Rec	Lower	Upper	RPD	Limit	Qual
WG313719													
L91358-01DUP	DUP	11/16/11 18:17			.01	.02	%				66.7	20	RA

Sulfur Sulfate
M600/2-78-054 3.2.4

ACZ ID	Type	Analyzed	PCN/SCN	QC	Sample	Found	Units	Rec	Lower	Upper	RPD	Limit	Qual
WG313719													
L91358-01DUP	DUP	11/16/11 18:17			U	U	%				0	20	RA

Sulfur Total
M600/2-78-054 3.2.4

ACZ ID	Type	Analyzed	PCN/SCN	QC	Sample	Found	Units	Rec	Lower	Upper	RPD	Limit	Qual
WG313719													
WG313719PBS	PBS	11/16/11 14:00				U	%		-0.03	0.03			
WG313719LCSS	LCSS	11/16/11 15:25	PCN38174	4.07		4.13	%	101.5					
L91358-01DUP	DUP	11/16/11 18:17			.04	.05	%				22.2	20	RA

Total Sulfur Minus Sulfate
M600/2-78-054 3.2.4

ACZ ID	Type	Analyzed	PCN/SCN	QC	Sample	Found	Units	Rec	Lower	Upper	RPD	Limit	Qual
WG313719													
L91358-01DUP	DUP	11/16/11 18:17			.04	.05	%				22.2	20	RA

Inorganic Extended Qualifier Report

Freeport-McMoRan - Chino Mines Company

ACZ Project ID: ***L91358***

ACZ ID	WORKNUM	PARAMETER	METHOD	QUAL	DESCRIPTION
L91358-01	WG313764	Copper, total (3050)	M6010B ICP	M3	The spike recovery value is unusable since the analyte concentration in the sample is disproportionate to the spike level. The recovery of the associated control sample (LCS or LFB) was acceptable.
	WG313719	Sulfur Organic Residual	M600/2-78-054 3.2.4	RA	Relative Percent Difference (RPD) was not used for data validation because the sample concentration is too low for accurate evaluation (< 10x MDL).
		Sulfur Pyritic Sulfide	M600/2-78-054 3.2.4	RA	Relative Percent Difference (RPD) was not used for data validation because the sample concentration is too low for accurate evaluation (< 10x MDL).
		Sulfur Sulfate	M600/2-78-054 3.2.4	RA	Relative Percent Difference (RPD) was not used for data validation because the sample concentration is too low for accurate evaluation (< 10x MDL).
		Sulfur Total	M600/2-78-054 3.2.4	RA	Relative Percent Difference (RPD) was not used for data validation because the sample concentration is too low for accurate evaluation (< 10x MDL).
		Total Sulfur minus Sulfate	M600/2-78-054 3.2.4	RA	Relative Percent Difference (RPD) was not used for data validation because the sample concentration is too low for accurate evaluation (< 10x MDL).
L91358-02	WG313764	Copper, total (3050)	M6010B ICP	M3	The spike recovery value is unusable since the analyte concentration in the sample is disproportionate to the spike level. The recovery of the associated control sample (LCS or LFB) was acceptable.
L91358-03	WG313764	Copper, total (3050)	M6010B ICP	M3	The spike recovery value is unusable since the analyte concentration in the sample is disproportionate to the spike level. The recovery of the associated control sample (LCS or LFB) was acceptable.
	WG313690	Neutralization Potential as CaCO3	M600/2-78-054 3.2.3	RA	Relative Percent Difference (RPD) was not used for data validation because the sample concentration is too low for accurate evaluation (< 10x MDL).
	WG313719	Sulfur Organic Residual	M600/2-78-054 3.2.4	RA	Relative Percent Difference (RPD) was not used for data validation because the sample concentration is too low for accurate evaluation (< 10x MDL).
		Sulfur Pyritic Sulfide	M600/2-78-054 3.2.4	RA	Relative Percent Difference (RPD) was not used for data validation because the sample concentration is too low for accurate evaluation (< 10x MDL).
		Sulfur Sulfate	M600/2-78-054 3.2.4	RA	Relative Percent Difference (RPD) was not used for data validation because the sample concentration is too low for accurate evaluation (< 10x MDL).
		Sulfur Total	M600/2-78-054 3.2.4	RA	Relative Percent Difference (RPD) was not used for data validation because the sample concentration is too low for accurate evaluation (< 10x MDL).
		Total Sulfur minus Sulfate	M600/2-78-054 3.2.4	RA	Relative Percent Difference (RPD) was not used for data validation because the sample concentration is too low for accurate evaluation (< 10x MDL).
L91358-04	WG313764	Copper, total (3050)	M6010B ICP	M3	The spike recovery value is unusable since the analyte concentration in the sample is disproportionate to the spike level. The recovery of the associated control sample (LCS or LFB) was acceptable.
	WG313719	Sulfur Organic Residual	M600/2-78-054 3.2.4	RA	Relative Percent Difference (RPD) was not used for data validation because the sample concentration is too low for accurate evaluation (< 10x MDL).
		Sulfur Pyritic Sulfide	M600/2-78-054 3.2.4	RA	Relative Percent Difference (RPD) was not used for data validation because the sample concentration is too low for accurate evaluation (< 10x MDL).
		Sulfur Sulfate	M600/2-78-054 3.2.4	RA	Relative Percent Difference (RPD) was not used for data validation because the sample concentration is too low for accurate evaluation (< 10x MDL).
		Sulfur Total	M600/2-78-054 3.2.4	RA	Relative Percent Difference (RPD) was not used for data validation because the sample concentration is too low for accurate evaluation (< 10x MDL).
		Total Sulfur minus Sulfate	M600/2-78-054 3.2.4	RA	Relative Percent Difference (RPD) was not used for data validation because the sample concentration is too low for accurate evaluation (< 10x MDL).

ACZ ID	WORKNUM	PARAMETER	METHOD	QUAL	DESCRIPTION
L91358-05	WG313764	Copper, total (3050)	M6010B ICP	M3	The spike recovery value is unusable since the analyte concentration in the sample is disproportionate to the spike level. The recovery of the associated control sample (LCS or LFB) was acceptable.
	WG313719	Sulfur Organic Residual	M600/2-78-054 3.2.4	RA	Relative Percent Difference (RPD) was not used for data validation because the sample concentration is too low for accurate evaluation (< 10x MDL).
		Sulfur Pyritic Sulfide	M600/2-78-054 3.2.4	RA	Relative Percent Difference (RPD) was not used for data validation because the sample concentration is too low for accurate evaluation (< 10x MDL).
		Sulfur Sulfate	M600/2-78-054 3.2.4	RA	Relative Percent Difference (RPD) was not used for data validation because the sample concentration is too low for accurate evaluation (< 10x MDL).
		Sulfur Total	M600/2-78-054 3.2.4	RA	Relative Percent Difference (RPD) was not used for data validation because the sample concentration is too low for accurate evaluation (< 10x MDL).
		Total Sulfur minus Sulfate	M600/2-78-054 3.2.4	RA	Relative Percent Difference (RPD) was not used for data validation because the sample concentration is too low for accurate evaluation (< 10x MDL).
L91358-06	WG313764	Copper, total (3050)	M6010B ICP	M3	The spike recovery value is unusable since the analyte concentration in the sample is disproportionate to the spike level. The recovery of the associated control sample (LCS or LFB) was acceptable.
	WG313690	Neutralization Potential as CaCO3	M600/2-78-054 3.2.3	RA	Relative Percent Difference (RPD) was not used for data validation because the sample concentration is too low for accurate evaluation (< 10x MDL).
	WG313719	Sulfur Organic Residual	M600/2-78-054 3.2.4	RA	Relative Percent Difference (RPD) was not used for data validation because the sample concentration is too low for accurate evaluation (< 10x MDL).
		Sulfur Pyritic Sulfide	M600/2-78-054 3.2.4	RA	Relative Percent Difference (RPD) was not used for data validation because the sample concentration is too low for accurate evaluation (< 10x MDL).
		Sulfur Sulfate	M600/2-78-054 3.2.4	RA	Relative Percent Difference (RPD) was not used for data validation because the sample concentration is too low for accurate evaluation (< 10x MDL).
		Sulfur Total	M600/2-78-054 3.2.4	RA	Relative Percent Difference (RPD) was not used for data validation because the sample concentration is too low for accurate evaluation (< 10x MDL).
		Total Sulfur minus Sulfate	M600/2-78-054 3.2.4	RA	Relative Percent Difference (RPD) was not used for data validation because the sample concentration is too low for accurate evaluation (< 10x MDL).
L91358-07	WG313764	Copper, total (3050)	M6010B ICP	M3	The spike recovery value is unusable since the analyte concentration in the sample is disproportionate to the spike level. The recovery of the associated control sample (LCS or LFB) was acceptable.
	WG313690	Neutralization Potential as CaCO3	M600/2-78-054 3.2.3	RA	Relative Percent Difference (RPD) was not used for data validation because the sample concentration is too low for accurate evaluation (< 10x MDL).
	WG313719	Sulfur Organic Residual	M600/2-78-054 3.2.4	RA	Relative Percent Difference (RPD) was not used for data validation because the sample concentration is too low for accurate evaluation (< 10x MDL).
		Sulfur Pyritic Sulfide	M600/2-78-054 3.2.4	RA	Relative Percent Difference (RPD) was not used for data validation because the sample concentration is too low for accurate evaluation (< 10x MDL).
		Sulfur Sulfate	M600/2-78-054 3.2.4	RA	Relative Percent Difference (RPD) was not used for data validation because the sample concentration is too low for accurate evaluation (< 10x MDL).
		Sulfur Total	M600/2-78-054 3.2.4	RA	Relative Percent Difference (RPD) was not used for data validation because the sample concentration is too low for accurate evaluation (< 10x MDL).
		Total Sulfur minus Sulfate	M600/2-78-054 3.2.4	RA	Relative Percent Difference (RPD) was not used for data validation because the sample concentration is too low for accurate evaluation (< 10x MDL).

ACZ ID	WORKNUM	PARAMETER	METHOD	QUAL	DESCRIPTION
L91358-08	WG313764	Copper, total (3050)	M6010B ICP	M3	The spike recovery value is unusable since the analyte concentration in the sample is disproportionate to the spike level. The recovery of the associated control sample (LCS or LFB) was acceptable.
	WG313690	Neutralization Potential as CaCO3	M600/2-78-054 3.2.3	RA	Relative Percent Difference (RPD) was not used for data validation because the sample concentration is too low for accurate evaluation (< 10x MDL).
	WG313719	Sulfur Organic Residual	M600/2-78-054 3.2.4	RA	Relative Percent Difference (RPD) was not used for data validation because the sample concentration is too low for accurate evaluation (< 10x MDL).
		Sulfur Pyritic Sulfide	M600/2-78-054 3.2.4	RA	Relative Percent Difference (RPD) was not used for data validation because the sample concentration is too low for accurate evaluation (< 10x MDL).
		Sulfur Sulfate	M600/2-78-054 3.2.4	RA	Relative Percent Difference (RPD) was not used for data validation because the sample concentration is too low for accurate evaluation (< 10x MDL).
		Sulfur Total	M600/2-78-054 3.2.4	RA	Relative Percent Difference (RPD) was not used for data validation because the sample concentration is too low for accurate evaluation (< 10x MDL).
		Total Sulfur minus Sulfate	M600/2-78-054 3.2.4	RA	Relative Percent Difference (RPD) was not used for data validation because the sample concentration is too low for accurate evaluation (< 10x MDL).
L91358-09	WG313764	Copper, total (3050)	M6010B ICP	M3	The spike recovery value is unusable since the analyte concentration in the sample is disproportionate to the spike level. The recovery of the associated control sample (LCS or LFB) was acceptable.
	WG313719	Sulfur Organic Residual	M600/2-78-054 3.2.4	RA	Relative Percent Difference (RPD) was not used for data validation because the sample concentration is too low for accurate evaluation (< 10x MDL).
		Sulfur Pyritic Sulfide	M600/2-78-054 3.2.4	RA	Relative Percent Difference (RPD) was not used for data validation because the sample concentration is too low for accurate evaluation (< 10x MDL).
		Sulfur Sulfate	M600/2-78-054 3.2.4	RA	Relative Percent Difference (RPD) was not used for data validation because the sample concentration is too low for accurate evaluation (< 10x MDL).
		Sulfur Total	M600/2-78-054 3.2.4	RA	Relative Percent Difference (RPD) was not used for data validation because the sample concentration is too low for accurate evaluation (< 10x MDL).
		Total Sulfur minus Sulfate	M600/2-78-054 3.2.4	RA	Relative Percent Difference (RPD) was not used for data validation because the sample concentration is too low for accurate evaluation (< 10x MDL).
L91358-10	WG313764	Copper, total (3050)	M6010B ICP	M3	The spike recovery value is unusable since the analyte concentration in the sample is disproportionate to the spike level. The recovery of the associated control sample (LCS or LFB) was acceptable.
	WG313690	Neutralization Potential as CaCO3	M600/2-78-054 3.2.3	RA	Relative Percent Difference (RPD) was not used for data validation because the sample concentration is too low for accurate evaluation (< 10x MDL).
	WG313719	Sulfur Organic Residual	M600/2-78-054 3.2.4	RA	Relative Percent Difference (RPD) was not used for data validation because the sample concentration is too low for accurate evaluation (< 10x MDL).
		Sulfur Pyritic Sulfide	M600/2-78-054 3.2.4	RA	Relative Percent Difference (RPD) was not used for data validation because the sample concentration is too low for accurate evaluation (< 10x MDL).
		Sulfur Sulfate	M600/2-78-054 3.2.4	RA	Relative Percent Difference (RPD) was not used for data validation because the sample concentration is too low for accurate evaluation (< 10x MDL).
		Sulfur Total	M600/2-78-054 3.2.4	RA	Relative Percent Difference (RPD) was not used for data validation because the sample concentration is too low for accurate evaluation (< 10x MDL).
		Total Sulfur minus Sulfate	M600/2-78-054 3.2.4	RA	Relative Percent Difference (RPD) was not used for data validation because the sample concentration is too low for accurate evaluation (< 10x MDL).

ACZ ID	WORKNUM	PARAMETER	METHOD	QUAL	DESCRIPTION
L91358-11	WG313690	Neutralization Potential as CaCO3	M600/2-78-054 3.2.3	RA	Relative Percent Difference (RPD) was not used for data validation because the sample concentration is too low for accurate evaluation (< 10x MDL).
	WG313719	Sulfur Organic Residual	M600/2-78-054 3.2.4	RA	Relative Percent Difference (RPD) was not used for data validation because the sample concentration is too low for accurate evaluation (< 10x MDL).
		Sulfur Pyritic Sulfide	M600/2-78-054 3.2.4	RA	Relative Percent Difference (RPD) was not used for data validation because the sample concentration is too low for accurate evaluation (< 10x MDL).
		Sulfur Sulfate	M600/2-78-054 3.2.4	RA	Relative Percent Difference (RPD) was not used for data validation because the sample concentration is too low for accurate evaluation (< 10x MDL).
		Sulfur Total	M600/2-78-054 3.2.4	RA	Relative Percent Difference (RPD) was not used for data validation because the sample concentration is too low for accurate evaluation (< 10x MDL).
		Total Sulfur minus Sulfate	M600/2-78-054 3.2.4	RA	Relative Percent Difference (RPD) was not used for data validation because the sample concentration is too low for accurate evaluation (< 10x MDL).
L91358-12	WG313764	Copper, total (3050)	M6010B ICP	M3	The spike recovery value is unusable since the analyte concentration in the sample is disproportionate to the spike level. The recovery of the associated control sample (LCS or LFB) was acceptable.
	WG313690	Neutralization Potential as CaCO3	M600/2-78-054 3.2.3	RA	Relative Percent Difference (RPD) was not used for data validation because the sample concentration is too low for accurate evaluation (< 10x MDL).
	WG313719	Sulfur Organic Residual	M600/2-78-054 3.2.4	RA	Relative Percent Difference (RPD) was not used for data validation because the sample concentration is too low for accurate evaluation (< 10x MDL).
		Sulfur Pyritic Sulfide	M600/2-78-054 3.2.4	RA	Relative Percent Difference (RPD) was not used for data validation because the sample concentration is too low for accurate evaluation (< 10x MDL).
		Sulfur Sulfate	M600/2-78-054 3.2.4	RA	Relative Percent Difference (RPD) was not used for data validation because the sample concentration is too low for accurate evaluation (< 10x MDL).
		Sulfur Total	M600/2-78-054 3.2.4	RA	Relative Percent Difference (RPD) was not used for data validation because the sample concentration is too low for accurate evaluation (< 10x MDL).
		Total Sulfur minus Sulfate	M600/2-78-054 3.2.4	RA	Relative Percent Difference (RPD) was not used for data validation because the sample concentration is too low for accurate evaluation (< 10x MDL).
L91358-13	WG313764	Copper, total (3050)	M6010B ICP	M3	The spike recovery value is unusable since the analyte concentration in the sample is disproportionate to the spike level. The recovery of the associated control sample (LCS or LFB) was acceptable.
	WG313690	Neutralization Potential as CaCO3	M600/2-78-054 3.2.3	RA	Relative Percent Difference (RPD) was not used for data validation because the sample concentration is too low for accurate evaluation (< 10x MDL).
	WG313719	Sulfur Organic Residual	M600/2-78-054 3.2.4	RA	Relative Percent Difference (RPD) was not used for data validation because the sample concentration is too low for accurate evaluation (< 10x MDL).
		Sulfur Pyritic Sulfide	M600/2-78-054 3.2.4	RA	Relative Percent Difference (RPD) was not used for data validation because the sample concentration is too low for accurate evaluation (< 10x MDL).
		Sulfur Sulfate	M600/2-78-054 3.2.4	RA	Relative Percent Difference (RPD) was not used for data validation because the sample concentration is too low for accurate evaluation (< 10x MDL).
		Sulfur Total	M600/2-78-054 3.2.4	RA	Relative Percent Difference (RPD) was not used for data validation because the sample concentration is too low for accurate evaluation (< 10x MDL).
		Total Sulfur minus Sulfate	M600/2-78-054 3.2.4	RA	Relative Percent Difference (RPD) was not used for data validation because the sample concentration is too low for accurate evaluation (< 10x MDL).

ACZ ID	WORKNUM	PARAMETER	METHOD	QUAL	DESCRIPTION
L91358-14	WG313764	Copper, total (3050)	M6010B ICP	M3	The spike recovery value is unusable since the analyte concentration in the sample is disproportionate to the spike level. The recovery of the associated control sample (LCS or LFB) was acceptable.
	WG313690	Neutralization Potential as CaCO3	M600/2-78-054 3.2.3	RA	Relative Percent Difference (RPD) was not used for data validation because the sample concentration is too low for accurate evaluation (< 10x MDL).
	WG313719	Sulfur Organic Residual	M600/2-78-054 3.2.4	RA	Relative Percent Difference (RPD) was not used for data validation because the sample concentration is too low for accurate evaluation (< 10x MDL).
		Sulfur Pyritic Sulfide	M600/2-78-054 3.2.4	RA	Relative Percent Difference (RPD) was not used for data validation because the sample concentration is too low for accurate evaluation (< 10x MDL).
		Sulfur Sulfate	M600/2-78-054 3.2.4	RA	Relative Percent Difference (RPD) was not used for data validation because the sample concentration is too low for accurate evaluation (< 10x MDL).
		Sulfur Total	M600/2-78-054 3.2.4	RA	Relative Percent Difference (RPD) was not used for data validation because the sample concentration is too low for accurate evaluation (< 10x MDL).
		Total Sulfur minus Sulfate	M600/2-78-054 3.2.4	RA	Relative Percent Difference (RPD) was not used for data validation because the sample concentration is too low for accurate evaluation (< 10x MDL).
L91358-15	WG313764	Copper, total (3050)	M6010B ICP	M3	The spike recovery value is unusable since the analyte concentration in the sample is disproportionate to the spike level. The recovery of the associated control sample (LCS or LFB) was acceptable.
	WG313690	Neutralization Potential as CaCO3	M600/2-78-054 3.2.3	RA	Relative Percent Difference (RPD) was not used for data validation because the sample concentration is too low for accurate evaluation (< 10x MDL).
	WG313719	Sulfur Organic Residual	M600/2-78-054 3.2.4	RA	Relative Percent Difference (RPD) was not used for data validation because the sample concentration is too low for accurate evaluation (< 10x MDL).
		Sulfur Pyritic Sulfide	M600/2-78-054 3.2.4	RA	Relative Percent Difference (RPD) was not used for data validation because the sample concentration is too low for accurate evaluation (< 10x MDL).
		Sulfur Sulfate	M600/2-78-054 3.2.4	RA	Relative Percent Difference (RPD) was not used for data validation because the sample concentration is too low for accurate evaluation (< 10x MDL).
		Sulfur Total	M600/2-78-054 3.2.4	RA	Relative Percent Difference (RPD) was not used for data validation because the sample concentration is too low for accurate evaluation (< 10x MDL).
		Total Sulfur minus Sulfate	M600/2-78-054 3.2.4	RA	Relative Percent Difference (RPD) was not used for data validation because the sample concentration is too low for accurate evaluation (< 10x MDL).

Inorganic Extended Qualifier Report

Freeport-McMoRan - Chino Mines Company

ACZ Project ID: ***L91358***

ACZ ID	WORKNUM	PARAMETER	METHOD	QUAL	DESCRIPTION
L91358-16	WG313764	Copper, total (3050)	M6010B ICP	M3	The spike recovery value is unusable since the analyte concentration in the sample is disproportionate to the spike level. The recovery of the associated control sample (LCS or LFB) was acceptable.
	WG313690	Neutralization Potential as CaCO3	M600/2-78-054 3.2.3	RA	Relative Percent Difference (RPD) was not used for data validation because the sample concentration is too low for accurate evaluation (< 10x MDL).
	WG313719	Sulfur Organic Residual	M600/2-78-054 3.2.4	RA	Relative Percent Difference (RPD) was not used for data validation because the sample concentration is too low for accurate evaluation (< 10x MDL).
		Sulfur Pyritic Sulfide	M600/2-78-054 3.2.4	RA	Relative Percent Difference (RPD) was not used for data validation because the sample concentration is too low for accurate evaluation (< 10x MDL).
		Sulfur Sulfate	M600/2-78-054 3.2.4	RA	Relative Percent Difference (RPD) was not used for data validation because the sample concentration is too low for accurate evaluation (< 10x MDL).
		Sulfur Total	M600/2-78-054 3.2.4	RA	Relative Percent Difference (RPD) was not used for data validation because the sample concentration is too low for accurate evaluation (< 10x MDL).
		Total Sulfur minus Sulfate	M600/2-78-054 3.2.4	RA	Relative Percent Difference (RPD) was not used for data validation because the sample concentration is too low for accurate evaluation (< 10x MDL).

Soil Analysis

The following parameters are not offered for certification or are not covered by NELAC certificate #ACZ.

Neutralization Potential as CaCO3	M600/2-78-054 3.2.3
pH, Saturated Paste	USDA No. 60 (21A)
Solids, Percent	CLPSOW390, PART F, D-98
Sulfur Organic Residual	M600/2-78-054 3.2.4
Sulfur Pyritic Sulfide	M600/2-78-054 3.2.4
Sulfur Sulfate	M600/2-78-054 3.2.4
Sulfur Total	M600/2-78-054 3.2.4
Total Sulfur minus Sulfate	M600/2-78-054 3.2.4

Sample Receipt

Freeport-McMoRan - Chino Mines Company
ZN000000J8

ACZ Project ID: L91358
Date Received: 10/18/2011 09:23
Received By: ksj
Date Printed: 10/19/2011

Receipt Verification

	YES	NO	NA
1) Does this project require special handling procedures such as CLP protocol?			X
2) Are the custody seals on the cooler intact?	X		
3) Are the custody seals on the sample containers intact?			X
4) Is there a Chain of Custody or other directive shipping papers present?	X		▨
5) Is the Chain of Custody complete?	X		▨
6) Is the Chain of Custody in agreement with the samples received?	X		▨
7) Is there enough sample for all requested analyses?	X		▨
8) Are all samples within holding times for requested analyses?	X		▨
9) Were all sample containers received intact?	X		▨
10) Are the temperature blanks present?			X
11) Are the trip blanks (VOA and/or Cyanide) present?			X
12) Are samples requiring no headspace, headspace free?			X
13) Do the samples that require a Foreign Soils Permit have one?			X

Exceptions: If you answered no to any of the above questions, please describe

N/A

Contact (For any discrepancies, the client must be contacted)

N/A

Shipping Containers

Cooler Id		Temp (°C)	Rad (µR/hr)
3282		9.2	18
3164		10.4	18
3045		13.6	20

Client must contact ACZ Project Manager if analysis should not proceed for samples received outside of thermal preservation acceptance criteria.

Notes

ACZ Laboratories, Inc.
2773 Downhill Drive Steamboat Springs, CO 80487 (800) 334-5493

Sample Receipt

Freeport-McMoRan - Chino Mines Company
ZN000000J8

ACZ Project ID:	L91358
Date Received:	10/18/2011 09:23
Received By:	ksj
Date Printed:	10/19/2011

Sample Container Preservation

SAMPLE	CLIENT ID	R < 2	G < 2	BK < 2	Y< 2	YG< 2	B< 2	O < 2	T >12	N/A	RAD	ID
L91358-01	STS-PH-2011-FID37									X		☐
L91358-02	STS-PCUG-2011-40									X		☐
L91358-03	STS-PH-2011-FID101									X		☐
L91358-04	STS-PH-2011-REFPLOT3									X		☐
L91358-05	STS-PH-2011-REFPLOT4									X		☐
L91358-06	DUP11									X		☐
L91358-07	STS-PH-2011-FID105									X		☐
L91358-08	DUP12									X		☐
L91358-09	STS-PH-2011-REFPLOT1									X		☐
L91358-10	STS-PH-2011-REFPLOT2									X		☐
L91358-11	STS-PH-2011-FID22									X		☐
L91358-12	STS-PH-2011-FID10									X		☐
L91358-13	STS-PH-2011-FID15									X		☐
L91358-14	STS-PH-2011-FID16									X		☐
L91358-15	STS-PH-2011-FID17									X		☐
L91358-16	STS-PH-2011-FID18									X		☐

Sample Container Preservation Legend

Abbreviation	**Description**	**Container Type**	**Preservative/Limits**
R	Raw/Nitric	RED	pH must be < 2
B	Filtered/Sulfuric	BLUE	pH must be < 2
BK	Filtered/Nitric	BLACK	pH must be < 2
G	Filtered/Nitric	GREEN	pH must be < 2
O	Raw/Sulfuric	ORANGE	pH must be < 2
P	Raw/NaOH	PURPLE	pH must be > 12 *
T	Raw/NaOH Zinc Acetate	TAN	pH must be > 12
Y	Raw/Sulfuric	YELLOW	pH must be < 2
YG	Raw/Sulfuric	YELLOW GLASS	pH must be < 2
N/A	No preservative needed	Not applicable	
RAD	Gamma/Beta dose rate	Not applicable	must be < 250 µR/hr

* pH check performed by analyst prior to sample preparation

Sample IDs Reviewed By: ksj

ACZ Laboratories, Inc. L91358
2773 Downhill Drive Steamboat Springs, CO 80487 (800) 334-5493

CHAIN of CUSTODY

Report to

Name: Pam Pinson	Address: P.O. Box 10
Company: Chino Mines Company	Bayard, NM 88023
E-mail: Pamela_Pinson@FMI.com	Telephone: 575-912-5213

Copy of Report to

Name: Matthew Barkley	E-mail: Matthew.Barkley@arcadis-us.com
Company: ARCADIS	Telephone: 303-231-9115 ext 157

Invoice to

Name: Pam Pinson	Address: P.O. Box 10
Company: Chino Mines Company	Bayard, NM 88023
E-mail: Pamela_Pinson@FMI.com	Telephone: 575-912-5213

If sample(s) received past holding time (HT), or if insufficient HT remains to complete analysis before expiration, shall ACZ proceed with requested short HT analyses? YES ☒ NO ☐
If "NO" then ACZ will contact client for further instruction. If neither "YES" nor "NO" is indicated, ACZ will proceed with the requested analyses, even if HT is expired, and data will be qualified.

Are samples for CO DW Compliance Monitoring? YES ☐ NO ☒
If yes, please include state forms. Results will be reported to PQL.

PROJECT INFORMATION

Quote #:
Project/PO #:
Reporting state for compliance testing:
Sampler's Name: Carolyn Meyer
Are any samples NRC licensable material? Yes No

ANALYSES REQUESTED

SAMPLE IDENTIFICATION	DATE:TIME	Matrix	# of Containers	soil sieved to < 2mm	pH	Total CU	ABA				
STS-PH-2011-FID37	10.11.11 : 09:45	SO	1	X	X	X	X				
STS-PCUG-2011-40	10.13.11 : 13:55	SO	1	X	X	X					
STS-PH-2011-FID101	10.12.11 : 16:45	SO	1	X	X	X	X				
STS-PH-2011-REFPLOT3	10.7.11 : 11:50	SO	1	X	X	X	X				
STS-PH-2011-REFPLOT4	10.6.11 : 10:39	SO	1	X	X	X	X				
DUP11	10.12.11 : ---	SO	1	X	X	X	X				
STS-PH-2011-FID105	10.6.11 : 13:30	SO	1	X	X	X	X				
DUP12	10.13.11 : ---	SO	1	X	X	X	X				
STS-PH-2011-REFPLOT1	10.4.11 : 11:09	SO	1	X	X	X	X				
STS-PH-2011-REFPLOT2	10.5.11 : 12:30	SO	1	X	X	X	X				

Matrix SW (Surface Water) · GW (Ground Water) · WW (Waste Water) · DW (Drinking Water) · SL (Sludge) · SO (Soil) · OL (Oil) · Other (Specify)

REMARKS

Please send to Sheri Fling at URS for validation. Sieve all soil samples to <2 mm prior to analysis. Soil should be reported on a dry weight basis.
Methods:
pH - 9045C, Total Copper - 6010B

Please refer to ACZ's terms & conditions located on the reverse side of this COC.

RELINQUISHED BY	DATE:TIME	RECEIVED BY	DATE:TIME
	10.14.11 10:30		
			[illegible] 11 9:[illegible]

FRMAD050.01.15.09 White - Return with sample. Yellow - Retain for your records.

L91358 Chain of Custody

①

ACZ Laboratories, Inc. L91358

2773 Downhill Drive Steamboat Springs, CO 80487 (800) 334-5493

CHAIN of CUSTODY

Report to:

Name: Pam Pinson
Company: Chino Mines Company
E-mail: Pamela_Pinson@FMI.com

Address: P.O. Box 10
Bayard, NM 88023
Telephone: 575-912-5213

Copy of Report to:

Name: Matthew Barkley
Company: ARCADIS

E-mail: Matthew.Barkley@arcadis-us.com
Telephone: 303-231-9115 ext 157

Invoice to:

Name: Pam Pinson
Company: Chino Mines Company
E-mail: Pamela_Pinson@FMI.com

Address: P.O. Box 10
Bayard, NM 88023
Telephone: 575-912-5213

If sample(s) received past holding time (HT), or if insufficient HT remains to complete analysis before expiration, shall ACZ proceed with requested short HT analyses? YES ☒ NO ☐

If "NO" then ACZ will contact client for further instruction. If neither "YES" nor "NO" is indicated, ACZ will proceed with the requested analyses, even if HT is expired, and data will be qualified.

Are samples for CO DW Compliance Monitoring? YES ☐

If yes, please include state forms. Results will be reported to PQL. NO ☒

PROJECT INFORMATION

Quote #:
Project/PO #:
Reporting state for compliance testing:
Sampler's Name: Carolyn Meyer
Are any samples NRC licensable material? Yes No

SAMPLE IDENTIFICATION	DATE:TIME	Matrix	# of Containers	soil sieved to < 2mm	pH	Total CU	ABA				
STS-PH-2011-FID22	10.13.11 : 16:40	SO	1	✗	✗	✗	✗				
mb ~~STS-PH-2011-FID8~~	~~10.12.11 : 15:55~~	~~SO~~	~~1~~	~~✗~~	~~✗~~	~~✗~~	~~✗~~				
STS-PH-2011-FID10	10.7.11 : 14:35	SO	1	✗	✗	✗	✗				
STS-PH-2011-FID15	10.10.11 : 11:50	SO	1	✗	✗	✗	✗				
STS-PH-2011-FID16	10.10.11 : 12:30	SO	1	✗	✗	✗	✗				
STS-PH-2011-FID17	10.11.11 : 17:35	SO	1	✗	✗	✗	✗				
STS-PH-2011-FID18	10.12.11 : 15:55	SO	1	✗	✗	✗	✗				

Matrix SW (Surface Water) · GW (Ground Water) · WW (Waste Water) · DW (Drinking Water) · SL (Sludge) · SO (Soil) · OL (Oil) · Other (Specify)

REMARKS

Please send to Sheri Fling at URS for validation. Sieve all soil samples to <2 mm prior to analysis. Soil should be reported on a dry weight basis.

Methods:

pH - 9045C, Total Copper - 6010B

Please refer to ACZ's terms & conditions located on the reverse side of this COC.

RELINQUISHED BY	DATE:TIME	RECEIVED BY	DATE:TIME
	10.14.11 10:30		
			[illegible]-11 9:[illegible]

2

FRMAD050.01.15.09 White - Return with sample. Yellow - Retain for your records.

ACZ Laboratories, Inc.
2773 Downhill Drive Steamboat Springs, CO 80487 (800) 334-5493

Analytical Report

November 21, 2011

Report to:
Pam Pinson
Freeport-McMoRan - Chino Mines Company
PO Box 10
Bayard, NM 88023

Bill to:
Pam Pinson
Freeport-McMoRan - Chino Mines Company
P.O. Box 13308
Phoenix, AZ 85002-3308

cc: Matthew Barkley, Sheri Fling

Project ID: ZN000000J8
ACZ Project ID: L91359

Pam Pinson:

Enclosed are the analytical results for sample(s) submitted to ACZ Laboratories, Inc. (ACZ) on October 18, 2011. This project has been assigned to ACZ's project number, L91359. Please reference this number in all future inquiries.

All analyses were performed according to ACZ's Quality Assurance Plan. The enclosed results relate only to the samples received under L91359. Each section of this report has been reviewed and approved by the appropriate Laboratory Supervisor, or a qualified substitute.

Except as noted, the test results for the methods and parameters listed on ACZ's current NELAC certificate letter (#ACZ) meet all requirements of NELAC.

This report shall be used or copied only in its entirety. ACZ is not responsible for the consequences arising from the use of a partial report.

All samples and sub-samples associated with this project will be disposed of after December 21, 2011. If the samples are determined to be hazardous, additional charges apply for disposal (typically less than $10/sample). If you would like the samples to be held longer than ACZ's stated policy or to be returned, please contact your Project Manager or Customer Service Representative for further details and associated costs. ACZ retains analytical reports for five years.

If you have any questions or other needs, please contact your Project Manager.

S. Habermehl

Scott Habermehl has reviewed
and approved this report.

Inorganic Analytical Results

Freeport-McMoRan - Chino Mines Company

Project ID:	ZN000000J8	ACZ Sample ID:	***L91359-01***
Sample ID:	STS-CG-2011-11	Date Sampled:	*10/04/11 13:55*
		Date Received:	*10/18/11*
		Sample Matrix:	*Soil*

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010B ICP	1370		*	mg/Kg	1	5	11/15/11 20:31	aeb

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Solids, Percent	CLPSOW390, PART F, D-98	92.0		*	%	0.1	0.5	11/16/11 16:00	ndj

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/11/11 14:00	mss2
Digestion - Hot Plate	M3050B ICP							11/14/11 15:08	mss2
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/14/11 11:50	thf

** Please refer to Qualifier Reports for details.*

Freeport-McMoRan - Chino Mines Company

Project ID:	ZN000000J8	ACZ Sample ID:	***L91359-02***
Sample ID:	STS-CG-2011-12	Date Sampled:	*10/07/11 15:15*
		Date Received:	*10/18/11*
		Sample Matrix:	*Soil*

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010B ICP	1670		*	mg/Kg	1	5	11/15/11 20:40	aeb

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Solids, Percent	CLPSOW390, PART F, D-98	93.0		*	%	0.1	0.5	11/16/11 16:00	ndj

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/11/11 14:03	mss2
Digestion - Hot Plate	M3050B ICP							11/14/11 16:17	mss2
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/14/11 11:52	thf

** Please refer to Qualifier Reports for details.*

Freeport-McMoRan - Chino Mines Company

Project ID:	ZN000000J8
Sample ID:	STS-CG-2011-13

ACZ Sample ID:	***L91359-03***
Date Sampled:	*10/04/11 14:25*
Date Received:	*10/18/11*
Sample Matrix:	*Soil*

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010B ICP	906		*	mg/Kg	1	5	11/15/11 20:43	aeb

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Solids, Percent	CLPSOW390, PART F, D-98	93.1		*	%	0.1	0.5	11/16/11 16:00	ndj

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/11/11 14:06	mss2
Digestion - Hot Plate	M3050B ICP							11/14/11 16:39	mss2
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/14/11 11:55	thf

** Please refer to Qualifier Reports for details.*

Freeport-McMoRan - Chino Mines Company

Project ID:	ZN000000J8	ACZ Sample ID:	***L91359-04***
Sample ID:	STS-CG-2011-14	Date Sampled:	*10/04/11 15:05*
		Date Received:	*10/18/11*
		Sample Matrix:	*Soil*

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010B ICP	977		*	mg/Kg	1	5	11/15/11 20:46	aeb

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Solids, Percent	CLPSOW390, PART F, D-98	93.5		*	%	0.1	0.5	11/16/11 16:00	ndj

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/11/11 14:09	mss2
Digestion - Hot Plate	M3050B ICP							11/14/11 17:02	mss2
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/14/11 11:58	thf

** Please refer to Qualifier Reports for details.*

Freeport-McMoRan - Chino Mines Company

Project ID:	ZN000000J8	ACZ Sample ID:	***L91359-05***
Sample ID:	STS-CG-2011-15	Date Sampled:	*10/07/11 16:05*
		Date Received:	*10/18/11*
		Sample Matrix:	*Soil*

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010B ICP	1790		*	mg/Kg	1	5	11/15/11 20:49	aeb

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Solids, Percent	CLPSOW390, PART F, D-98	89.7		*	%	0.1	0.5	11/16/11 16:00	ndj

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/11/11 14:12	mss2
Digestion - Hot Plate	M3050B ICP							11/14/11 17:25	mss2
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/14/11 12:01	thf

** Please refer to Qualifier Reports for details.*

Freeport-McMoRan - Chino Mines Company

Project ID:	ZN000000J8	ACZ Sample ID:	***L91359-06***
Sample ID:	STS-CG-2011-17	Date Sampled:	*10/04/11 15:50*
		Date Received:	*10/18/11*
		Sample Matrix:	*Soil*

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010B ICP	637		*	mg/Kg	1	5	11/15/11 20:58	aeb

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Solids, Percent	CLPSOW390, PART F, D-98	91.3		*	%	0.1	0.5	11/16/11 16:00	ndj

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/11/11 14:15	mss2
Digestion - Hot Plate	M3050B ICP							11/14/11 17:48	mss2
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/14/11 12:04	thf

** Please refer to Qualifier Reports for details.*

Inorganic Analytical Results

Freeport-McMoRan - Chino Mines Company

Project ID:	ZN000000J8	ACZ Sample ID:	***L91359-07***
Sample ID:	STS-CG-2011-19	Date Sampled:	*10/05/11 15:05*
		Date Received:	*10/18/11*
		Sample Matrix:	*Soil*

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010B ICP	1050		*	mg/Kg	1	5	11/15/11 21:01	aeb

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Solids, Percent	CLPSOW390, PART F, D-98	91.4		*	%	0.1	0.5	11/16/11 16:00	ndj

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/11/11 14:18	mss2
Digestion - Hot Plate	M3050B ICP							11/14/11 18:11	mss2
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/14/11 12:07	thf

** Please refer to Qualifier Reports for details.*

Inorganic Analytical Results

Freeport-McMoRan - Chino Mines Company

Project ID:	ZN000000J8	ACZ Sample ID:	***L91359-08***
Sample ID:	STS-CG-2011-20	Date Sampled:	*10/08/11 16:40*
		Date Received:	*10/18/11*
		Sample Matrix:	*Soil*

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010B ICP	555		*	mg/Kg	1	5	11/15/11 21:04	aeb

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Solids, Percent	CLPSOW390, PART F, D-98	89.4		*	%	0.1	0.5	11/16/11 16:00	ndj

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/11/11 14:21	mss2
Digestion - Hot Plate	M3050B ICP							11/14/11 18:34	mss2
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/14/11 12:10	thf

** Please refer to Qualifier Reports for details.*

Inorganic Analytical Results

Freeport-McMoRan - Chino Mines Company

Project ID:	ZN000000J8	ACZ Sample ID:	***L91359-09***
Sample ID:	STS-PCUG-2011-1	Date Sampled:	*10/13/11 10:45*
		Date Received:	*10/18/11*
		Sample Matrix:	*Soil*

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010B ICP	263		*	mg/Kg	1	5	11/15/11 21:10	aeb

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
pH, Saturated Paste	USDA No. 60 (21A)	5.6		*	units	0.1	0.1	11/15/11 2:21	thf
Solids, Percent	CLPSOW390, PART F, D-98	96.4		*	%	0.1	0.5	11/16/11 16:00	ndj

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/11/11 14:24	mss2
Digestion - Hot Plate	M3050B ICP							11/14/11 18:57	mss2
Saturated Paste Extraction	USDA No. 60 (2)							11/15/11 1:52	thf
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/14/11 12:13	thf

** Please refer to Qualifier Reports for details.*

Freeport-McMoRan - Chino Mines Company

Project ID: ZN000000J8
Sample ID: STS-PCUG-2011-2

ACZ Sample ID: ***L91359-10***
Date Sampled: *10/12/11 11:15*
Date Received: *10/18/11*
Sample Matrix: *Soil*

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010B ICP	876		*	mg/Kg	1	5	11/15/11 21:13	aeb

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
pH, Saturated Paste	USDA No. 60 (21A)	6.5		*	units	0.1	0.1	11/15/11 3:02	thf
Solids, Percent	CLPSOW390, PART F, D-98	95.6		*	%	0.1	0.5	11/16/11 16:00	ndj

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/11/11 14:27	mss2
Digestion - Hot Plate	M3050B ICP							11/14/11 19:19	mss2
Saturated Paste Extraction	USDA No. 60 (2)							11/15/11 2:48	thf
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/14/11 12:15	thf

** Please refer to Qualifier Reports for details.*

Freeport-McMoRan - Chino Mines Company		ACZ Sample ID:	***L91359-11***
Project ID:	ZN000000J8	Date Sampled:	*10/12/11 09:30*
Sample ID:	STS-PCUG-2011-3	Date Received:	*10/18/11*
		Sample Matrix:	*Soil*

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010B ICP	587		*	mg/Kg	1	5	11/15/11 21:16	aeb

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
pH, Saturated Paste	USDA No. 60 (21A)	4.8		*	units	0.1	0.1	11/15/11 3:43	thf
Solids, Percent	CLPSOW390, PART F, D-98	91.0		*	%	0.1	0.5	11/16/11 16:00	ndj

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/11/11 14:30	mss2
Digestion - Hot Plate	M3050B ICP							11/14/11 19:42	mss2
Saturated Paste Extraction	USDA No. 60 (2)							11/15/11 3:44	thf
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/14/11 12:18	thf

** Please refer to Qualifier Reports for details.*

Freeport-McMoRan - Chino Mines Company

Project ID:	ZN000000J8	ACZ Sample ID:	***L91359-12***
Sample ID:	STS-PCUG-2011-4	Date Sampled:	*10/11/11 11:00*
		Date Received:	*10/18/11*
		Sample Matrix:	*Soil*

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010B ICP	794		*	mg/Kg	1	5	11/15/11 21:19	aeb

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
pH, Saturated Paste	USDA No. 60 (21A)	4.6		*	units	0.1	0.1	11/15/11 4:24	thf
Solids, Percent	CLPSOW390, PART F, D-98	92.2		*	%	0.1	0.5	11/16/11 16:00	ndj

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/11/11 14:33	mss2
Digestion - Hot Plate	M3050B ICP							11/14/11 20:05	mss2
Saturated Paste Extraction	USDA No. 60 (2)							11/15/11 4:39	thf
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/14/11 12:21	thf

** Please refer to Qualifier Reports for details.*

Freeport-McMoRan - Chino Mines Company		ACZ Sample ID:	***L91359-13***
Project ID:	ZN000000J8	Date Sampled:	*10/13/11 12:15*
Sample ID:	STS-PCUG-2011-33	Date Received:	*10/18/11*
		Sample Matrix:	*Soil*

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010B ICP	273		*	mg/Kg	1	5	11/15/11 21:22	aeb

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
pH, Saturated Paste	USDA No. 60 (21A)	6.7		*	units	0.1	0.1	11/15/11 5:05	thf
Solids, Percent	CLPSOW390, PART F, D-98	95.8		*	%	0.1	0.5	11/16/11 16:00	ndj

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/11/11 14:36	mss2
Digestion - Hot Plate	M3050B ICP							11/14/11 20:28	mss2
Saturated Paste Extraction	USDA No. 60 (2)							11/15/11 5:35	thf
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/14/11 12:24	thf

** Please refer to Qualifier Reports for details.*

Inorganic Analytical Results

Freeport-McMoRan - Chino Mines Company

Project ID:	ZN000000J8	ACZ Sample ID:	***L91359-14***
Sample ID:	STS-PCUG-2011-7	Date Sampled:	*10/05/11 18:15*
		Date Received:	*10/18/11*
		Sample Matrix:	*Soil*

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010B ICP	387		*	mg/Kg	1	5	11/15/11 21:25	aeb

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
pH, Saturated Paste	USDA No. 60 (21A)	7.7		*	units	0.1	0.1	11/15/11 5:46	thf
Solids, Percent	CLPSOW390, PART F, D-98	89.8		*	%	0.1	0.5	11/16/11 16:00	ndj

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/11/11 14:39	mss2
Digestion - Hot Plate	M3050B ICP							11/14/11 20:51	mss2
Saturated Paste Extraction	USDA No. 60 (2)							11/15/11 6:31	thf
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/14/11 12:27	thf

** Please refer to Qualifier Reports for details.*

Freeport-McMoRan - Chino Mines Company

Project ID:	ZN000000J8	ACZ Sample ID:	***L91359-15***
Sample ID:	STS-PCUG-2011-38	Date Sampled:	*10/13/11 15:55*
		Date Received:	*10/18/11*
		Sample Matrix:	*Soil*

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010B ICP	350		*	mg/Kg	1	5	11/15/11 21:35	aeb

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
pH, Saturated Paste	USDA No. 60 (21A)	3.9		*	units	0.1	0.1	11/15/11 6:27	thf
Solids, Percent	CLPSOW390, PART F, D-98	95.4		*	%	0.1	0.5	11/16/11 16:00	ndj

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/11/11 14:42	mss2
Digestion - Hot Plate	M3050B ICP							11/14/11 21:14	mss2
Saturated Paste Extraction	USDA No. 60 (2)							11/15/11 7:26	thf
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/14/11 12:30	thf

** Please refer to Qualifier Reports for details.*

Freeport-McMoRan - Chino Mines Company

Project ID:	ZN000000J8	ACZ Sample ID:	***L91359-16***
Sample ID:	STS-PCUG-2011-39	Date Sampled:	*10/13/11 15:00*
		Date Received:	*10/18/11*
		Sample Matrix:	*Soil*

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010B ICP	360		*	mg/Kg	1	5	11/15/11 21:38	aeb

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
pH, Saturated Paste	USDA No. 60 (21A)	4.7		*	units	0.1	0.1	11/15/11 7:08	thf
Solids, Percent	CLPSOW390, PART F, D-98	96.6		*	%	0.1	0.5	11/16/11 16:00	ndj

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/11/11 14:45	mss2
Digestion - Hot Plate	M3050B ICP							11/14/11 21:37	mss2
Saturated Paste Extraction	USDA No. 60 (2)							11/15/11 8:22	thf
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/14/11 12:33	thf

** Please refer to Qualifier Reports for details.*

Freeport-McMoRan - Chino Mines Company
Project ID: ZN000000J8
Sample ID: STS-PCUG-2011-10

ACZ Sample ID: ***L91359-17***
Date Sampled: *10/13/11 11:20*
Date Received: *10/18/11*
Sample Matrix: *Soil*

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010B ICP	324		*	mg/Kg	1	5	11/15/11 21:41	aeb

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
pH, Saturated Paste	USDA No. 60 (21A)	7.4		*	units	0.1	0.1	11/15/11 8:30	thf
Solids, Percent	CLPSOW390, PART F, D-98	96.1		*	%	0.1	0.5	11/16/11 16:00	ndj

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/11/11 14:48	mss2
Digestion - Hot Plate	M3050B ICP							11/14/11 21:59	mss2
Saturated Paste Extraction	USDA No. 60 (2)							11/15/11 9:18	thf
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/14/11 12:36	thf

** Please refer to Qualifier Reports for details.*

Inorganic Reference

Report Header Explanations

Batch	A distinct set of samples analyzed at a specific time
Found	Value of the QC Type of interest
Limit	Upper limit for RPD, in %.
Lower	Lower Recovery Limit, in % (except for LCSS, mg/Kg)
MDL	Method Detection Limit. Same as Minimum Reporting Limit. Allows for instrument and annual fluctuations.
PCN/SCN	A number assigned to reagents/standards to trace to the manufacturer's certificate of analysis
PQL	Practical Quantitation Limit, typically 5 times the MDL.
QC	True Value of the Control Sample or the amount added to the Spike
Rec	Amount of the true value or spike added recovered, in % (except for LCSS, mg/Kg)
RPD	Relative Percent Difference, calculation used for Duplicate QC Types
Upper	Upper Recovery Limit, in % (except for LCSS, mg/Kg)
Sample	Value of the Sample of interest

QC Sample Types

AS	Analytical Spike (Post Digestion)	*LCSWD*	Laboratory Control Sample - Water Duplicate
ASD	Analytical Spike (Post Digestion) Duplicate	*LFB*	Laboratory Fortified Blank
CCB	Continuing Calibration Blank	*LFM*	Laboratory Fortified Matrix
CCV	Continuing Calibration Verification standard	*LFMD*	Laboratory Fortified Matrix Duplicate
DUP	Sample Duplicate	*LRB*	Laboratory Reagent Blank
ICB	Initial Calibration Blank	*MS*	Matrix Spike
ICV	Initial Calibration Verification standard	*MSD*	Matrix Spike Duplicate
ICSAB	Inter-element Correction Standard - A plus B solutions	*PBS*	Prep Blank - Soil
LCSS	Laboratory Control Sample - Soil	*PBW*	Prep Blank - Water
LCSSD	Laboratory Control Sample - Soil Duplicate	*PQV*	Practical Quantitation Verification standard
LCSW	Laboratory Control Sample - Water	*SDL*	Serial Dilution

QC Sample Type Explanations

Blanks	Verifies that there is no or minimal contamination in the prep method or calibration procedure.
Control Samples	Verifies the accuracy of the method, including the prep procedure.
Duplicates	Verifies the precision of the instrument and/or method.
Spikes/Fortified Matrix	Determines sample matrix interferences, if any.
Standard	Verifies the validity of the calibration.

ACZ Qualifiers (Qual)

B	Analyte concentration detected at a value between MDL and PQL. The associated value is an estimated quantity.
H	Analysis exceeded method hold time. pH is a field test with an immediate hold time.
L	Target analyte response was below the laboratory defined negative threshold.
U	The material was analyzed for, but was not detected above the level of the associated value. The associated value is either the sample quantitation limit or the sample detection limit.

Method References

(1) EPA 600/4-83-020. Methods for Chemical Analysis of Water and Wastes, March 1983.
(2) EPA 600/R-93-100. Methods for the Determination of Inorganic Substances in Environmental Samples, August 1993.
(3) EPA 600/R-94-111. Methods for the Determination of Metals in Environmental Samples - Supplement I, May 1994.
(4) EPA SW-846. Test Methods for Evaluating Solid Waste, Third Edition with Update III, December 1996.
(5) Standard Methods for the Examination of Water and Wastewater, 19th edition, 1995 & 20th edition (1998).

Comments

(1) QC results calculated from raw data. Results may vary slightly if the rounded values are used in the calculations.
(2) Soil, Sludge, and Plant matrices for Inorganic analyses are reported on a dry weight basis.
(3) Animal matrices for Inorganic analyses are reported on an "as received" basis.
(4) An asterisk in the "XQ" column indicates there is an extended qualifier and/or certification qualifier associated with the result.

For a complete list of ACZ's Extended Qualifiers, please click: http://www.acz.com/public/extquallist.pdf

Copper, total (3050) M6010B ICP

ACZ ID	Type	Analyzed	PCN/SCN	QC	Sample	Found	Units	Rec	Lower	Upper	RPD	Limit	Qual
WG313608													
WG313608ICV	ICV	11/15/11 20:07	II111012-2	2		1.969	mg/L	98.5	90	110			
WG313608ICB	ICB	11/15/11 20:10				U	mg/L		-0.03	0.03			
WG313608PQV	PQV	11/15/11 20:13	II111024-4	.05		.046	mg/L	92	70	130			
WG313608ICSAB	ICSAB	11/15/11 20:16	II110922-1	.255		.265	mg/L	103.9	80	120			
WG313533PBS	PBS	11/15/11 20:22				U	mg/Kg		-3	3			
WG313533LCSS	LCSS	11/15/11 20:25	PCN38231	117		120.4	mg/Kg		98	136			
WG313533LCSSD	LCSSD	11/15/11 20:28	PCN38231	117		121	mg/Kg		98	136	0.5	20	
L91359-01MS	MS	11/15/11 20:34	II111104-3	50.5	1370	1355.2	mg/Kg	-29.3	75	125			M3
L91359-01MSD	MSD	11/15/11 20:37	II111104-3	50.5	1370	1315.8	mg/Kg	-107.3	75	125	2.95	20	M3
WG313608CCV1	CCV	11/15/11 20:52	II111031-1	1		.995	mg/L	99.5	90	110			
WG313608CCB1	CCB	11/15/11 20:55				.013	mg/L		-0.03	0.03			
L91359-08SDL	SDL	11/15/11 21:07			555	576.5	mg/Kg				3.9	10	
WG313608CCV2	CCV	11/15/11 21:28	II111031-1	1		.966	mg/L	96.6	90	110			
WG313608CCB2	CCB	11/15/11 21:32				U	mg/L		-0.03	0.03			
WG313608CCV3	CCV	11/15/11 21:44	II111031-1	1		.971	mg/L	97.1	90	110			
WG313608CCB3	CCB	11/15/11 21:47				U	mg/L		-0.03	0.03			

pH, Saturated Paste USDA No. 60 (21A)

ACZ ID	Type	Analyzed	PCN/SCN	QC	Sample	Found	Units	Rec	Lower	Upper	RPD	Limit	Qual
WG313542													
WG313542ICV	ICV	11/14/11 16:47	PCN36616	4		4.01	units	100.3	97	103			
L91355-01DUP	DUP	11/14/11 18:09			4.8	4.74	units				1.3	20	
WG313542CCV1	CCV	11/15/11 0:18	PCN36616	4		3.99	units	99.8	97	103			
WG313542CCV2	CCV	11/15/11 7:49	PCN36616	4		3.99	units	99.8	97	103			
WG313542CCV3	CCV	11/15/11 9:11	PCN36616	4		3.98	units	99.5	97	103			

Solids, Percent CLPSOW390, PART F, D-98

ACZ ID	Type	Analyzed	PCN/SCN	QC	Sample	Found	Units	Rec	Lower	Upper	RPD	Limit	Qual
WG313741													
WG313741PBS	PBS	11/16/11 16:00				U	%		99.9	100.1			
L91359-14DUP	DUP	11/16/11 16:00			89.8	90.14	%				0.4	20	

Inorganic Extended Qualifier Report

Freeport-McMoRan - Chino Mines Company

ACZ Project ID: ***L91359***

ACZ ID	WORKNUM	PARAMETER	METHOD	QUAL	DESCRIPTION
L91359-01	WG313608	Copper, total (3050)	M6010B ICP	M3	The spike recovery value is unusable since the analyte concentration in the sample is disproportionate to the spike level. The recovery of the associated control sample (LCS or LFB) was acceptable.
L91359-02	WG313608	Copper, total (3050)	M6010B ICP	M3	The spike recovery value is unusable since the analyte concentration in the sample is disproportionate to the spike level. The recovery of the associated control sample (LCS or LFB) was acceptable.
L91359-03	WG313608	Copper, total (3050)	M6010B ICP	M3	The spike recovery value is unusable since the analyte concentration in the sample is disproportionate to the spike level. The recovery of the associated control sample (LCS or LFB) was acceptable.
L91359-04	WG313608	Copper, total (3050)	M6010B ICP	M3	The spike recovery value is unusable since the analyte concentration in the sample is disproportionate to the spike level. The recovery of the associated control sample (LCS or LFB) was acceptable.
L91359-05	WG313608	Copper, total (3050)	M6010B ICP	M3	The spike recovery value is unusable since the analyte concentration in the sample is disproportionate to the spike level. The recovery of the associated control sample (LCS or LFB) was acceptable.
L91359-06	WG313608	Copper, total (3050)	M6010B ICP	M3	The spike recovery value is unusable since the analyte concentration in the sample is disproportionate to the spike level. The recovery of the associated control sample (LCS or LFB) was acceptable.
L91359-07	WG313608	Copper, total (3050)	M6010B ICP	M3	The spike recovery value is unusable since the analyte concentration in the sample is disproportionate to the spike level. The recovery of the associated control sample (LCS or LFB) was acceptable.
L91359-08	WG313608	Copper, total (3050)	M6010B ICP	M3	The spike recovery value is unusable since the analyte concentration in the sample is disproportionate to the spike level. The recovery of the associated control sample (LCS or LFB) was acceptable.
L91359-09	WG313608	Copper, total (3050)	M6010B ICP	M3	The spike recovery value is unusable since the analyte concentration in the sample is disproportionate to the spike level. The recovery of the associated control sample (LCS or LFB) was acceptable.
L91359-10	WG313608	Copper, total (3050)	M6010B ICP	M3	The spike recovery value is unusable since the analyte concentration in the sample is disproportionate to the spike level. The recovery of the associated control sample (LCS or LFB) was acceptable.
L91359-11	WG313608	Copper, total (3050)	M6010B ICP	M3	The spike recovery value is unusable since the analyte concentration in the sample is disproportionate to the spike level. The recovery of the associated control sample (LCS or LFB) was acceptable.
L91359-12	WG313608	Copper, total (3050)	M6010B ICP	M3	The spike recovery value is unusable since the analyte concentration in the sample is disproportionate to the spike level. The recovery of the associated control sample (LCS or LFB) was acceptable.
L91359-13	WG313608	Copper, total (3050)	M6010B ICP	M3	The spike recovery value is unusable since the analyte concentration in the sample is disproportionate to the spike level. The recovery of the associated control sample (LCS or LFB) was acceptable.
L91359-14	WG313608	Copper, total (3050)	M6010B ICP	M3	The spike recovery value is unusable since the analyte concentration in the sample is disproportionate to the spike level. The recovery of the associated control sample (LCS or LFB) was acceptable.

ACZ ID	WORKNUM	PARAMETER	METHOD	QUAL	DESCRIPTION
L91359-15	WG313608	Copper, total (3050)	M6010B ICP	M3	The spike recovery value is unusable since the analyte concentration in the sample is disproportionate to the spike level. The recovery of the associated control sample (LCS or LFB) was acceptable.
L91359-16	WG313608	Copper, total (3050)	M6010B ICP	M3	The spike recovery value is unusable since the analyte concentration in the sample is disproportionate to the spike level. The recovery of the associated control sample (LCS or LFB) was acceptable.
L91359-17	WG313608	Copper, total (3050)	M6010B ICP	M3	The spike recovery value is unusable since the analyte concentration in the sample is disproportionate to the spike level. The recovery of the associated control sample (LCS or LFB) was acceptable.

Soil Analysis

The following parameters are not offered for certification or are not covered by NELAC certificate #ACZ.

pH, Saturated Paste	USDA No. 60 (21A)
Solids, Percent	CLPSOW390, PART F, D-98

ACZ Laboratories, Inc.
2773 Downhill Drive Steamboat Springs, CO 80487 (800) 334-5493

Sample Receipt

Freeport-McMoRan - Chino Mines Company
ZN000000J8

ACZ Project ID: L91359
Date Received: 10/18/2011 09:23
Received By: ksj
Date Printed: 10/19/2011

Receipt Verification

	YES	NO	NA
1) Does this project require special handling procedures such as CLP protocol?			X
2) Are the custody seals on the cooler intact?	X		
3) Are the custody seals on the sample containers intact?			X
4) Is there a Chain of Custody or other directive shipping papers present?	X		
5) Is the Chain of Custody complete?	X		
6) Is the Chain of Custody in agreement with the samples received?	X		
7) Is there enough sample for all requested analyses?	X		
8) Are all samples within holding times for requested analyses?	X		
9) Were all sample containers received intact?	X		
10) Are the temperature blanks present?			X
11) Are the trip blanks (VOA and/or Cyanide) present?			X
12) Are samples requiring no headspace, headspace free?			X
13) Do the samples that require a Foreign Soils Permit have one?			X

Exceptions: If you answered no to any of the above questions, please describe

N/A

Contact (For any discrepancies, the client must be contacted)

N/A

Shipping Containers

Cooler Id		Temp (°C)	Rad (µR/hr)
3045		17.6	20
2316		13.3	22
3164		10.4	18
3282		9.2	18

Client must contact ACZ Project Manager if analysis should not proceed for samples received outside of thermal preservation acceptance criteria.

Notes

ACZ Laboratories, Inc.

2773 Downhill Drive Steamboat Springs, CO 80487 (800) 334-5493

Sample Receipt

Freeport-McMoRan - Chino Mines Company
ZN000000J8

ACZ Project ID: L91359
Date Received: 10/18/2011 09:23
Received By: ksj
Date Printed: 10/19/2011

Sample Container Preservation

SAMPLE	CLIENT ID	R < 2	G < 2	BK < 2	Y< 2	YG< 2	B< 2	O < 2	T >12	N/A	RAD	ID
L91359-01	STS-CG-2011-11									X		▣
L91359-02	STS-CG-2011-12									X		▣
L91359-03	STS-CG-2011-13									X		▣
L91359-04	STS-CG-2011-14									X		▣
L91359-05	STS-CG-2011-15									X		▣
L91359-06	STS-CG-2011-17									X		▣
L91359-07	STS-CG-2011-19									X		▣
L91359-08	STS-CG-2011-20									X		▣
L91359-09	STS-PCUG-2011-1									X		▣
L91359-10	STS-PCUG-2011-2									X		▣
L91359-11	STS-PCUG-2011-3									X		▣
L91359-12	STS-PCUG-2011-4									X		▣
L91359-13	STS-PCUG-2011-33									X		▣
L91359-14	STS-PCUG-2011-7									X		▣
L91359-15	STS-PCUG-2011-38									X		▣
L91359-16	STS-PCUG-2011-39									X		▣
L91359-17	STS-PCUG-2011-10									X		▣

Sample Container Preservation Legend

Abbreviation	Description	Container Type	Preservative/Limits
R	Raw/Nitric	RED	pH must be < 2
B	Filtered/Sulfuric	BLUE	pH must be < 2
BK	Filtered/Nitric	BLACK	pH must be < 2
G	Filtered/Nitric	GREEN	pH must be < 2
O	Raw/Sulfuric	ORANGE	pH must be < 2
P	Raw/NaOH	PURPLE	pH must be > 12 *
T	Raw/NaOH Zinc Acetate	TAN	pH must be > 12
Y	Raw/Sulfuric	YELLOW	pH must be < 2
YG	Raw/Sulfuric	YELLOW GLASS	pH must be < 2
N/A	No preservative needed	Not applicable	
RAD	Gamma/Beta dose rate	Not applicable	must be < 250 µR/hr

* pH check performed by analyst prior to sample preparation

Sample IDs Reviewed By: ksj

ACZ Laboratories, Inc. L91359

2773 Downhill Drive Steamboat Springs, CO 80487 (800) 334-5493

CHAIN of CUSTODY

Report to

Name: Pam Pinson
Company: Chino Mines Company
E-mail: Pamela_Pinson@FMI.com

Address: P.O. Box 10
Bayard, NM 88023
Telephone: 575-912-5213

Copy of Report to

Name: Matthew Barkley
Company: ARCADIS

E-mail: Matthew.Barkley@arcadis-us.com
Telephone: 303-231-9115 ext 157

Invoice to

Name: Pam Pinson
Company: Chino Mines Company
E-mail: Pamela_Pinson@FMI.com

Address: P.O. Box 10
Bayard, NM 88023
Telephone: 575-912-5213

If sample(s) received past holding time (HT), or if insufficient HT remains to complete analysis before expiration, shall ACZ proceed with requested short HT analyses? YES ☒ NO ☐

If "NO" then ACZ will contact client for further instruction. If neither "YES" nor "NO" is indicated, ACZ will proceed with the requested analyses, even if HT is expired, and data will be qualified.

Are samples for CO DW Compliance Monitoring? YES ☐ NO ☒

If yes, please include state forms. Results will be reported to PQL.

PROJECT INFORMATION

Quote #:
Project/PO #:
Reporting state for compliance testing:
Sampler's Name: Carolyn Meyer
Are any samples NRC licensable material? Yes No

SAMPLE IDENTIFICATION	DATE:TIME	Matrix	# of Containers	soil sieved to < 2mm	Total Copper						
STS-CG-2011-11	10.4.11 : 13:55	SO	1	X	X						
STS-CG-2011-12	10.7.11 : 15:15	SO	1	X	X						
STS-CG-2011-13	10.4.11 : 14:25	SO	1	X	X						
STS-CG-2011-14	10.4.11 : 15:05	SO	1	X	X						
STS-CG-2011-15	10.7.11 : 16:05	SO	1	X	X						
~~STS-CG-2011-16~~	~~10.9.11 : 12:55~~	~~SO~~	~~1~~	~~X~~	~~X~~						
STS-CG-2011-17	10.4.11 : 15:50	SO	1	X	X						
~~STS-CG-2011-7~~	~~10.5.11 : 18:15~~	~~SO~~	~~1~~	~~X~~	~~X~~						
STS-CG-2011-19	10.5.11 : 15:05	SO	1	X	X						
STS-CG-2011-20	10.8.11 : 16:40	SO	1	X	X						

Matrix SW (Surface Water) · GW (Ground Water) · WW (Waste Water) · DW (Drinking Water) · SL (Sludge) · SO (Soil) · OL (Oil) · Other (Specify)

REMARKS

Please send to Sheri Fling at URS for validation. Sieve all soil samples to <2 mm prior to analysis. Soil should be reported on a dry weight basis.
Methods:
Copper - 6010B

L91359 Chain of Custody

Please refer to ACZ's terms & conditions located on the reverse side of this COC.

RELINQUISHED BY	DATE:TIME	RECEIVED BY	DATE:TIME
	10.14.11 10:30		[illegible] 11 9:44

FRMAD050.01.15.09 White - Return with sample. Yellow - Retain for your records.

①

ACZ Laboratories, Inc.
2773 Downhill Drive Steamboat Springs, CO 80487 (800) 334-5493

L91359

CHAIN of CUSTODY

Name: Pam Pinson
Company: Chino Mines Company
E-mail: Pamela_Pinson@FMI.com

Address: P.O. Box 10
Bayard, NM 88023
Telephone: 575-912-5213

Name: Matthew Barkley
Company: ARCADIS

E-mail: Matthew.Barkley@arcadis-us.com
Telephone: 303-231-9115 ext 157

Name: Pam Pinson
Company: Chino Mines Company
E-mail: Pamela_Pinson@FMI.com

Address: P.O. Box 10
Bayard, NM 88023
Telephone: 575-912-5213

If sample(s) received past holding time (HT), or if insufficient HT remains to complete analysis before expiration, shall ACZ proceed with requested short HT analyses? YES ☒ NO ☐
If "NO" then ACZ will contact client for further instruction. If neither "YES" nor "NO" is indicated, ACZ will proceed with the requested analyses, even if HT is expired, and data will be qualified.

Are samples for CO DW Compliance Monitoring? YES ☐ NO ☒
If yes, please include state forms. Results will be reported to PQL.

Quote #:
Project/PO #:
Reporting state for compliance testing:
Sampler's Name: Carolyn Meyer
Are any samples NRC licensable material? Yes No

			# of Containers	soil sieved to < 2mm	pH	Total CU
STS-PCUG-2011-1 •	10.13.11 : 10:45"	SO	1	x	x	x
STS-PCUG-2011-2 •	10.12.11 : 11:15"	SO	1	x	x	x
STS-PCUG-2011-3	10.12.11 : 09:30"	SO	1	x	x	x
STS-PCUG-2011-4 •	10.11.11 : 11:00"	SO	1	x	x	x
~~STS-PCUG-2011-31~~	~~10.5.11 : 14:05'~~	~~SO~~	~~1~~	~~x~~	~~x~~	~~x~~
STS-PCUG-2011-33 •	10.13.11 : 12:15"	SO	1	x	x	x
STS-PCUG-2011-7 •	10.5.11 : 18:15"	SO	1	x	x	x
STS-PCUG-2011-38 •	10.13.11 : 15:55"	SO	1	x	x	x
STS-PCUG-2011-39	10.13.11 : 15:00"	SO	1	x	x	x
STS-PCUG-2011-10 •	10.13.11 : 11:20"	SO	1	x	x	x

Matrix SW (Surface Water) · GW (Ground Water) · WW (Waste Water) · DW (Drinking Water) · SL (Sludge) · SO (Soil) · OL (Oil) · Other (Specify)

REMARKS

Please send to Sheri Fling at URS for validation. Sieve all soil samples to <2 mm prior to analysis. Soil should be reported on a dry weight basis.
Methods:
pH - 9045C and Copper - 6010B

Please refer to ACZ's terms & conditions located on the reverse side of this COC.

	10.14.11 10:30		10/15/11 9:22

2

FRMAD050.01.15.09 White - Return with sample. Yellow - Retain for your records.

ACZ Laboratories, Inc.
2773 Downhill Drive Steamboat Springs, CO 80487 (800) 334-5493

Analytical Report

November 22, 2011

Report to:
Pam Pinson
Freeport-McMoRan - Chino Mines Company
PO Box 10
Bayard, NM 88023

Bill to:
Pam Pinson
Freeport-McMoRan - Chino Mines Company
P.O. Box 13308
Phoenix, AZ 85002-3308

cc: Matthew Barkley, Sheri Fling

Project ID: ZN000000J8
ACZ Project ID: L91360

Pam Pinson:

Enclosed are the analytical results for sample(s) submitted to ACZ Laboratories, Inc. (ACZ) on October 18, 2011. This project has been assigned to ACZ's project number, L91360. Please reference this number in all future inquiries.

All analyses were performed according to ACZ's Quality Assurance Plan. The enclosed results relate only to the samples received under L91360. Each section of this report has been reviewed and approved by the appropriate Laboratory Supervisor, or a qualified substitute.

Except as noted, the test results for the methods and parameters listed on ACZ's current NELAC certificate letter (#ACZ) meet all requirements of NELAC.

This report shall be used or copied only in its entirety. ACZ is not responsible for the consequences arising from the use of a partial report.

All samples and sub-samples associated with this project will be disposed of after December 22, 2011. If the samples are determined to be hazardous, additional charges apply for disposal (typically less than $10/sample). If you would like the samples to be held longer than ACZ's stated policy or to be returned, please contact your Project Manager or Customer Service Representative for further details and associated costs. ACZ retains analytical reports for five years.

If you have any questions or other needs, please contact your Project Manager.

S. Habermehl

Scott Habermehl has reviewed
and approved this report.

Freeport-McMoRan - Chino Mines Company

Project ID:	ZN000000J8	ACZ Sample ID:	***L91360-01***
Sample ID:	STS-CG-2011-31	Date Sampled:	*10/05/11 14:05*
		Date Received:	*10/18/11*
		Sample Matrix:	*Soil*

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010B ICP	1770		*	mg/Kg	1	5	11/15/11 12:34	aeb

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Solids, Percent	CLPSOW390, PART F, D-98	90.6		*	%	0.1	0.5	11/21/11 17:00	bsu

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/11/11 16:00	nrc
Digestion - Hot Plate	M3050B ICP							11/14/11 15:20	mss2
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/14/11 12:39	thf

** Please refer to Qualifier Reports for details.*

Inorganic Analytical Results

Freeport-McMoRan - Chino Mines Company

Project ID:	ZN000000J8	ACZ Sample ID:	***L91360-02***
Sample ID:	DUP5	Date Sampled:	*10/05/11 00:00*
		Date Received:	*10/18/11*
		Sample Matrix:	*Soil*

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010B ICP	528		*	mg/Kg	1	5	11/15/11 12:43	aeb

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Solids, Percent	CLPSOW390, PART F, D-98	89.4		*	%	0.1	0.5	11/21/11 19:02	bsu

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/11/11 16:06	nrc
Digestion - Hot Plate	M3050B ICP							11/14/11 16:40	mss2
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/14/11 12:41	thf

** Please refer to Qualifier Reports for details.*

Freeport-McMoRan - Chino Mines Company

Project ID: ZN000000J8
Sample ID: STS-CG-2011-33

ACZ Sample ID: ***L91360-03***
Date Sampled: *10/08/11 13:50*
Date Received: *10/18/11*
Sample Matrix: *Soil*

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010B ICP	666		*	mg/Kg	1	5	11/15/11 12:46	aeb

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Solids, Percent	CLPSOW390, PART F, D-98	91.2		*	%	0.1	0.5	11/21/11 20:02	bsu

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/11/11 16:13	nrc
Digestion - Hot Plate	M3050B ICP							11/14/11 18:00	mss2
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/14/11 12:44	thf

** Please refer to Qualifier Reports for details.*

Freeport-McMoRan - Chino Mines Company

Project ID:	ZN000000J8	ACZ Sample ID:	***L91360-04***
Sample ID:	STS-CG-2011-34	Date Sampled:	*10/10/11 15:30*
		Date Received:	*10/18/11*
		Sample Matrix:	*Soil*

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010B ICP	1190		*	mg/Kg	1	5	11/15/11 12:49	aeb

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Solids, Percent	CLPSOW390, PART F, D-98	96.4		*	%	0.1	0.5	11/21/11 21:03	bsu

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/11/11 16:20	nrc
Digestion - Hot Plate	M3050B ICP							11/14/11 18:26	mss2
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/14/11 12:47	thf

** Please refer to Qualifier Reports for details.*

Freeport-McMoRan - Chino Mines Company

Project ID: ZN000000J8
Sample ID: STS-CG-2011-35

ACZ Sample ID: ***L91360-05***
Date Sampled: *10/08/11 11:40*
Date Received: *10/18/11*
Sample Matrix: *Soil*

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010B ICP	362		*	mg/Kg	1	5	11/15/11 12:53	aeb

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Solids, Percent	CLPSOW390, PART F, D-98	91.2		*	%	0.1	0.5	11/21/11 22:04	bsu

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/11/11 16:26	nrc
Digestion - Hot Plate	M3050B ICP							11/14/11 18:53	mss2
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/14/11 12:50	thf

** Please refer to Qualifier Reports for details.*

Inorganic Analytical Results

Freeport-McMoRan - Chino Mines Company

Project ID:	ZN000000J8	ACZ Sample ID:	***L91360-06***
Sample ID:	STS-CG-2011-36	Date Sampled:	*10/10/11 16:10*
		Date Received:	*10/18/11*
		Sample Matrix:	*Soil*

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010B ICP	507		*	mg/Kg	1	5	11/15/11 13:05	aeb

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Solids, Percent	CLPSOW390, PART F, D-98	94.3		*	%	0.1	0.5	11/21/11 23:04	bsu

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/11/11 16:33	nrc
Digestion - Hot Plate	M3050B ICP							11/14/11 19:20	mss2
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/14/11 12:53	thf

** Please refer to Qualifier Reports for details.*

Freeport-McMoRan - Chino Mines Company

Project ID:	ZN000000J8
Sample ID:	DUP6

ACZ Sample ID:	***L91360-07***
Date Sampled:	*10/05/11 00:00*
Date Received:	*10/18/11*
Sample Matrix:	*Soil*

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010B ICP	613		*	mg/Kg	1	5	11/15/11 13:08	aeb

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Solids, Percent	CLPSOW390, PART F, D-98	90.7		*	%	0.1	0.5	11/22/11 0:05	bsu

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/11/11 16:40	nrc
Digestion - Hot Plate	M3050B ICP							11/14/11 19:46	mss2
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/14/11 12:56	thf

** Please refer to Qualifier Reports for details.*

Freeport-McMoRan - Chino Mines Company

Project ID:	ZN000000J8	ACZ Sample ID:	***L91360-08***
Sample ID:	STS-CG-2011-38	Date Sampled:	*10/08/11 12:50*
		Date Received:	*10/18/11*
		Sample Matrix:	*Soil*

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010B ICP	633		*	mg/Kg	1	5	11/15/11 13:11	aeb

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Solids, Percent	CLPSOW390, PART F, D-98	91.4		*	%	0.1	0.5	11/22/11 1:06	bsu

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/11/11 16:46	nrc
Digestion - Hot Plate	M3050B ICP							11/14/11 20:13	mss2
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/14/11 12:59	thf

** Please refer to Qualifier Reports for details.*

Inorganic Analytical Results

Freeport-McMoRan - Chino Mines Company

Project ID:	ZN000000J8	ACZ Sample ID:	***L91360-09***
Sample ID:	STS-CG-2011-39	Date Sampled:	*10/09/11 08:35*
		Date Received:	*10/18/11*
		Sample Matrix:	*Soil*

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010B ICP	682		*	mg/Kg	1	5	11/15/11 13:14	aeb

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Solids, Percent	CLPSOW390, PART F, D-98	89.7		*	%	0.1	0.5	11/22/11 2:06	bsu

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/11/11 16:53	nrc
Digestion - Hot Plate	M3050B ICP							11/14/11 20:40	mss2
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/14/11 13:02	thf

** Please refer to Qualifier Reports for details.*

Inorganic Analytical Results

Freeport-McMoRan - Chino Mines Company		ACZ Sample ID:	***L91360-10***
Project ID:	ZN000000J8	Date Sampled:	*10/06/11 17:00*
Sample ID:	STS-CG-2011-40	Date Received:	*10/18/11*
		Sample Matrix:	*Soil*

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010B ICP	608		*	mg/Kg	1	5	11/15/11 13:17	aeb

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Solids, Percent	CLPSOW390, PART F, D-98	94.0		*	%	0.1	0.5	11/22/11 3:07	bsu

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/11/11 17:00	nrc
Digestion - Hot Plate	M3050B ICP							11/14/11 21:06	mss2
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/14/11 13:04	thf

** Please refer to Qualifier Reports for details.*

Inorganic Reference

Report Header Explanations

Batch	A distinct set of samples analyzed at a specific time
Found	Value of the QC Type of interest
Limit	Upper limit for RPD, in %.
Lower	Lower Recovery Limit, in % (except for LCSS, mg/Kg)
MDL	Method Detection Limit. Same as Minimum Reporting Limit. Allows for instrument and annual fluctuations.
PCN/SCN	A number assigned to reagents/standards to trace to the manufacturer's certificate of analysis
PQL	Practical Quantitation Limit, typically 5 times the MDL.
QC	True Value of the Control Sample or the amount added to the Spike
Rec	Amount of the true value or spike added recovered, in % (except for LCSS, mg/Kg)
RPD	Relative Percent Difference, calculation used for Duplicate QC Types
Upper	Upper Recovery Limit, in % (except for LCSS, mg/Kg)
Sample	Value of the Sample of interest

QC Sample Types

AS	Analytical Spike (Post Digestion)	*LCSWD*	Laboratory Control Sample - Water Duplicate
ASD	Analytical Spike (Post Digestion) Duplicate	*LFB*	Laboratory Fortified Blank
CCB	Continuing Calibration Blank	*LFM*	Laboratory Fortified Matrix
CCV	Continuing Calibration Verification standard	*LFMD*	Laboratory Fortified Matrix Duplicate
DUP	Sample Duplicate	*LRB*	Laboratory Reagent Blank
ICB	Initial Calibration Blank	*MS*	Matrix Spike
ICV	Initial Calibration Verification standard	*MSD*	Matrix Spike Duplicate
ICSAB	Inter-element Correction Standard - A plus B solutions	*PBS*	Prep Blank - Soil
LCSS	Laboratory Control Sample - Soil	*PBW*	Prep Blank - Water
LCSSD	Laboratory Control Sample - Soil Duplicate	*PQV*	Practical Quantitation Verification standard
LCSW	Laboratory Control Sample - Water	*SDL*	Serial Dilution

QC Sample Type Explanations

Blanks	Verifies that there is no or minimal contamination in the prep method or calibration procedure.
Control Samples	Verifies the accuracy of the method, including the prep procedure.
Duplicates	Verifies the precision of the instrument and/or method.
Spikes/Fortified Matrix	Determines sample matrix interferences, if any.
Standard	Verifies the validity of the calibration.

ACZ Qualifiers (Qual)

B	Analyte concentration detected at a value between MDL and PQL. The associated value is an estimated quantity.
H	Analysis exceeded method hold time. pH is a field test with an immediate hold time.
L	Target analyte response was below the laboratory defined negative threshold.
U	The material was analyzed for, but was not detected above the level of the associated value. The associated value is either the sample quantitation limit or the sample detection limit.

Method References

(1) EPA 600/4-83-020. Methods for Chemical Analysis of Water and Wastes, March 1983.
(2) EPA 600/R-93-100. Methods for the Determination of Inorganic Substances in Environmental Samples, August 1993.
(3) EPA 600/R-94-111. Methods for the Determination of Metals in Environmental Samples - Supplement I, May 1994.
(4) EPA SW-846. Test Methods for Evaluating Solid Waste, Third Edition with Update III, December 1996.
(5) Standard Methods for the Examination of Water and Wastewater, 19th edition, 1995 & 20th edition (1998).

Comments

(1) QC results calculated from raw data. Results may vary slightly if the rounded values are used in the calculations.
(2) Soil, Sludge, and Plant matrices for Inorganic analyses are reported on a dry weight basis.
(3) Animal matrices for Inorganic analyses are reported on an "as received" basis.
(4) An asterisk in the "XQ" column indicates there is an extended qualifier and/or certification qualifier associated with the result.

For a complete list of ACZ's Extended Qualifiers, please click: http://www.acz.com/public/extquallist.pdf

Freeport-McMoRan - Chino Mines Company
Project ID: ZN000000J8

ACZ Project ID: ***L91360***

Copper, total (3050) M6010B ICP

WG313584

ACZ ID	Type	Analyzed	PCN/SCN	QC	Sample	Found	Units	Rec	Lower	Upper	RPD	Limit	Qual
WG313584ICV	ICV	11/15/11 12:09	II111012-2	2		1.967	mg/L	98.4	90	110			
WG313584ICB	ICB	11/15/11 12:12				U	mg/L		-0.03	0.03			
WG313584PQV	PQV	11/15/11 12:15	II111024-4	.05		.046	mg/L	92	70	130			
WG313584ICSAB	ICSAB	11/15/11 12:18	II110922-1	.255		.247	mg/L	96.9	80	120			
WG313530PBS	PBS	11/15/11 12:25				1.4	mg/Kg		-3	3			
WG313530LCSS	LCSS	11/15/11 12:28	PCN38231	117		117.4	mg/Kg		98	136			
WG313530LCSSD	LCSSD	11/15/11 12:31	PCN38231	117		112.2	mg/Kg		98	136	4.5	20	
L91360-01MS	MS	11/15/11 12:37	II111104-3	50.5	1770	1832.2	mg/Kg	123.2	75	125			
L91360-01MSD	MSD	11/15/11 12:40	II111104-3	50.5	1770	1611.5	mg/Kg	-313.9	75	125	12.82	20	M3
WG313584CCV1	CCV	11/15/11 12:56	II111031-1	1		.979	mg/L	97.9	90	110			
WG313584CCB1	CCB	11/15/11 12:59				U	mg/L		-0.03	0.03			
L91360-05SDL	SDL	11/15/11 13:02			362	377	mg/Kg				4.1	10	
WG313584CCV2	CCV	11/15/11 13:27	II111031-1	1		.975	mg/L	97.5	90	110			
WG313584CCB2	CCB	11/15/11 13:30				U	mg/L		-0.03	0.03			

Solids, Percent CLPSOW390, PART F, D-98

WG314028

ACZ ID	Type	Analyzed	PCN/SCN	QC	Sample	Found	Units	Rec	Lower	Upper	RPD	Limit	Qual
WG314028PBS	PBS	11/21/11 16:00				U	%		99.9	100.1			
L91360-01DUP	DUP	11/21/11 18:01			90.6	90.08	%				0.6	20	

ACZ ID	WORKNUM	PARAMETER	METHOD	QUAL	DESCRIPTION
L91360-01	WG313584	Copper, total (3050)	M6010B ICP	M3	The spike recovery value is unusable since the analyte concentration in the sample is disproportionate to the spike level. The recovery of the associated control sample (LCS or LFB) was acceptable.
L91360-02	WG313584	Copper, total (3050)	M6010B ICP	M3	The spike recovery value is unusable since the analyte concentration in the sample is disproportionate to the spike level. The recovery of the associated control sample (LCS or LFB) was acceptable.
L91360-03	WG313584	Copper, total (3050)	M6010B ICP	M3	The spike recovery value is unusable since the analyte concentration in the sample is disproportionate to the spike level. The recovery of the associated control sample (LCS or LFB) was acceptable.
L91360-04	WG313584	Copper, total (3050)	M6010B ICP	M3	The spike recovery value is unusable since the analyte concentration in the sample is disproportionate to the spike level. The recovery of the associated control sample (LCS or LFB) was acceptable.
L91360-05	WG313584	Copper, total (3050)	M6010B ICP	M3	The spike recovery value is unusable since the analyte concentration in the sample is disproportionate to the spike level. The recovery of the associated control sample (LCS or LFB) was acceptable.
L91360-06	WG313584	Copper, total (3050)	M6010B ICP	M3	The spike recovery value is unusable since the analyte concentration in the sample is disproportionate to the spike level. The recovery of the associated control sample (LCS or LFB) was acceptable.
L91360-07	WG313584	Copper, total (3050)	M6010B ICP	M3	The spike recovery value is unusable since the analyte concentration in the sample is disproportionate to the spike level. The recovery of the associated control sample (LCS or LFB) was acceptable.
L91360-08	WG313584	Copper, total (3050)	M6010B ICP	M3	The spike recovery value is unusable since the analyte concentration in the sample is disproportionate to the spike level. The recovery of the associated control sample (LCS or LFB) was acceptable.
L91360-09	WG313584	Copper, total (3050)	M6010B ICP	M3	The spike recovery value is unusable since the analyte concentration in the sample is disproportionate to the spike level. The recovery of the associated control sample (LCS or LFB) was acceptable.
L91360-10	WG313584	Copper, total (3050)	M6010B ICP	M3	The spike recovery value is unusable since the analyte concentration in the sample is disproportionate to the spike level. The recovery of the associated control sample (LCS or LFB) was acceptable.

Soil Analysis

The following parameters are not offered for certification or are not covered by NELAC certificate #ACZ.	
Solids, Percent	CLPSOW390, PART F, D-98

ACZ Laboratories, Inc.
2773 Downhill Drive Steamboat Springs, CO 80487 (800) 334-5493

Sample Receipt

Freeport-McMoRan - Chino Mines Company
ZN000000J8

ACZ Project ID: L91360
Date Received: 10/18/2011 09:23
Received By: ksj
Date Printed: 10/19/2011

Receipt Verification

	YES	NO	NA
1) Does this project require special handling procedures such as CLP protocol?			X
2) Are the custody seals on the cooler intact?	X		
3) Are the custody seals on the sample containers intact?			X
4) Is there a Chain of Custody or other directive shipping papers present?	X		
5) Is the Chain of Custody complete?	X		
6) Is the Chain of Custody in agreement with the samples received?	X		
7) Is there enough sample for all requested analyses?	X		
8) Are all samples within holding times for requested analyses?	X		
9) Were all sample containers received intact?	X		
10) Are the temperature blanks present?			X
11) Are the trip blanks (VOA and/or Cyanide) present?			X
12) Are samples requiring no headspace, headspace free?			X
13) Do the samples that require a Foreign Soils Permit have one?			X

Exceptions: If you answered no to any of the above questions, please describe

N/A

Contact (For any discrepancies, the client must be contacted)

N/A

Shipping Containers

Cooler Id		Temp (°C)	Rad (µR/hr)
3164		10.4	18
3045		13.6	20
2316		13.3	22

Client must contact ACZ Project Manager if analysis should not proceed for samples received outside of thermal preservation acceptance criteria.

Notes

ACZ Laboratories, Inc.
2773 Downhill Drive Steamboat Springs, CO 80487 (800) 334-5493

Sample Receipt

Freeport-McMoRan - Chino Mines Company
ZN000000J8

ACZ Project ID: L91360
Date Received: 10/18/2011 09:23
Received By: ksj
Date Printed: 10/19/2011

Sample Container Preservation

SAMPLE	CLIENT ID	R < 2	G < 2	BK < 2	Y< 2	YG< 2	B< 2	O < 2	T >12	N/A	RAD	ID
L91360-01	STS-CG-2011-31									X		☐
L91360-02	DUP5									X		☐
L91360-03	STS-CG-2011-33									X		☐
L91360-04	STS-CG-2011-34									X		☐
L91360-05	STS-CG-2011-35									X		☐
L91360-06	STS-CG-2011-36									X		☐
L91360-07	DUP6									X		☐
L91360-08	STS-CG-2011-38									X		☐
L91360-09	STS-CG-2011-39									X		☐
L91360-10	STS-CG-2011-40									X		☐

Sample Container Preservation Legend

Abbreviation	**Description**	**Container Type**	**Preservative/Limits**
R	Raw/Nitric	RED	pH must be < 2
B	Filtered/Sulfuric	BLUE	pH must be < 2
BK	Filtered/Nitric	BLACK	pH must be < 2
G	Filtered/Nitric	GREEN	pH must be < 2
O	Raw/Sulfuric	ORANGE	pH must be < 2
P	Raw/NaOH	PURPLE	pH must be > 12 *
T	Raw/NaOH Zinc Acetate	TAN	pH must be > 12
Y	Raw/Sulfuric	YELLOW	pH must be < 2
YG	Raw/Sulfuric	YELLOW GLASS	pH must be < 2
N/A	No preservative needed	Not applicable	
RAD	Gamma/Beta dose rate	Not applicable	must be < 250 µR/hr

* pH check performed by analyst prior to sample preparation

Sample IDs Reviewed By: ksj

ACZ Laboratories, Inc. L91360 **CHAIN of CUSTODY**

2773 Downhill Drive Steamboat Springs, CO 80487 (800) 334-5493

Report to:

Name: Pam Pinson
Company: Chino Mines Company
E-mail: Pamela_Pinson@FMI.com

Address: P.O. Box 10
Bayard, NM 88023
Telephone: 575-912-5213

Copy of Report to:

Name: Matthew Barkley
Company: ARCADIS

E-mail: Matthew.Barkley@arcadis-us.com
Telephone: 303-231-9115 ext 157

Invoice to:

Name: Pam Pinson
Company: Chino Mines Company
E-mail: Pamela_Pinson@FMI.com

Address: P.O. Box 10
Bayard, NM 88023
Telephone: 575-912-5213

If sample(s) received past holding time (HT), or if insufficient HT remains to complete analysis before expiration, shall ACZ proceed with requested short HT analyses? If "NO" then ACZ will contact client for further instruction. If neither "YES" nor "NO" is indicated, ACZ will proceed with the requested analyses, even if HT is expired, and data will be qualified.
YES ☒
NO ☐

Are samples for CO DW Compliance Monitoring? If yes, please include state forms. Results will be reported to PQL.
YES ☐
NO ☒

PROJECT INFORMATION

Quote #:
Project/PO #:
Reporting state for compliance testing:
Sampler's Name: Carolyn Meyer
Are any samples NRC licensable material? Yes No

SAMPLE IDENTIFICATION	DATE:TIME	Matrix	# of Containers	soil sieved to < 2mm	Total Copper						
STS-CG-2011-31	10.5.11 : 14:05	SO	1	✗	✗						
DUP5	10.5.11 : ---	SO	1	✗	✗						
STS-CG-2011-33	10.8.11 : 13:50	SO	1	✗	✗						
STS-CG-2011-34	10.10.11 : 15:30	SO	1	✗	✗						
STS-CG-2011-35	10.8.11 : 11:40	SO	1	✗	✗						
STS-CG-2011-36	10.10.11 :16:10	SO	1	✗	✗						
DUP6	10.5.11 : ---	SO	1	✗	✗						
STS-CG-2011-38	10.8.11 : 12:50	SO	1	✗	✗						
STS-CG-2011-39	10.9.11 : 08:35	SO	1	✗	✗						
STS-CG-2011-40	10.6.11 : 17:00	SO	1	✗	✗						

Matrix SW (Surface Water) · GW (Ground Water) · WW (Waste Water) · DW (Drinking Water) · SL (Sludge) · SO (Soil) · OL (Oil) · Other (Specify)

REMARKS

Please send to Sheri Fling at URS for validation. Sieve all soil samples to <2 mm prior to analysis. Soil should be reported on a dry weight basis.
Methods:
Copper - 6010B

Please refer to ACZ's terms & conditions located on the reverse side of this COC.

RELINQUISHED BY:	DATE:TIME	RECEIVED BY:	DATE:TIME
	10-14.11 10:30		10/14/11 9:[illegible]

FRMAD050.01.15.09 White - Return with sample. Yellow - Retain for your records.

L91360 Chain of Custody

ACZ Laboratories, Inc.
2773 Downhill Drive   Steamboat Springs, CO 80487   (800) 334-5493

Analytical Report

December 05, 2011

Report to:	Bill to:
Pam Pinson	Pam Pinson
Freeport-McMoRan - Chino Mines Company	Freeport-McMoRan - Chino Mines Company
PO Box 10	P.O. Box 13308
Bayard, NM 88023	Phoenix, AZ 85002-3308

cc: Matthew Barkley, Sheri Fling

Project ID: ZN000000J8
ACZ Project ID: L91526

Pam Pinson:

Enclosed are the analytical results for sample(s) submitted to ACZ Laboratories, Inc. (ACZ) on October 26, 2011. This project has been assigned to ACZ's project number, L91526. Please reference this number in all future inquiries.

All analyses were performed according to ACZ's Quality Assurance Plan. The enclosed results relate only to the samples received under L91526. Each section of this report has been reviewed and approved by the appropriate Laboratory Supervisor, or a qualified substitute.

Except as noted, the test results for the methods and parameters listed on ACZ's current NELAC certificate letter (#ACZ) meet all requirements of NELAC.

This report shall be used or copied only in its entirety. ACZ is not responsible for the consequences arising from the use of a partial report.

All samples and sub-samples associated with this project will be disposed of after January 05, 2012. If the samples are determined to be hazardous, additional charges apply for disposal (typically less than $10/sample). If you would like the samples to be held longer than ACZ's stated policy or to be returned, please contact your Project Manager or Customer Service Representative for further details and associated costs. ACZ retains analytical reports for five years.

If you have any questions or other needs, please contact your Project Manager.

S. Habermehl

Scott Habermehl has reviewed
and approved this report.

Freeport-McMoRan - Chino Mines Company
Project ID: ZN000000J8
Sample ID: STS-PCUG-2011-27

ACZ Sample ID: ***L91526-01***
Date Sampled: *10/20/11 16:05*
Date Received: *10/26/11*
Sample Matrix: *Soil*

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010B ICP	438			mg/Kg	1	5	11/28/11 21:40	jjc

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
pH, Corrosivity	M9045D/M9040C								
pH		6.9			units	0.1	0.1	11/29/11 0:00	mss2
pH measured at		22.7			C	0.1	0.1	11/29/11 0:00	mss2
Solids, Percent	CLPSOW390, PART F, D-98	96.3		*	%	0.1	0.5	11/29/11 13:02	nrc

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/15/11 16:00	ndj
Crush and Pulverize	USDA No. 1, 1972							11/21/11 14:45	mfm/thf
Digestion - Hot Plate	M3050B ICP							11/23/11 10:52	nrc
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/21/11 14:45	mfm/thf

** Please refer to Qualifier Reports for details.*

Inorganic Analytical Results

Freeport-McMoRan - Chino Mines Company		ACZ Sample ID:	***L91526-02***
Project ID:	ZN000000J8	Date Sampled:	*10/19/11 10:50*
Sample ID:	STS-PCUG-2011-31	Date Received:	*10/26/11*
		Sample Matrix:	*Soil*

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010B ICP	304			mg/Kg	1	5	11/28/11 21:49	jjc

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
pH, Corrosivity	M9045D/M9040C								
pH		4.3			units	0.1	0.1	11/29/11 0:00	mss2
pH measured at		22.5			C	0.1	0.1	11/29/11 0:00	mss2
Solids, Percent	CLPSOW390, PART F, D-98	96.7		*	%	0.1	0.5	11/29/11 14:05	nrc

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/15/11 16:01	ndj
Crush and Pulverize	USDA No. 1, 1972							11/21/11 16:01	mfm/thf
Digestion - Hot Plate	M3050B ICP							11/23/11 11:45	nrc
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/21/11 16:01	mfm/thf

** Please refer to Qualifier Reports for details.*

Freeport-McMoRan - Chino Mines Company

Project ID: ZN000000J8

Sample ID: DUP4

ACZ Sample ID: ***L91526-03***

Date Sampled: *10/19/11 00:00*

Date Received: *10/26/11*

Sample Matrix: *Soil*

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010B ICP	261			mg/Kg	1	5	11/28/11 21:52	jjc

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
pH, Corrosivity	M9045D/M9040C								
pH		4.2			units	0.1	0.1	11/29/11 0:00	mss2
pH measured at		22.3			C	0.1	0.1	11/29/11 0:00	mss2
Solids, Percent	CLPSOW390, PART F, D-98	96.7		*	%	0.1	0.5	11/29/11 15:08	nrc

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/15/11 16:03	ndj
Crush and Pulverize	USDA No. 1, 1972							11/21/11 17:18	mfm/thf
Digestion - Hot Plate	M3050B ICP							11/23/11 12:02	nrc
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/21/11 17:18	mfm/thf

** Please refer to Qualifier Reports for details.*

Inorganic Analytical Results

Freeport-McMoRan - Chino Mines Company

Project ID:	ZN000000J8	ACZ Sample ID:	***L91526-04***
Sample ID:	STS-PCUG-2011-5	Date Sampled:	*10/20/11 13:25*
		Date Received:	*10/26/11*
		Sample Matrix:	*Soil*

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010B ICP	458			mg/Kg	1	5	11/28/11 21:55	jjc

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
pH, Corrosivity	M9045D/M9040C								
pH		5.8			units	0.1	0.1	11/29/11 0:00	mss2
pH measured at		22.4			C	0.1	0.1	11/29/11 0:00	mss2
Solids, Percent	CLPSOW390, PART F, D-98	94.8		*	%	0.1	0.5	11/29/11 16:11	nrc

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/15/11 16:04	ndj
Crush and Pulverize	USDA No. 1, 1972							11/21/11 18:34	mfm/thf
Digestion - Hot Plate	M3050B ICP							11/23/11 12:20	nrc
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/21/11 18:34	mfm/thf

** Please refer to Qualifier Reports for details.*

Inorganic Analytical Results

Freeport-McMoRan - Chino Mines Company

Project ID:	ZN000000J8	ACZ Sample ID:	***L91526-05***
Sample ID:	STS-PCUG-2011-6	Date Sampled:	*10/18/11 10:55*
		Date Received:	*10/26/11*
		Sample Matrix:	*Soil*

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010B ICP	290			mg/Kg	1	5	11/28/11 22:07	jjc

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
pH, Corrosivity	M9045D/M9040C								
pH		5.0			units	0.1	0.1	11/29/11 0:00	mss2
pH measured at		22.3			C	0.1	0.1	11/29/11 0:00	mss2
Solids, Percent	CLPSOW390, PART F, D-98	95.4		*	%	0.1	0.5	11/29/11 17:14	nrc

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/15/11 16:06	ndj
Crush and Pulverize	USDA No. 1, 1972							11/21/11 19:51	mfm/thf
Digestion - Hot Plate	M3050B ICP							11/23/11 12:37	nrc
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/21/11 19:51	mfm/thf

** Please refer to Qualifier Reports for details.*

Freeport-McMoRan - Chino Mines Company
Project ID: ZN000000J8
Sample ID: STS-PCUG-2011-8

ACZ Sample ID: ***L91526-06***
Date Sampled: *10/20/11 12:15*
Date Received: *10/26/11*
Sample Matrix: *Soil*

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010B ICP	449			mg/Kg	1	5	11/28/11 22:10	jjc

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
pH, Corrosivity	M9045D/M9040C								
pH		5.8			units	0.1	0.1	11/29/11 0:00	mss2
pH measured at		22.4			C	0.1	0.1	11/29/11 0:00	mss2
Solids, Percent	CLPSOW390, PART F, D-98	96.4		*	%	0.1	0.5	11/29/11 18:17	nrc

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/15/11 16:07	ndj
Crush and Pulverize	USDA No. 1, 1972							11/21/11 21:07	mfm/thf
Digestion - Hot Plate	M3050B ICP							11/23/11 12:55	nrc
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/21/11 21:07	mfm/thf

** Please refer to Qualifier Reports for details.*

Inorganic Analytical Results

Freeport-McMoRan - Chino Mines Company

Project ID:	ZN000000J8
Sample ID:	STS-PCUG-2011-9
ACZ Sample ID:	***L91526-07***
Date Sampled:	*10/18/11 14:05*
Date Received:	*10/26/11*
Sample Matrix:	*Soil*

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010B ICP	246			mg/Kg	1	5	11/28/11 22:13	jjc

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
pH, Corrosivity	M9045D/M9040C								
pH		4.8			units	0.1	0.1	11/29/11 0:00	mss2
pH measured at		22.3			C	0.1	0.1	11/29/11 0:00	mss2
Solids, Percent	CLPSOW390, PART F, D-98	97.9		*	%	0.1	0.5	11/29/11 19:19	nrc

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/15/11 16:09	ndj
Crush and Pulverize	USDA No. 1, 1972							11/21/11 22:24	mfm/thf
Digestion - Hot Plate	M3050B ICP							11/23/11 13:12	nrc
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/21/11 22:24	mfm/thf

** Please refer to Qualifier Reports for details.*

Freeport-McMoRan - Chino Mines Company
Project ID: ZN000000J8
Sample ID: STS-PCUG-2011-15

ACZ Sample ID: ***L91526-08***
Date Sampled: *10/18/11 10:15*
Date Received: *10/26/11*
Sample Matrix: *Soil*

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010B ICP	357			mg/Kg	1	5	11/28/11 22:16	jjc

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
pH, Corrosivity	M9045D/M9040C								
pH		4.3			units	0.1	0.1	11/29/11 0:00	mss2
pH measured at		22.4			C	0.1	0.1	11/29/11 0:00	mss2
Solids, Percent	CLPSOW390, PART F, D-98	95.5		*	%	0.1	0.5	11/29/11 20:22	nrc

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/15/11 16:11	ndj
Crush and Pulverize	USDA No. 1, 1972							11/21/11 23:41	mfm/thf
Digestion - Hot Plate	M3050B ICP							11/23/11 13:30	nrc
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/21/11 23:41	mfm/thf

** Please refer to Qualifier Reports for details.*

Inorganic Analytical Results

Freeport-McMoRan - Chino Mines Company
Project ID: ZN000000J8
Sample ID: STS-PH-2011-FID106

ACZ Sample ID: ***L91526-09***
Date Sampled: *10/18/11 12:05*
Date Received: *10/26/11*
Sample Matrix: *Soil*

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010B ICP	254			mg/Kg	1	5	11/28/11 22:19	jjc

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Acid Generation Potential (calc on Sulfur total)	M600/2-78-054 1.3	1	B		t CaCO3/Kt	1	5	12/05/11 13:30	calc
Acid Neutralization Potential (calc)	M600/2-78-054 1.3	0.0			t CaCO3/Kt	1	5	12/05/11 13:30	calc
Acid-Base Potential (calc on Sulfur total)	M600/2-78-054 1.3	-1			t CaCO3/Kt	1	5	12/05/11 13:30	calc
Neutralization Potential as CaCO3	M600/2-78-054 3.2.3 - Modified (No Heat)		U	*	%	0.1	0.5	11/29/11 7:48	bsu
pH, Corrosivity	M9045D/M9040C								
pH		5.0			units	0.1	0.1	11/29/11 0:00	mss2
pH measured at		22.2			C	0.1	0.1	11/29/11 0:00	mss2
Solids, Percent	CLPSOW390, PART F, D-98	96.4		*	%	0.1	0.5	11/29/11 21:25	nrc
Sulfur Forms	M600/2-78-054 3.2.4-MOD								
Sulfur HCl Residue		0.03	B	*	%	0.01	0.1	11/28/11 0:00	bsu
Sulfur HNO3 Residue		0.03	B	*	%	0.01	0.1	11/28/11 0:00	bsu
Sulfur Organic Residual Mod		0.03	B	*	%	0.01	0.1	11/28/11 0:00	bsu
Sulfur Pyritic Sulfide			U	*	%	0.01	0.1	11/28/11 0:00	bsu
Sulfur Sulfate		0.01	B	*	%	0.01	0.1	11/28/11 0:00	bsu
Sulfur Total		0.04	B	*	%	0.01	0.1	11/28/11 0:00	bsu
Total Sulfur minus Sulfate		0.03	B	*	%	0.01	0.1	11/28/11 0:00	bsu

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/15/11 16:12	ndj
Crush and Pulverize	USDA No. 1, 1972							11/22/11 0:57	mfm/thf
Digestion - Hot Plate	M3050B ICP							11/23/11 13:47	nrc
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/22/11 0:57	mfm/thf
Sieve-250 um (60 mesh)	ASA No.9, 15-4.2.2							11/22/11 0:57	mfm/thf

** Please refer to Qualifier Reports for details.*

Freeport-McMoRan - Chino Mines Company		ACZ Sample ID:	***L91526-10***
Project ID:	ZN000000J8	Date Sampled:	*10/19/11 11:25*
Sample ID:	STS-PCUG-2011-32	Date Received:	*10/26/11*
		Sample Matrix:	*Soil*

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010B ICP	420			mg/Kg	1	5	11/28/11 22:22	jjc

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
pH, Corrosivity	M9045D/M9040C								
pH		3.8			units	0.1	0.1	11/29/11 0:00	mss2
pH measured at		22.3			C	0.1	0.1	11/29/11 0:00	mss2
Solids, Percent	CLPSOW390, PART F, D-98	96.6		*	%	0.1	0.5	11/29/11 22:28	nrc

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/15/11 16:14	ndj
Crush and Pulverize	USDA No. 1, 1972							11/22/11 2:14	mfm/thf
Digestion - Hot Plate	M3050B ICP							11/23/11 14:05	nrc
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/22/11 2:14	mfm/thf

** Please refer to Qualifier Reports for details.*

Inorganic Analytical Results

Freeport-McMoRan - Chino Mines Company

Project ID:	ZN000000J8	ACZ Sample ID:	***L91526-11***
Sample ID:	STS-PCUG-2011-34	Date Sampled:	*10/19/11 12:00*
		Date Received:	*10/26/11*
		Sample Matrix:	*Soil*

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010B ICP	364			mg/Kg	1	5	11/28/11 22:25	jjc

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
pH, Corrosivity	M9045D/M9040C								
pH		4.0			units	0.1	0.1	11/29/11 0:00	mss2
pH measured at		22.0			C	0.1	0.1	11/29/11 0:00	mss2
Solids, Percent	CLPSOW390, PART F, D-98	95.4		*	%	0.1	0.5	11/29/11 23:31	nrc

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/15/11 16:15	ndj
Crush and Pulverize	USDA No. 1, 1972							11/22/11 3:30	mfm/thf
Digestion - Hot Plate	M3050B ICP							11/23/11 14:22	nrc
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/22/11 3:30	mfm/thf

** Please refer to Qualifier Reports for details.*

Freeport-McMoRan - Chino Mines Company
Project ID: ZN000000J8
Sample ID: STS-PCUG-2011-35

ACZ Sample ID: ***L91526-12***
Date Sampled: *10/18/11 13:30*
Date Received: *10/26/11*
Sample Matrix: *Soil*

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010B ICP	287			mg/Kg	1	5	11/28/11 22:28	jjc

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
pH, Corrosivity	M9045D/M9040C								
pH		5.5			units	0.1	0.1	11/29/11 0:00	mss2
pH measured at		22.0			C	0.1	0.1	11/29/11 0:00	mss2
Solids, Percent	CLPSOW390, PART F, D-98	97.4		*	%	0.1	0.5	11/30/11 0:34	nrc

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/15/11 16:17	ndj
Crush and Pulverize	USDA No. 1, 1972							11/22/11 4:47	mfm/thf
Digestion - Hot Plate	M3050B ICP							11/23/11 14:40	nrc
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/22/11 4:47	mfm/thf

** Please refer to Qualifier Reports for details.*

Inorganic Analytical Results

Freeport-McMoRan - Chino Mines Company

Project ID:	ZN000000J8	ACZ Sample ID:	***L91526-13***
Sample ID:	STS-PCUG-2011-36	Date Sampled:	*10/18/11 12:40*
		Date Received:	*10/26/11*
		Sample Matrix:	*Soil*

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010B ICP	270			mg/Kg	1	5	11/28/11 22:31	jjc

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
pH, Corrosivity	M9045D/M9040C								
pH		5.6			units	0.1	0.1	11/29/11 0:00	mss2
pH measured at		21.9			C	0.1	0.1	11/29/11 0:00	mss2
Solids, Percent	CLPSOW390, PART F, D-98	96.5		*	%	0.1	0.5	11/30/11 1:37	nrc

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/15/11 16:19	ndj
Crush and Pulverize	USDA No. 1, 1972							11/22/11 6:04	mfm/thf
Digestion - Hot Plate	M3050B ICP							11/23/11 14:57	nrc
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/22/11 6:04	mfm/thf

** Please refer to Qualifier Reports for details.*

Freeport-McMoRan - Chino Mines Company
Project ID: ZN000000J8
Sample ID: STS-PCUG-2011-37

ACZ Sample ID: ***L91526-14***
Date Sampled: *10/19/11 10:05*
Date Received: *10/26/11*
Sample Matrix: *Soil*

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010B ICP	244			mg/Kg	1	5	11/28/11 22:34	jjc

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
pH, Corrosivity	M9045D/M9040C								
pH		6.9			units	0.1	0.1	11/29/11 0:00	mss2
pH measured at		21.9			C	0.1	0.1	11/29/11 0:00	mss2
Solids, Percent	CLPSOW390, PART F, D-98	95.8		*	%	0.1	0.5	11/30/11 2:39	nrc

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/15/11 16:20	ndj
Crush and Pulverize	USDA No. 1, 1972							11/22/11 7:20	mfm/thf
Digestion - Hot Plate	M3050B ICP							11/23/11 15:15	nrc
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/22/11 7:20	mfm/thf

** Please refer to Qualifier Reports for details.*

Freeport-McMoRan - Chino Mines Company

Project ID: ZN000000J8
Sample ID: DUP10

ACZ Sample ID: ***L91526-15***
Date Sampled: *10/19/11 00:00*
Date Received: *10/26/11*
Sample Matrix: *Soil*

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010B ICP	248			mg/Kg	1	5	11/28/11 22:43	jjc

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Solids, Percent	CLPSOW390, PART F, D-98	95.9		*	%	0.1	0.5	11/30/11 3:42	nrc

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/15/11 16:22	ndj
Crush and Pulverize	USDA No. 1, 1972							11/22/11 8:37	mfm/thf
Digestion - Hot Plate	M3050B ICP							11/23/11 15:32	nrc
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/22/11 8:37	mfm/thf

** Please refer to Qualifier Reports for details.*

Inorganic Analytical Results

Freeport-McMoRan - Chino Mines Company

Project ID: ZN000000J8
Sample ID: STS-CG-2011-44

ACZ Sample ID: ***L91526-16***
Date Sampled: *10/20/11 11:25*
Date Received: *10/26/11*
Sample Matrix: *Soil*

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010B ICP	761			mg/Kg	1	5	11/28/11 22:46	jjc

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Solids, Percent	CLPSOW390, PART F, D-98	94.6		*	%	0.1	0.5	11/30/11 4:45	nrc

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/15/11 16:23	ndj
Crush and Pulverize	USDA No. 1, 1972							11/22/11 9:53	mfm/thf
Digestion - Hot Plate	M3050B ICP							11/23/11 15:50	nrc
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/22/11 9:53	mfm/thf

** Please refer to Qualifier Reports for details.*

Freeport-McMoRan - Chino Mines Company		ACZ Sample ID:	***L91526-17***
Project ID:	ZN000000J8	Date Sampled:	*10/20/11 14:30*
Sample ID:	STS-CG-2011-47	Date Received:	*10/26/11*
		Sample Matrix:	*Soil*

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010B ICP	472			mg/Kg	1	5	11/28/11 22:49	jjc

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Solids, Percent	CLPSOW390, PART F, D-98	94.3		*	%	0.1	0.5	11/30/11 5:48	nrc

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/15/11 16:25	ndj
Crush and Pulverize	USDA No. 1, 1972							11/22/11 11:10	mfm/thf
Digestion - Hot Plate	M3050B ICP							11/23/11 16:07	nrc
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/22/11 11:10	mfm/thf

** Please refer to Qualifier Reports for details.*

Freeport-McMoRan - Chino Mines Company

Project ID:	ZN000000J8
Sample ID:	STS-CG-2011-48
ACZ Sample ID:	***L91526-18***
Date Sampled:	*10/20/11 09:30*
Date Received:	*10/26/11*
Sample Matrix:	*Soil*

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010B ICP	1260			mg/Kg	1	5	11/28/11 22:52	jjc

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Solids, Percent	CLPSOW390, PART F, D-98	95.8		*	%	0.1	0.5	11/30/11 6:51	nrc

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/15/11 16:26	ndj
Crush and Pulverize	USDA No. 1, 1972							11/22/11 12:26	mfm/thf
Digestion - Hot Plate	M3050B ICP							11/23/11 16:25	nrc
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/22/11 12:26	mfm/thf

** Please refer to Qualifier Reports for details.*

Freeport-McMoRan - Chino Mines Company

Project ID:	ZN000000J8	ACZ Sample ID:	***L91526-19***
Sample ID:	STS-CG-2011-16	Date Sampled:	*10/19/11 17:40*
		Date Received:	*10/26/11*
		Sample Matrix:	*Soil*

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010B ICP	949			mg/Kg	1	5	11/28/11 22:55	jjc

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Solids, Percent	CLPSOW390, PART F, D-98	92.6		*	%	0.1	0.5	11/30/11 7:54	nrc

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/15/11 16:28	ndj
Crush and Pulverize	USDA No. 1, 1972							11/22/11 13:43	mfm/thf
Digestion - Hot Plate	M3050B ICP							11/23/11 16:42	nrc
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/22/11 13:43	mfm/thf

** Please refer to Qualifier Reports for details.*

Inorganic Analytical Results

Freeport-McMoRan - Chino Mines Company

Project ID:	ZN000000J8	ACZ Sample ID:	***L91526-20***
Sample ID:	STS-CG-2011-7	Date Sampled:	*10/19/11 15:30*
		Date Received:	*10/26/11*
		Sample Matrix:	*Soil*

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010B ICP	627			mg/Kg	1	5	11/28/11 22:58	jjc

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Solids, Percent	CLPSOW390, PART F, D-98	95.2		*	%	0.1	0.5	11/30/11 8:57	nrc

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/15/11 16:30	ndj
Crush and Pulverize	USDA No. 1, 1972							11/22/11 15:00	mfm/thf
Digestion - Hot Plate	M3050B ICP							11/23/11 17:00	nrc
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/22/11 15:00	mfm/thf

** Please refer to Qualifier Reports for details.*

Inorganic Reference

Report Header Explanations

Batch	A distinct set of samples analyzed at a specific time
Found	Value of the QC Type of interest
Limit	Upper limit for RPD, in %.
Lower	Lower Recovery Limit, in % (except for LCSS, mg/Kg)
MDL	Method Detection Limit. Same as Minimum Reporting Limit. Allows for instrument and annual fluctuations.
PCN/SCN	A number assigned to reagents/standards to trace to the manufacturer's certificate of analysis
PQL	Practical Quantitation Limit, typically 5 times the MDL.
QC	True Value of the Control Sample or the amount added to the Spike
Rec	Amount of the true value or spike added recovered, in % (except for LCSS, mg/Kg)
RPD	Relative Percent Difference, calculation used for Duplicate QC Types
Upper	Upper Recovery Limit, in % (except for LCSS, mg/Kg)
Sample	Value of the Sample of interest

QC Sample Types

AS	Analytical Spike (Post Digestion)	*LCSWD*	Laboratory Control Sample - Water Duplicate
ASD	Analytical Spike (Post Digestion) Duplicate	*LFB*	Laboratory Fortified Blank
CCB	Continuing Calibration Blank	*LFM*	Laboratory Fortified Matrix
CCV	Continuing Calibration Verification standard	*LFMD*	Laboratory Fortified Matrix Duplicate
DUP	Sample Duplicate	*LRB*	Laboratory Reagent Blank
ICB	Initial Calibration Blank	*MS*	Matrix Spike
ICV	Initial Calibration Verification standard	*MSD*	Matrix Spike Duplicate
ICSAB	Inter-element Correction Standard - A plus B solutions	*PBS*	Prep Blank - Soil
LCSS	Laboratory Control Sample - Soil	*PBW*	Prep Blank - Water
LCSSD	Laboratory Control Sample - Soil Duplicate	*PQV*	Practical Quantitation Verification standard
LCSW	Laboratory Control Sample - Water	*SDL*	Serial Dilution

QC Sample Type Explanations

Blanks	Verifies that there is no or minimal contamination in the prep method or calibration procedure.
Control Samples	Verifies the accuracy of the method, including the prep procedure.
Duplicates	Verifies the precision of the instrument and/or method.
Spikes/Fortified Matrix	Determines sample matrix interferences, if any.
Standard	Verifies the validity of the calibration.

ACZ Qualifiers (Qual)

B	Analyte concentration detected at a value between MDL and PQL. The associated value is an estimated quantity.
H	Analysis exceeded method hold time. pH is a field test with an immediate hold time.
L	Target analyte response was below the laboratory defined negative threshold.
U	The material was analyzed for, but was not detected above the level of the associated value. The associated value is either the sample quantitation limit or the sample detection limit.

Method References

(1) EPA 600/4-83-020. Methods for Chemical Analysis of Water and Wastes, March 1983.

(2) EPA 600/R-93-100. Methods for the Determination of Inorganic Substances in Environmental Samples, August 1993.

(3) EPA 600/R-94-111. Methods for the Determination of Metals in Environmental Samples - Supplement I, May 1994.

(4) EPA SW-846. Test Methods for Evaluating Solid Waste, Third Edition with Update III, December 1996.

(5) Standard Methods for the Examination of Water and Wastewater, 19th edition, 1995 & 20th edition (1998).

Comments

(1) QC results calculated from raw data. Results may vary slightly if the rounded values are used in the calculations.

(2) Soil, Sludge, and Plant matrices for Inorganic analyses are reported on a dry weight basis.

(3) Animal matrices for Inorganic analyses are reported on an "as received" basis.

(4) An asterisk in the "XQ" column indicates there is an extended qualifier and/or certification qualifier associated with the result.

For a complete list of ACZ's Extended Qualifiers, please click: http://www.acz.com/public/extquallist.pdf

Freeport-McMoRan - Chino Mines Company ACZ Project ID: ***L91526***
Project ID: ZN000000J8

Copper, total (3050) M6010B ICP

ACZ ID	Type	Analyzed	PCN/SCN	QC	Sample	Found	Units	Rec	Lower	Upper	RPD	Limit	Qual
WG314273													
WG314273ICV	ICV	11/28/11 21:16	II111012-2	2		1.944	mg/L	97.2	90	110			
WG314273ICB	ICB	11/28/11 21:19				U	mg/L		-0.03	0.03			
WG314273PQV	PQV	11/28/11 21:22	II111128-2	.05		.051	mg/L	102	70	130			
WG314273ICSAB	ICSAB	11/28/11 21:25	II110922-1	.255		.261	mg/L	102.4	80	120			
WG314166PBS	PBS	11/28/11 21:31				U	mg/Kg		-3	3			
WG314166LCSS	LCSS	11/28/11 21:34	PCN38811	82.8		89.6	mg/Kg		64.2	101			
WG314166LCSSD	LCSSD	11/28/11 21:37	PCN38811	82.8		84.4	mg/Kg		64.2	101	6	20	
L91526-01MS	MS	11/28/11 21:43	II111115-2	50.5	438	496	mg/Kg	114.9	75	125			
L91526-01MSD	MSD	11/28/11 21:46	II111115-2	50.5	438	484.2	mg/Kg	91.5	75	125	2.41	20	
L91526-04SDL	SDL	11/28/11 21:58			458	498	mg/Kg				8.7	10	
WG314273CCV1	CCV	11/28/11 22:01	II111031-1	1		.991	mg/L	99.1	90	110			
WG314273CCB1	CCB	11/28/11 22:04				U	mg/L		-0.03	0.03			
WG314273CCV2	CCV	11/28/11 22:37	II111031-1	1		.997	mg/L	99.7	90	110			
WG314273CCB2	CCB	11/28/11 22:40				U	mg/L		-0.03	0.03			
WG314273CCV3	CCV	11/28/11 23:01	II111031-1	1		1.018	mg/L	101.8	90	110			
WG314273CCB3	CCB	11/28/11 23:04				.023	mg/L		-0.03	0.03			

Neutralization Potential as CaCO3 M600/2-78-054 3.2.3 - Modified (No Heat)

ACZ ID	Type	Analyzed	PCN/SCN	QC	Sample	Found	Units	Rec	Lower	Upper	RPD	Limit	Qual
WG314242													
WG314242PBS	PBS	11/29/11 4:42				U	%		-0.1	0.1			
WG314242LCSS	LCSS	11/29/11 6:15	PCN33453	100		100.04	%	100	80	120			
L91526-09DUP	DUP	11/29/11 9:21			U	U	%				0	20	RA

Ph M9045D/M9040C

ACZ ID	Type	Analyzed	PCN/SCN	QC	Sample	Found	Units	Rec	Lower	Upper	RPD	Limit	Qual
WG314357													
WG314357ICV	ICV	11/29/11 16:18	PCN37501	4		4.06	units	101.5	97	103			
L91526-01DUP	DUP	11/29/11 16:30			6.9	6.89	units				0.1	20	
WG314357CCV1	CCV	11/29/11 17:24	PCN37501	4		4.04	units	101	97	103			
WG314357CCV2	CCV	11/29/11 18:00	PCN37501	4		4.03	units	100.8	97	103			

Solids, Percent CLPSOW390, PART F, D-98

ACZ ID	Type	Analyzed	PCN/SCN	QC	Sample	Found	Units	Rec	Lower	Upper	RPD	Limit	Qual
WG314188													
WG314188PBS	PBS	11/29/11 12:00				U	%		99.9	100.1			
L91526-20DUP	DUP	11/30/11 9:59			95.2	95.64	%				0.5	20	

Sulfur Organic Residual Mod M600/2-78-054 3.2.4-MOD

ACZ ID	Type	Analyzed	PCN/SCN	QC	Sample	Found	Units	Rec	Lower	Upper	RPD	Limit	Qual
WG314230													
L91526-09DUP	DUP	11/29/11 0:19			.03	.01	%				100	20	RA

Sulfur Pyritic Sulfide M600/2-78-054 3.2.4-MOD

ACZ ID	Type	Analyzed	PCN/SCN	QC	Sample	Found	Units	Rec	Lower	Upper	RPD	Limit	Qual
WG314230													
L91526-09DUP	DUP	11/29/11 0:19			U	.03	%				200	20	RA

Sulfur Sulfate M600/2-78-054 3.2.4-MOD

ACZ ID	Type	Analyzed	PCN/SCN	QC	Sample	Found	Units	Rec	Lower	Upper	RPD	Limit	Qual
WG314230													
L91526-09DUP	DUP	11/29/11 0:19			.01	.01	%				0	20	RA

Sulfur Total M600/2-78-054 3.2.4-MOD

ACZ ID	Type	Analyzed	PCN/SCN	QC	Sample	Found	Units	Rec	Lower	Upper	RPD	Limit	Qual
WG314230													
WG314230PBS	PBS	11/28/11 12:00				U	%		-0.03	0.03			
WG314230LCSS	LCSS	11/28/11 16:06	PCN38175	4.07		3.98	%	97.8					
L91526-09DUP	DUP	11/29/11 0:19			.04	.05	%				22.2	20	RA

Total Sulfur Minus Sulfate M600/2-78-054 3.2.4-MOD

ACZ ID	Type	Analyzed	PCN/SCN	QC	Sample	Found	Units	Rec	Lower	Upper	RPD	Limit	Qual
WG314230													
L91526-09DUP	DUP	11/29/11 0:19			.03	.04	%				28.6	20	RA

ACZ ID	WORKNUM	PARAMETER	METHOD	QUAL	DESCRIPTION
L91526-09	WG314242	Neutralization Potential as CaCO3	M600/2-78-054 3.2.3 - Modified (No Heat)	RA	Relative Percent Difference (RPD) was not used for data validation because the sample concentration is too low for accurate evaluation (< 10x MDL).
	WG314230	Sulfur Organic Residual Mod	M600/2-78-054 3.2.4-MOD	RA	Relative Percent Difference (RPD) was not used for data validation because the sample concentration is too low for accurate evaluation (< 10x MDL).
		Sulfur Pyritic Sulfide	M600/2-78-054 3.2.4-MOD	RA	Relative Percent Difference (RPD) was not used for data validation because the sample concentration is too low for accurate evaluation (< 10x MDL).
		Sulfur Sulfate	M600/2-78-054 3.2.4-MOD	RA	Relative Percent Difference (RPD) was not used for data validation because the sample concentration is too low for accurate evaluation (< 10x MDL).
		Sulfur Total	M600/2-78-054 3.2.4-MOD	RA	Relative Percent Difference (RPD) was not used for data validation because the sample concentration is too low for accurate evaluation (< 10x MDL).
		Total Sulfur minus Sulfate	M600/2-78-054 3.2.4-MOD	RA	Relative Percent Difference (RPD) was not used for data validation because the sample concentration is too low for accurate evaluation (< 10x MDL).

Soil Analysis

The following parameters are not offered for certification or are not covered by NELAC certificate #ACZ.

Neutralization Potential as CaCO3	M600/2-78-054 3.2.3 - Modified (No Heat)
Solids, Percent	CLPSOW390, PART F, D-98
Sulfur HCl Residue	M600/2-78-054 3.2.4-MOD
Sulfur HNO3 Residue	M600/2-78-054 3.2.4-MOD
Sulfur Organic Residual Mod	M600/2-78-054 3.2.4-MOD
Sulfur Pyritic Sulfide	M600/2-78-054 3.2.4-MOD
Sulfur Sulfate	M600/2-78-054 3.2.4-MOD
Sulfur Total	M600/2-78-054 3.2.4-MOD
Total Sulfur minus Sulfate	M600/2-78-054 3.2.4-MOD

ACZ Laboratories, Inc.
2773 Downhill Drive Steamboat Springs, CO 80487 (800) 334-5493

Sample Receipt

Freeport-McMoRan - Chino Mines Company
ZN000000J8

ACZ Project ID: L91526
Date Received: 10/26/2011 09:47
Received By: ksj
Date Printed: 10/27/2011

Receipt Verification

	YES	NO	NA
1) Does this project require special handling procedures such as CLP protocol?			X
2) Are the custody seals on the cooler intact?	X		
3) Are the custody seals on the sample containers intact?			X
4) Is there a Chain of Custody or other directive shipping papers present?	X		
5) Is the Chain of Custody complete?	X		
6) Is the Chain of Custody in agreement with the samples received?	X		
7) Is there enough sample for all requested analyses?	X		
8) Are all samples within holding times for requested analyses?	X		
9) Were all sample containers received intact?	X		
10) Are the temperature blanks present?			X
11) Are the trip blanks (VOA and/or Cyanide) present?			X
12) Are samples requiring no headspace, headspace free?			X
13) Do the samples that require a Foreign Soils Permit have one?			X

Exceptions: If you answered no to any of the above questions, please describe

N/A

Contact (For any discrepancies, the client must be contacted)

N/A

Shipping Containers

Cooler Id		Temp (°C)	Rad (µR/hr)
3139		6.4	20
2638		8.5	23
3325		8.4	19

Client must contact ACZ Project Manager if analysis should not proceed for samples received outside of thermal preservation acceptance criteria.

Notes

ACZ Laboratories, Inc.
2773 Downhill Drive Steamboat Springs, CO 80487 (800) 334-5493

Sample Receipt

Freeport-McMoRan - Chino Mines Company
ZN000000J8

ACZ Project ID: L91526
Date Received: 10/26/2011 09:47
Received By: ksj
Date Printed: 10/27/2011

Sample Container Preservation

SAMPLE	CLIENT ID	R < 2	G < 2	BK < 2	Y< 2	YG< 2	B< 2	O < 2	T >12	N/A	RAD	ID
L91526-01	STS-PCUG-2011-27									X		☐
L91526-02	STS-PCUG-2011-31									X		☐
L91526-03	DUP4									X		☐
L91526-04	STS-PCUG-2011-5									X		☐
L91526-05	STS-PCUG-2011-6									X		☐
L91526-06	STS-PCUG-2011-8									X		☐
L91526-07	STS-PCUG-2011-9									X		☐
L91526-08	STS-PCUG-2011-15									X		☐
L91526-09	STS-PH-2011-FID106									X		☐
L91526-10	STS-PCUG-2011-32									X		☐
L91526-11	STS-PCUG-2011-34									X		☐
L91526-12	STS-PCUG-2011-35									X		☐
L91526-13	STS-PCUG-2011-36									X		☐
L91526-14	STS-PCUG-2011-37									X		☐
L91526-15	DUP10									X		☐
L91526-16	STS-CG-2011-44									X		☐
L91526-17	STS-CG-2011-47									X		☐
L91526-18	STS-CG-2011-48									X		☐
L91526-19	STS-CG-2011-16									X		☐
L91526-20	STS-CG-2011-7									X		☐

Sample Container Preservation Legend

Abbreviation	Description	Container Type	Preservative/Limits
R	Raw/Nitric	RED	pH must be < 2
B	Filtered/Sulfuric	BLUE	pH must be < 2
BK	Filtered/Nitric	BLACK	pH must be < 2
G	Filtered/Nitric	GREEN	pH must be < 2
O	Raw/Sulfuric	ORANGE	pH must be < 2
P	Raw/NaOH	PURPLE	pH must be > 12 *
T	Raw/NaOH Zinc Acetate	TAN	pH must be > 12
Y	Raw/Sulfuric	YELLOW	pH must be < 2
YG	Raw/Sulfuric	YELLOW GLASS	pH must be < 2
N/A	No preservative needed	Not applicable	
RAD	Gamma/Beta dose rate	Not applicable	must be < 250 µR/hr

* pH check performed by analyst prior to sample preparation

Sample IDs Reviewed By: ksj

ACZ Laboratories, Inc. L91526

2773 Downhill Drive Steamboat Springs, CO 80487 (800) 334-5493

CHAIN of CUSTODY

Name: Pam Pinson
Company: Chino Mines Company
E-mail: Pamela_Pinson@FMI.com
Address: P.O. Box 10
Bayard, NM 88023
Telephone: 575-912-5213

Name: Matthew Barkley
Company: ARCADIS
E-mail: Matthew.Barkley@arcadis-us.com
Telephone: 303-231-9115 ext 157

Name: Pam Pinson
Company: Chino Mines Company
E-mail: Pamela_Pinson@FMI.com
Address: P.O. Box 10
Bayard, NM 88023
Telephone: 575-912-5213

If sample(s) received past holding time (HT), or if insufficient HT remains to complete analysis before expiration, shall ACZ proceed with requested short HT analyses? YES ☒ NO ☐
If "NO" then ACZ will contact client for further instruction. If neither "YES" nor "NO" is indicated, ACZ will proceed with the requested analyses, even if HT is expired, and data will be qualified.

Are samples for CO DW Compliance Monitoring? YES ☐
If yes, please include state forms. Results will be reported to PQL. NO ☒

PROJECT INFORMATION

Quote #:
Project/PO #:
Reporting state for compliance testing:
Sampler's Name: Carolyn Meyer
Are any samples NRC licensable material? Yes No

SAMPLE IDENTIFICATION	DATE:TIME	Matrix	# of Containers	soil sieved to < 2mm	pH	Total CU					
STS-PCUG-2011-27	10.20.11 - 16:05'	SO	1	✗	✗	✗					
STS-PCUG-2011-31	10.19.11 - 10:50'	SO	1	✗	✗	✗					
DUP4	10.19.11 - ---'	SO	1	✗	✗	✗					
STS-PCUG-2011-5	10.20.11 - 13:25'	SO	1	✗	✗	✗					
STS-PCUG-2011-6	10.18.11 - 10:55'	SO	1	✗	✗	✗					
STS-PCUG-2011-8	10.20.11 - 12:15'	SO	1	✗	✗	✗					
STS-PCUG-2011-9	10.18.11 - 14:05'	SO	1	✗	✗	✗					
STS-PCUG-2011-15	10.18.11 - 10:15'	SO	1	✗	✗	✗					

Matrix SW (Surface Water) · GW (Ground Water) · WW (Waste Water) · DW (Drinking Water) · SL (Sludge) · SO (Soil) · OL (Oil) · Other (Specify)

REMARKS

Please send to Sheri Fling at URS for validation. Sieve all soil samples to <2 mm prior to analysis. Soil should be reported on a dry weight basis.
Methods:
pH - 9045C and Copper - 6010B

Please refer to ACZ's terms & conditions located on the reverse side of this COC.

RELINQUISHED BY:	DATE:TIME	RECEIVED BY:	DATE:TIME
	10.24.11 1500		
			26.11 9:47

FRMAD050.01.15.09 White - Return with sample. Yellow - Retain for your records.

L91526 Chain of Custody

ACZ Laboratories, Inc. L91526

2773 Downhill Drive Steamboat Springs, CO 80487 (800) 334-5493

CHAIN of CUSTODY

Report to:

Name: Pam Pinson
Company: Chino Mines Company
E-mail: Pamela_Pinson@FMI.com

Address: P.O. Box 10
Bayard, NM 88023
Telephone: 575-912-5213

Copy of Report to:

Name: Matthew Barkley
Company: ARCADIS

E-mail: Matthew.Barkley@arcadis-us.com
Telephone: 303-231-9115 ext 157

Invoice to:

Name: Pam Pinson
Company: Chino Mines Company
E-mail: Pamela_Pinson@FMI.com

Address: P.O. Box 10
Bayard, NM 88023
Telephone: 575-912-5213

If sample(s) received past holding time (HT), or if insufficient HT remains to complete analysis before expiration, shall ACZ proceed with requested short HT analyses? YES ☒ NO ☐
If "NO" then ACZ will contact client for further instruction. If neither "YES" nor "NO" is indicated, ACZ will proceed with the requested analyses, even if HT is expired, and data will be qualified.

Are samples for CO DW Compliance Monitoring? YES ☐ NO ☒
If yes, please include state forms. Results will be reported to PQL.

PROJECT INFORMATION

Quote #:
Project/PO #:
Reporting state for compliance testing:
Sampler's Name: Carolyn Meyer
Are any samples NRC licensable material? Yes No

SAMPLE IDENTIFICATION	DATE:TIME	Matrix	# of Containers	soil sieved to < 2mm	pH	Total CU	ABA				
STS-PH-2011-FID106	10.18.11 - 12:05'	SO	1	✗	✗	✗	✗				
STS-PCUG-2011-32	10.19.11 - 11:25'	SO	1	✗	✗	✗					
STS-PCUG-2011-34	10.19.11 - 12:00'	SO	1	✗	✗	✗					
STS-PCUG-2011-35	10.18.11 - 13:30'	SO	1	✗	✗	✗					
STS-PCUG-2011-36	10.18.11 - 12:40'	SO	1	✗	✗	✗					
STS-PCUG-2011-37	10.19.11 - 10:05'	SO	1	✗	✗	✗					

Matrix SW (Surface Water) · GW (Ground Water) · WW (Waste Water) · DW (Drinking Water) · SL (Sludge) · SO (Soil) · OL (Oil) · Other (Specify)

REMARKS

Please send to Sheri Fling at URS for validation. Sieve all soil samples to <2 mm prior to analysis. Soil should be reported on a dry weight basis.
Methods:
pH - 9045C and Copper - 6010B

Please refer to ACZ's terms & conditions located on the reverse side of this COC.

RELINQUISHED BY	DATE:TIME	RECEIVED BY	DATE:TIME
10.24.11	1500		
		10.26	11 9:47

2

FRMAD050.01.15.09 White - Return with sample. Yellow - Retain for your records.

ACZ Laboratories, Inc. L91526

2773 Downhill Drive Steamboat Springs, CO 80487 (800) 334-5493

CHAIN of CUSTODY

Name: Pam Pinson
Company: Chino Mines Company
E-mail: Pamela_Pinson@FMI.com

Address: P.O. Box 10
Bayard, NM 88023
Telephone: 575-912-5213

Name: Matthew Barkley
Company: ARCADIS

E-mail: Matthew.Barkley@arcadis-us.com
Telephone: 303-231-9115 ext 157

Name: Pam Pinson
Company: Chino Mines Company
E-mail: Pamela_Pinson@FMI.com

Address: P.O. Box 10
Bayard, NM 88023
Telephone: 575-912-5213

If sample(s) received past holding time (HT), or if insufficient HT remains to complete analysis before expiration, shall ACZ proceed with requested short HT analyses? YES ☒ NO ☐
If "NO" then ACZ will contact client for further instruction. If neither "YES" nor "NO" is indicated, ACZ will proceed with the requested analyses, even if HT is expired, and data will be qualified.

Are samples for CO DW Compliance Monitoring? YES ☐ NO ☒
If yes, please include state forms. Results will be reported to PQL.

PROJECT INFORMATION

Quote #:
Project/PO #:
Reporting state for compliance testing:
Sampler's Name: Carolyn Meyer
Are any samples NRC licensable material? Yes No

SAMPLE IDENTIFICATION	DATE:TIME	Matrix	# of Containers	soil sieved to < 2mm	Total Copper						
DUP10	10.19.11 - ---'	SO	1	✗	✗						
STS-CG-2011-44	10.20.11 - 11:25'	SO	1	✗	✗						
STS-CG-2011-47	10.20.11 - 14:30'	SO	1	✗	✗						
STS-CG-2011-48	10.20.11 - 09:30'	SO	1	✗	✗						
STS-CG-2011-16	10.19.11 - 17:40'	SO	1	✗	✗						
STS-CG-2011-7	10.19.11 - 15:30'	SO	1	✗	✗						

Matrix SW (Surface Water) · GW (Ground Water) · WW (Waste Water) · DW (Drinking Water) · SL (Sludge) · SO (Soil) · OL (Oil) · Other (Specify)

REMARKS

Please send to Sheri Fling at URS for validation. Sieve all soil samples to <2 mm prior to analysis. Soil should be reported on a dry weight basis.

Please refer to ACZ's terms & conditions located on the reverse side of this COC.

RELINQUISHED BY	DATE:TIME	RECEIVED BY	DATE:TIME
	10-24-11 1600		
			10-26-11 9:40

3

FRMAD050.01.15.09 White - Return with sample. Yellow - Retain for your records.

ACZ Laboratories, Inc.
2773 Downhill Drive Steamboat Springs, CO 80487 (800) 334-5493

Analytical Report

December 02, 2011

Report to:
Pam Pinson
Freeport-McMoRan - Chino Mines Company
PO Box 10
Bayard, NM 88023

Bill to:
Pam Pinson
Freeport-McMoRan - Chino Mines Company
P.O. Box 13308
Phoenix, AZ 85002-3308

cc: Matthew Barkley, Sheri Fling

Project ID: ZN000000J8
ACZ Project ID: L91527

Pam Pinson:

Enclosed are the analytical results for sample(s) submitted to ACZ Laboratories, Inc. (ACZ) on October 26, 2011. This project has been assigned to ACZ's project number, L91527. Please reference this number in all future inquiries.

All analyses were performed according to ACZ's Quality Assurance Plan. The enclosed results relate only to the samples received under L91527. Each section of this report has been reviewed and approved by the appropriate Laboratory Supervisor, or a qualified substitute.

Except as noted, the test results for the methods and parameters listed on ACZ's current NELAC certificate letter (#ACZ) meet all requirements of NELAC.

This report shall be used or copied only in its entirety. ACZ is not responsible for the consequences arising from the use of a partial report.

All samples and sub-samples associated with this project will be disposed of after January 02, 2012. If the samples are determined to be hazardous, additional charges apply for disposal (typically less than $10/sample). If you would like the samples to be held longer than ACZ's stated policy or to be returned, please contact your Project Manager or Customer Service Representative for further details and associated costs. ACZ retains analytical reports for five years.

If you have any questions or other needs, please contact your Project Manager.

S. Habermehl

Scott Habermehl has reviewed
and approved this report.

ACCREDITED IN ACCORDANCE WITH nelac

ACIL

Freeport-McMoRan - Chino Mines Company		ACZ Sample ID:	***L91527-01***
Project ID:	ZN000000J8	Date Sampled:	*10/20/11 14:50*
Sample ID:	STS-CG-2011-51	Date Received:	*10/26/11*
		Sample Matrix:	*Soil*

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010B ICP	463		*	mg/Kg	1	5	11/28/11 23:44	jjc

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Solids, Percent	CLPSOW390, PART F, D-98	94.5		*	%	0.1	0.5	11/29/11 16:51	nrc

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/15/11 16:00	nrc
Crush and Pulverize	USDA No. 1, 1972							11/22/11 14:00	thf
Digestion - Hot Plate	M3050B ICP							11/23/11 11:52	nrc
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/22/11 14:00	thf

** Please refer to Qualifier Reports for details.*

Inorganic Analytical Results

Freeport-McMoRan - Chino Mines Company

Project ID:	ZN000000J8	ACZ Sample ID:	***L91527-02***
Sample ID:	STS-CG-2011-52	Date Sampled:	*10/20/11 10:00*
		Date Received:	*10/26/11*
		Sample Matrix:	*Soil*

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010B ICP	780		*	mg/Kg	1	5	11/28/11 23:53	jjc

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Solids, Percent	CLPSOW390, PART F, D-98	96.8		*	%	0.1	0.5	11/29/11 17:42	nrc

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/15/11 16:03	nrc
Crush and Pulverize	USDA No. 1, 1972							11/22/11 14:03	thf
Digestion - Hot Plate	M3050B ICP							11/23/11 12:45	nrc
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/22/11 14:03	thf

** Please refer to Qualifier Reports for details.*

Freeport-McMoRan - Chino Mines Company		ACZ Sample ID:	***L91527-03***
Project ID:	ZN000000J8	Date Sampled:	*10/20/11 15:20*
Sample ID:	STS-CG-2011-53	Date Received:	*10/26/11*
		Sample Matrix:	*Soil*

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010B ICP	426		*	mg/Kg	1	5	11/28/11 23:56	jjc

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Solids, Percent	CLPSOW390, PART F, D-98	93.6		*	%	0.1	0.5	11/29/11 18:34	nrc

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/15/11 16:06	nrc
Crush and Pulverize	USDA No. 1, 1972							11/22/11 14:06	thf
Digestion - Hot Plate	M3050B ICP							11/23/11 13:02	nrc
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/22/11 14:06	thf

** Please refer to Qualifier Reports for details.*

Freeport-McMoRan - Chino Mines Company

Project ID:	ZN000000J8	ACZ Sample ID:	***L91527-04***
Sample ID:	STS-CG-2011-54	Date Sampled:	*10/20/11 16:40*
		Date Received:	*10/26/11*
		Sample Matrix:	*Soil*

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010B ICP	1100		*	mg/Kg	1	5	11/28/11 23:59	jjc

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Solids, Percent	CLPSOW390, PART F, D-98	96.9		*	%	0.1	0.5	11/29/11 19:25	nrc

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/15/11 16:09	nrc
Crush and Pulverize	USDA No. 1, 1972							11/22/11 14:09	thf
Digestion - Hot Plate	M3050B ICP							11/23/11 13:20	nrc
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/22/11 14:09	thf

** Please refer to Qualifier Reports for details.*

Inorganic Analytical Results

Freeport-McMoRan - Chino Mines Company

Project ID:	ZN000000J8	ACZ Sample ID:	***L91527-05***
Sample ID:	STS-CG-2011-55	Date Sampled:	*10/20/11 15:40*
		Date Received:	*10/26/11*
		Sample Matrix:	*Soil*

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010B ICP	633		*	mg/Kg	1	5	11/29/11 0:11	jjc

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Solids, Percent	CLPSOW390, PART F, D-98	95.5		*	%	0.1	0.5	11/29/11 20:17	nrc

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/15/11 16:12	nrc
Crush and Pulverize	USDA No. 1, 1972							11/22/11 14:12	thf
Digestion - Hot Plate	M3050B ICP							11/23/11 13:37	nrc
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/22/11 14:12	thf

** Please refer to Qualifier Reports for details.*

Inorganic Analytical Results

Freeport-McMoRan - Chino Mines Company

Project ID:	ZN000000J8	ACZ Sample ID:	***L91527-06***
Sample ID:	STS-CG-2011-56	Date Sampled:	*10/20/11 16:55*
		Date Received:	*10/26/11*
		Sample Matrix:	*Soil*

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010B ICP	177		*	mg/Kg	1	5	11/29/11 0:14	jjc

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Solids, Percent	CLPSOW390, PART F, D-98	97.6		*	%	0.1	0.5	11/29/11 21:08	nrc

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/15/11 16:15	nrc
Crush and Pulverize	USDA No. 1, 1972							11/22/11 14:15	thf
Digestion - Hot Plate	M3050B ICP							11/23/11 13:55	nrc
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/22/11 14:15	thf

** Please refer to Qualifier Reports for details.*

Freeport-McMoRan - Chino Mines Company

Project ID:	ZN000000J8	ACZ Sample ID:	***L91527-07***
Sample ID:	STS-CG-2011-57	Date Sampled:	*10/20/11 17:10*
		Date Received:	*10/26/11*
		Sample Matrix:	*Soil*

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010B ICP	434		*	mg/Kg	1	5	11/29/11 0:17	jjc

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Solids, Percent	CLPSOW390, PART F, D-98	95.7		*	%	0.1	0.5	11/29/11 22:00	nrc

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/15/11 16:18	nrc
Crush and Pulverize	USDA No. 1, 1972							11/22/11 14:18	thf
Digestion - Hot Plate	M3050B ICP							11/23/11 14:12	nrc
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/22/11 14:18	thf

** Please refer to Qualifier Reports for details.*

Freeport-McMoRan - Chino Mines Company

Project ID:	ZN000000J8		ACZ Sample ID:	***L91527-08***
Sample ID:	STS-CG-2011-32		Date Sampled:	*10/20/11 10:30*
			Date Received:	*10/26/11*
			Sample Matrix:	*Soil*

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010B ICP	1500		*	mg/Kg	1	5	11/29/11 0:20	jjc

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Solids, Percent	CLPSOW390, PART F, D-98	95.9		*	%	0.1	0.5	11/29/11 22:51	nrc

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/15/11 16:22	nrc
Crush and Pulverize	USDA No. 1, 1972							11/22/11 14:22	thf
Digestion - Hot Plate	M3050B ICP							11/23/11 14:30	nrc
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/22/11 14:22	thf

** Please refer to Qualifier Reports for details.*

Inorganic Analytical Results

Freeport-McMoRan - Chino Mines Company

Project ID:	ZN000000J8	ACZ Sample ID:	***L91527-09***
Sample ID:	STS-CG-2011-37	Date Sampled:	*10/20/11 11:00*
		Date Received:	*10/26/11*
		Sample Matrix:	*Soil*

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010B ICP	1560		*	mg/Kg	1	5	11/29/11 0:23	jjc

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Solids, Percent	CLPSOW390, PART F, D-98	94.4		*	%	0.1	0.5	11/29/11 23:42	nrc

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/15/11 16:25	nrc
Crush and Pulverize	USDA No. 1, 1972							11/22/11 14:25	thf
Digestion - Hot Plate	M3050B ICP							11/23/11 14:47	nrc
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/22/11 14:25	thf

** Please refer to Qualifier Reports for details.*

Inorganic Analytical Results

Freeport-McMoRan - Chino Mines Company
Project ID: ZN000000J8
Sample ID: STS-CG-2011-41

ACZ Sample ID: ***L91527-10***
Date Sampled: *10/20/11 14:15*
Date Received: *10/26/11*
Sample Matrix: *Soil*

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010B ICP	321		*	mg/Kg	1	5	11/29/11 0:26	jjc

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Solids, Percent	CLPSOW390, PART F, D-98	93.9		*	%	0.1	0.5	11/30/11 0:34	nrc

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/15/11 16:28	nrc
Crush and Pulverize	USDA No. 1, 1972							11/22/11 14:28	thf
Digestion - Hot Plate	M3050B ICP							11/23/11 15:05	nrc
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/22/11 14:28	thf

** Please refer to Qualifier Reports for details.*

Inorganic Analytical Results

Freeport-McMoRan - Chino Mines Company

Project ID:	ZN000000J8	ACZ Sample ID:	***L91527-11***
Sample ID:	STS-CG-2011-1	Date Sampled:	*10/19/11 14:40*
		Date Received:	*10/26/11*
		Sample Matrix:	*Soil*

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010B ICP	274		*	mg/Kg	1	5	11/29/11 0:29	jjc

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Solids, Percent	CLPSOW390, PART F, D-98	95.9		*	%	0.1	0.5	11/30/11 1:25	nrc

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/15/11 16:31	nrc
Crush and Pulverize	USDA No. 1, 1972							11/22/11 14:31	thf
Digestion - Hot Plate	M3050B ICP							11/23/11 15:22	nrc
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/22/11 14:31	thf

** Please refer to Qualifier Reports for details.*

Inorganic Analytical Results

Freeport-McMoRan - Chino Mines Company

Project ID:	ZN000000J8	ACZ Sample ID:	***L91527-12***
Sample ID:	STS-CG-2011-2	Date Sampled:	*10/19/11 14:15*
		Date Received:	*10/26/11*
		Sample Matrix:	*Soil*

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010B ICP	288		*	mg/Kg	1	5	11/29/11 0:32	jjc

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Solids, Percent	CLPSOW390, PART F, D-98	95.9		*	%	0.1	0.5	11/30/11 2:17	nrc

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/15/11 16:34	nrc
Crush and Pulverize	USDA No. 1, 1972							11/22/11 14:34	thf
Digestion - Hot Plate	M3050B ICP							11/23/11 15:40	nrc
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/22/11 14:34	thf

** Please refer to Qualifier Reports for details.*

Freeport-McMoRan - Chino Mines Company

Project ID: ZN000000J8
Sample ID: STS-CG-2011-3

ACZ Sample ID: ***L91527-13***
Date Sampled: *10/19/11 13:20*
Date Received: *10/26/11*
Sample Matrix: *Soil*

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010B ICP	573		*	mg/Kg	1	5	11/29/11 0:35	jjc

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Solids, Percent	CLPSOW390, PART F, D-98	95.6		*	%	0.1	0.5	11/30/11 3:08	nrc

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/15/11 16:37	nrc
Crush and Pulverize	USDA No. 1, 1972							11/22/11 14:37	thf
Digestion - Hot Plate	M3050B ICP							11/23/11 15:57	nrc
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/22/11 14:37	thf

** Please refer to Qualifier Reports for details.*

Inorganic Analytical Results

Freeport-McMoRan - Chino Mines Company

Project ID: ZN000000J8
Sample ID: STS-CG-2011-4

ACZ Sample ID: ***L91527-14***
Date Sampled: *10/19/11 13:35*
Date Received: *10/26/11*
Sample Matrix: *Soil*

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010B ICP	337		*	mg/Kg	1	5	11/29/11 0:38	jjc

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Solids, Percent	CLPSOW390, PART F, D-98	96.1		*	%	0.1	0.5	11/30/11 4:00	nrc

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/15/11 16:40	nrc
Crush and Pulverize	USDA No. 1, 1972							11/22/11 14:40	thf
Digestion - Hot Plate	M3050B ICP							11/23/11 16:15	nrc
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/22/11 14:40	thf

** Please refer to Qualifier Reports for details.*

Freeport-McMoRan - Chino Mines Company

Project ID:	ZN000000J8	ACZ Sample ID:	***L91527-15***
Sample ID:	STS-CG-2011-5	Date Sampled:	*10/19/11 16:05*
		Date Received:	*10/26/11*
		Sample Matrix:	*Soil*

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010B ICP	309		*	mg/Kg	1	5	11/29/11 0:47	jjc

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Solids, Percent	CLPSOW390, PART F, D-98	95.4		*	%	0.1	0.5	11/30/11 4:51	nrc

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/15/11 16:44	nrc
Crush and Pulverize	USDA No. 1, 1972							11/22/11 14:44	thf
Digestion - Hot Plate	M3050B ICP							11/23/11 16:32	nrc
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/22/11 14:44	thf

** Please refer to Qualifier Reports for details.*

Freeport-McMoRan - Chino Mines Company

Project ID:	ZN000000J8
Sample ID:	STS-CG-2011-6
ACZ Sample ID:	***L91527-16***
Date Sampled:	*10/19/11 15:45*
Date Received:	*10/26/11*
Sample Matrix:	*Soil*

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010B ICP	316		*	mg/Kg	1	5	11/29/11 0:50	jjc

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Solids, Percent	CLPSOW390, PART F, D-98	95.7		*	%	0.1	0.5	11/30/11 5:42	nrc

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/15/11 16:47	nrc
Crush and Pulverize	USDA No. 1, 1972							11/22/11 14:47	thf
Digestion - Hot Plate	M3050B ICP							11/23/11 16:50	nrc
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/22/11 14:47	thf

** Please refer to Qualifier Reports for details.*

Freeport-McMoRan - Chino Mines Company

Project ID:	ZN000000J8	ACZ Sample ID:	***L91527-17***
Sample ID:	STS-CG-2011-18	Date Sampled:	*10/20/11 08:30*
		Date Received:	*10/26/11*
		Sample Matrix:	*Soil*

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010B ICP	1640		*	mg/Kg	1	5	11/29/11 0:53	jjc

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Solids, Percent	CLPSOW390, PART F, D-98	93.7		*	%	0.1	0.5	11/30/11 6:34	nrc

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/15/11 16:50	nrc
Crush and Pulverize	USDA No. 1, 1972							11/22/11 14:50	thf
Digestion - Hot Plate	M3050B ICP							11/23/11 17:07	nrc
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/22/11 14:50	thf

** Please refer to Qualifier Reports for details.*

Inorganic Analytical Results

Freeport-McMoRan - Chino Mines Company

Project ID:	ZN000000J8	ACZ Sample ID:	***L91527-18***
Sample ID:	STS-CG-2011-8	Date Sampled:	*10/19/11 15:10*
		Date Received:	*10/26/11*
		Sample Matrix:	*Soil*

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010B ICP	490		*	mg/Kg	1	5	11/29/11 0:56	jjc

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Solids, Percent	CLPSOW390, PART F, D-98	95.5		*	%	0.1	0.5	11/30/11 7:25	nrc

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/15/11 16:53	nrc
Crush and Pulverize	USDA No. 1, 1972							11/22/11 14:53	thf
Digestion - Hot Plate	M3050B ICP							11/23/11 17:25	nrc
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/22/11 14:53	thf

** Please refer to Qualifier Reports for details.*

Freeport-McMoRan - Chino Mines Company

Project ID:	ZN000000J8	ACZ Sample ID:	***L91527-19***
Sample ID:	STS-CG-2011-22	Date Sampled:	*10/20/11 08:05*
		Date Received:	*10/26/11*
		Sample Matrix:	*Soil*

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010B ICP	1560		*	mg/Kg	1	5	11/29/11 0:59	jjc

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Solids, Percent	CLPSOW390, PART F, D-98	94.4		*	%	0.1	0.5	11/30/11 8:17	nrc

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/15/11 16:56	nrc
Crush and Pulverize	USDA No. 1, 1972							11/22/11 14:56	thf
Digestion - Hot Plate	M3050B ICP							11/23/11 17:42	nrc
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/22/11 14:56	thf

** Please refer to Qualifier Reports for details.*

Inorganic Analytical Results

Freeport-McMoRan - Chino Mines Company
Project ID: ZN000000J8
Sample ID: STS-CG-2011-23

ACZ Sample ID: ***L91527-20***
Date Sampled: *10/19/11 18:20*
Date Received: *10/26/11*
Sample Matrix: *Soil*

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Copper, total (3050)	M6010B ICP	2070		*	mg/Kg	1	5	11/29/11 1:02	jjc

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Solids, Percent	CLPSOW390, PART F, D-98	96.3		*	%	0.1	0.5	11/30/11 9:08	nrc

Soil Preparation

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972							11/15/11 16:59	nrc
Crush and Pulverize	USDA No. 1, 1972							11/22/11 14:59	thf
Digestion - Hot Plate	M3050B ICP							11/23/11 18:00	nrc
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2							11/22/11 14:59	thf

** Please refer to Qualifier Reports for details.*

Report Header Explanations

Batch	A distinct set of samples analyzed at a specific time
Found	Value of the QC Type of interest
Limit	Upper limit for RPD, in %.
Lower	Lower Recovery Limit, in % (except for LCSS, mg/Kg)
MDL	Method Detection Limit. Same as Minimum Reporting Limit. Allows for instrument and annual fluctuations.
PCN/SCN	A number assigned to reagents/standards to trace to the manufacturer's certificate of analysis
PQL	Practical Quantitation Limit, typically 5 times the MDL.
QC	True Value of the Control Sample or the amount added to the Spike
Rec	Amount of the true value or spike added recovered, in % (except for LCSS, mg/Kg)
RPD	Relative Percent Difference, calculation used for Duplicate QC Types
Upper	Upper Recovery Limit, in % (except for LCSS, mg/Kg)
Sample	Value of the Sample of interest

QC Sample Types

AS	Analytical Spike (Post Digestion)	*LCSWD*	Laboratory Control Sample - Water Duplicate
ASD	Analytical Spike (Post Digestion) Duplicate	*LFB*	Laboratory Fortified Blank
CCB	Continuing Calibration Blank	*LFM*	Laboratory Fortified Matrix
CCV	Continuing Calibration Verification standard	*LFMD*	Laboratory Fortified Matrix Duplicate
DUP	Sample Duplicate	*LRB*	Laboratory Reagent Blank
ICB	Initial Calibration Blank	*MS*	Matrix Spike
ICV	Initial Calibration Verification standard	*MSD*	Matrix Spike Duplicate
ICSAB	Inter-element Correction Standard - A plus B solutions	*PBS*	Prep Blank - Soil
LCSS	Laboratory Control Sample - Soil	*PBW*	Prep Blank - Water
LCSSD	Laboratory Control Sample - Soil Duplicate	*PQV*	Practical Quantitation Verification standard
LCSW	Laboratory Control Sample - Water	*SDL*	Serial Dilution

QC Sample Type Explanations

Blanks	Verifies that there is no or minimal contamination in the prep method or calibration procedure.
Control Samples	Verifies the accuracy of the method, including the prep procedure.
Duplicates	Verifies the precision of the instrument and/or method.
Spikes/Fortified Matrix	Determines sample matrix interferences, if any.
Standard	Verifies the validity of the calibration.

ACZ Qualifiers (Qual)

B	Analyte concentration detected at a value between MDL and PQL. The associated value is an estimated quantity.
H	Analysis exceeded method hold time. pH is a field test with an immediate hold time.
L	Target analyte response was below the laboratory defined negative threshold.
U	The material was analyzed for, but was not detected above the level of the associated value. The associated value is either the sample quantitation limit or the sample detection limit.

Method References

(1) EPA 600/4-83-020. Methods for Chemical Analysis of Water and Wastes, March 1983.
(2) EPA 600/R-93-100. Methods for the Determination of Inorganic Substances in Environmental Samples, August 1993.
(3) EPA 600/R-94-111. Methods for the Determination of Metals in Environmental Samples - Supplement I, May 1994.
(4) EPA SW-846. Test Methods for Evaluating Solid Waste, Third Edition with Update III, December 1996.
(5) Standard Methods for the Examination of Water and Wastewater, 19th edition, 1995 & 20th edition (1998).

Comments

(1) QC results calculated from raw data. Results may vary slightly if the rounded values are used in the calculations.
(2) Soil, Sludge, and Plant matrices for Inorganic analyses are reported on a dry weight basis.
(3) Animal matrices for Inorganic analyses are reported on an "as received" basis.
(4) An asterisk in the "XQ" column indicates there is an extended qualifier and/or certification qualifier associated with the result.

For a complete list of ACZ's Extended Qualifiers, please click: http://www.acz.com/public/extquallist.pdf

Freeport-McMoRan - Chino Mines Company ACZ Project ID: ***L91527***
Project ID: ZN000000J8

Copper, total (3050) M6010B ICP

ACZ ID	Type	Analyzed	PCN/SCN	QC	Sample	Found	Units	Rec	Lower	Upper	RPD	Limit	Qual
WG314276													
WG314276ICV	ICV	11/28/11 23:19	II111012-2	2		1.947	mg/L	97.4	90	110			
WG314276ICB	ICB	11/28/11 23:22				U	mg/L		-0.03	0.03			
WG314276PQV	PQV	11/28/11 23:25	II111128-2	.05		.043	mg/L	86	70	130			
WG314276ICSAB	ICSAB	11/28/11 23:28	II110922-1	.255		.249	mg/L	97.6	80	120			
WG314176PBS	PBS	11/28/11 23:35				U	mg/Kg		-3	3			
WG314176LCSS	LCSS	11/28/11 23:38	PCN38811	82.8		90.5	mg/Kg		64.2	101			
WG314176LCSSD	LCSSD	11/28/11 23:41	PCN38811	82.8		91.2	mg/Kg		64.2	101	0.8	20	
L91527-01MS	MS	11/28/11 23:47	II111115-2	50.5	463	500.5	mg/Kg	74.3	75	125			M3
L91527-01MSD	MSD	11/28/11 23:50	II111115-2	50.5	463	470.3	mg/Kg	14.5	75	125	6.22	20	M3
L91527-04SDL	SDL	11/29/11 0:02			1100	1155	mg/Kg				5	10	
WG314276CCV1	CCV	11/29/11 0:05	II111031-1	1		.979	mg/L	97.9	90	110			
WG314276CCB1	CCB	11/29/11 0:08				U	mg/L		-0.03	0.03			
WG314276CCV2	CCV	11/29/11 0:41	II111031-1	1		.982	mg/L	98.2	90	110			
WG314276CCB2	CCB	11/29/11 0:44				.013	mg/L		-0.03	0.03			
WG314276CCV3	CCV	11/29/11 1:05	II111031-1	1		1.023	mg/L	102.3	90	110			
WG314276CCB3	CCB	11/29/11 1:08				.027	mg/L		-0.03	0.03			

Solids, Percent CLPSOW390, PART F, D-98

ACZ ID	Type	Analyzed	PCN/SCN	QC	Sample	Found	Units	Rec	Lower	Upper	RPD	Limit	Qual
WG314345													
WG314345PBS	PBS	11/29/11 16:00				U	%		99.9	100.1			
L91527-20DUP	DUP	11/30/11 10:00			96.3	96.29	%				0	20	

Inorganic Extended Qualifier Report

Freeport-McMoRan - Chino Mines Company ACZ Project ID: ***L91527***

ACZ ID	WORKNUM	PARAMETER	METHOD	QUAL	DESCRIPTION
L91527-01	WG314276	Copper, total (3050)	M6010B ICP	M3	The spike recovery value is unusable since the analyte concentration in the sample is disproportionate to the spike level. The recovery of the associated control sample (LCS or LFB) was acceptable.
L91527-02	WG314276	Copper, total (3050)	M6010B ICP	M3	The spike recovery value is unusable since the analyte concentration in the sample is disproportionate to the spike level. The recovery of the associated control sample (LCS or LFB) was acceptable.
L91527-03	WG314276	Copper, total (3050)	M6010B ICP	M3	The spike recovery value is unusable since the analyte concentration in the sample is disproportionate to the spike level. The recovery of the associated control sample (LCS or LFB) was acceptable.
L91527-04	WG314276	Copper, total (3050)	M6010B ICP	M3	The spike recovery value is unusable since the analyte concentration in the sample is disproportionate to the spike level. The recovery of the associated control sample (LCS or LFB) was acceptable.
L91527-05	WG314276	Copper, total (3050)	M6010B ICP	M3	The spike recovery value is unusable since the analyte concentration in the sample is disproportionate to the spike level. The recovery of the associated control sample (LCS or LFB) was acceptable.
L91527-06	WG314276	Copper, total (3050)	M6010B ICP	M3	The spike recovery value is unusable since the analyte concentration in the sample is disproportionate to the spike level. The recovery of the associated control sample (LCS or LFB) was acceptable.
L91527-07	WG314276	Copper, total (3050)	M6010B ICP	M3	The spike recovery value is unusable since the analyte concentration in the sample is disproportionate to the spike level. The recovery of the associated control sample (LCS or LFB) was acceptable.
L91527-08	WG314276	Copper, total (3050)	M6010B ICP	M3	The spike recovery value is unusable since the analyte concentration in the sample is disproportionate to the spike level. The recovery of the associated control sample (LCS or LFB) was acceptable.
L91527-09	WG314276	Copper, total (3050)	M6010B ICP	M3	The spike recovery value is unusable since the analyte concentration in the sample is disproportionate to the spike level. The recovery of the associated control sample (LCS or LFB) was acceptable.
L91527-10	WG314276	Copper, total (3050)	M6010B ICP	M3	The spike recovery value is unusable since the analyte concentration in the sample is disproportionate to the spike level. The recovery of the associated control sample (LCS or LFB) was acceptable.
L91527-11	WG314276	Copper, total (3050)	M6010B ICP	M3	The spike recovery value is unusable since the analyte concentration in the sample is disproportionate to the spike level. The recovery of the associated control sample (LCS or LFB) was acceptable.
L91527-12	WG314276	Copper, total (3050)	M6010B ICP	M3	The spike recovery value is unusable since the analyte concentration in the sample is disproportionate to the spike level. The recovery of the associated control sample (LCS or LFB) was acceptable.
L91527-13	WG314276	Copper, total (3050)	M6010B ICP	M3	The spike recovery value is unusable since the analyte concentration in the sample is disproportionate to the spike level. The recovery of the associated control sample (LCS or LFB) was acceptable.
L91527-14	WG314276	Copper, total (3050)	M6010B ICP	M3	The spike recovery value is unusable since the analyte concentration in the sample is disproportionate to the spike level. The recovery of the associated control sample (LCS or LFB) was acceptable.

ACZ ID	WORKNUM	PARAMETER	METHOD	QUAL	DESCRIPTION
L91527-15	WG314276	Copper, total (3050)	M6010B ICP	M3	The spike recovery value is unusable since the analyte concentration in the sample is disproportionate to the spike level. The recovery of the associated control sample (LCS or LFB) was acceptable.
L91527-16	WG314276	Copper, total (3050)	M6010B ICP	M3	The spike recovery value is unusable since the analyte concentration in the sample is disproportionate to the spike level. The recovery of the associated control sample (LCS or LFB) was acceptable.
L91527-17	WG314276	Copper, total (3050)	M6010B ICP	M3	The spike recovery value is unusable since the analyte concentration in the sample is disproportionate to the spike level. The recovery of the associated control sample (LCS or LFB) was acceptable.
L91527-18	WG314276	Copper, total (3050)	M6010B ICP	M3	The spike recovery value is unusable since the analyte concentration in the sample is disproportionate to the spike level. The recovery of the associated control sample (LCS or LFB) was acceptable.
L91527-19	WG314276	Copper, total (3050)	M6010B ICP	M3	The spike recovery value is unusable since the analyte concentration in the sample is disproportionate to the spike level. The recovery of the associated control sample (LCS or LFB) was acceptable.
L91527-20	WG314276	Copper, total (3050)	M6010B ICP	M3	The spike recovery value is unusable since the analyte concentration in the sample is disproportionate to the spike level. The recovery of the associated control sample (LCS or LFB) was acceptable.

Certification Qualifiers

Freeport-McMoRan - Chino Mines Company

ACZ Project ID: ***L91527***

Soil Analysis

The following parameters are not offered for certification or are not covered by NELAC certificate #ACZ.	
Solids, Percent	CLPSOW390, PART F, D-98

Sample Receipt

Freeport-McMoRan - Chino Mines Company
ZN000000J8

ACZ Project ID: L91527
Date Received: 10/26/2011 09:46
Received By: ksj
Date Printed: 10/27/2011

Receipt Verification

	YES	NO	NA
1) Does this project require special handling procedures such as CLP protocol?			X
2) Are the custody seals on the cooler intact?	X		
3) Are the custody seals on the sample containers intact?			X
4) Is there a Chain of Custody or other directive shipping papers present?	X		
5) Is the Chain of Custody complete?	X		
6) Is the Chain of Custody in agreement with the samples received?	X		
7) Is there enough sample for all requested analyses?	X		
8) Are all samples within holding times for requested analyses?	X		
9) Were all sample containers received intact?	X		
10) Are the temperature blanks present?			X
11) Are the trip blanks (VOA and/or Cyanide) present?			X
12) Are samples requiring no headspace, headspace free?			X
13) Do the samples that require a Foreign Soils Permit have one?			X

Exceptions: If you answered no to any of the above questions, please describe

N/A

Contact (For any discrepancies, the client must be contacted)

N/A

Shipping Containers

Cooler Id		Temp (°C)	Rad (µR/hr)
3139		6.4	20
2638		8.5	23
3325		8.4	19

Client must contact ACZ Project Manager if analysis should not proceed for samples received outside of thermal preservation acceptance criteria.

Notes

Sample Receipt

Freeport-McMoRan - Chino Mines Company
ZN000000J8

ACZ Project ID: L91527
Date Received: 10/26/2011 09:46
Received By: ksj
Date Printed: 10/27/2011

Sample Container Preservation

SAMPLE	CLIENT ID	R < 2	G < 2	BK < 2	Y< 2	YG< 2	B< 2	O < 2	T >12	N/A	RAD	ID
L91527-01	STS-CG-2011-51									X		☐
L91527-02	STS-CG-2011-52									X		☐
L91527-03	STS-CG-2011-53									X		☐
L91527-04	STS-CG-2011-54									X		☐
L91527-05	STS-CG-2011-55									X		☐
L91527-06	STS-CG-2011-56									X		☐
L91527-07	STS-CG-2011-57									X		☐
L91527-08	STS-CG-2011-32									X		☐
L91527-09	STS-CG-2011-37									X		☐
L91527-10	STS-CG-2011-41									X		☐
L91527-11	STS-CG-2011-1									X		☐
L91527-12	STS-CG-2011-2									X		☐
L91527-13	STS-CG-2011-3									X		☐
L91527-14	STS-CG-2011-4									X		☐
L91527-15	STS-CG-2011-5									X		☐
L91527-16	STS-CG-2011-6									X		☐
L91527-17	STS-CG-2011-18									X		☐
L91527-18	STS-CG-2011-8									X		☐
L91527-19	STS-CG-2011-22									X		☐
L91527-20	STS-CG-2011-23									X		☐

Sample Container Preservation Legend

Abbreviation	Description	Container Type	Preservative/Limits
R	Raw/Nitric	RED	pH must be < 2
B	Filtered/Sulfuric	BLUE	pH must be < 2
BK	Filtered/Nitric	BLACK	pH must be < 2
G	Filtered/Nitric	GREEN	pH must be < 2
O	Raw/Sulfuric	ORANGE	pH must be < 2
P	Raw/NaOH	PURPLE	pH must be > 12 *
T	Raw/NaOH Zinc Acetate	TAN	pH must be > 12
Y	Raw/Sulfuric	YELLOW	pH must be < 2
YG	Raw/Sulfuric	YELLOW GLASS	pH must be < 2
N/A	No preservative needed	Not applicable	
RAD	Gamma/Beta dose rate	Not applicable	must be < 250 µR/hr

* pH check performed by analyst prior to sample preparation

Sample IDs Reviewed By: ksj

ACZ Laboratories, Inc. L91527

2773 Downhill Drive Steamboat Springs, CO 80487 (800) 334-5493

CHAIN of CUSTODY

Name: Pam Pinson
Company: Chino Mines Company
E-mail: Pamela_Pinson@FMI.com

Address: P.O. Box 10
Bayard, NM 88023
Telephone: 575-912-5213

Name: Matthew Barkley
Company: ARCADIS

E-mail: Matthew.Barkley@arcadis-us.com
Telephone: 303-231-9115 ext 157

Name: Pam Pinson
Company: Chino Mines Company
E-mail: Pamela_Pinson@FMI.com

Address: P.O. Box 10
Bayard, NM 88023
Telephone: 575-912-5213

If sample(s) received past holding time (HT), or if insufficient HT remains to complete analysis before expiration, shall ACZ proceed with requested short HT analyses? YES ☒ NO ☐
If "NO" then ACZ will contact client for further instruction. If neither "YES" nor "NO" is indicated, ACZ will proceed with the requested analyses, even if HT is expired, and data will be qualified.

Are samples for CO DW Compliance Monitoring? YES ☐
If yes, please include state forms. Results will be reported to PQL. NO ☒

PROJECT INFORMATION

Quote #:
Project/PO #:
Reporting state for compliance testing:
Sampler's Name: Carolyn Meyer
Are any samples NRC licensable material? Yes No

SAMPLE IDENTIFICATION	DATE:TIME	Matrix	# of Containers	soil sieved to < 2mm	Total Copper						
STS-CG-2011-51	10.20.11 - 14:50'	SO	1	x	x						
STS-CG-2011-52	10.20.11 - 10:00'	SO	1	x	x						
STS-CG-2011-53	10.20.11 - 15:20'	SO	1	x	x						
STS-CG-2011-54	10.20.11 - 16:40'	SO	1	x	x						
STS-CG-2011-55	10.20.11 - 15:40'	SO	1	x	x						
STS-CG-2011-56	10.20.11 - 16:55'	SO	1	x	x						
STS-CG-2011-57	10.20.11 - 17:10'	SO	1	x	x						
STS-CG-2011-32	10.20.11 - 10:30'	SO	1	x	x						
STS-CG-2011-37	10.20.11 - 11:00'	SO	1	x	x						
STS-CG-2011-41	10.20.11 - 14:15'	SO	1	x	x						

Matrix SW (Surface Water) · GW (Ground Water) · WW (Waste Water) · DW (Drinking Water) · SL (Sludge) · SO (Soil) · OL (Oil) · Other (Specify)

REMARKS

Please send to Sheri Fling at URS for validation. Sieve all soil samples to <2 mm prior to analysis. Soil should be reported on a dry weight basis.
Methods:
Copper - 6010B

Please refer to ACZ's terms & conditions located on the reverse side of this COC.

RELINQUISHED BY:	DATE:TIME	RECEIVED BY:	DATE:TIME
	10.24.11 1500		
			26/11 9:47

FRMAD050.01.15.09 White - Return with sample. Yellow - Retain for your records.

L91527 Chain of Custody

ACZ Laboratories, Inc. L91527

2773 Downhill Drive Steamboat Springs, CO 80487 (800) 334-5493

CHAIN of CUSTODY

Name: Pam Pinson
Company: Chino Mines Company
E-mail: Pamela_Pinson@FMI.com

Address: P.O. Box 10
Bayard, NM 88023
Telephone: 575-912-5213

Name: Matthew Barkley
Company: ARCADIS

E-mail: Matthew.Barkley@arcadis-us.com
Telephone: 303-231-9115 ext 157

Name: Pam Pinson
Company: Chino Mines Company
E-mail: Pamela_Pinson@FMI.com

Address: P.O. Box 10
Bayard, NM 88023
Telephone: 575-912-5213

If sample(s) received past holding time (HT), or if insufficient HT remains to complete analysis before expiration, shall ACZ proceed with requested short HT analyses? YES ☒ NO ☐
If "NO" then ACZ will contact client for further instruction. If neither "YES" nor "NO" is indicated, ACZ will proceed with the requested analyses, even if HT is expired, and data will be qualified.

Are samples for CO DW Compliance Monitoring? YES ☐ NO ☒
If yes, please include state forms. Results will be reported to PQL.

PROJECT INFORMATION

Quote #:
Project/PO #:
Reporting state for compliance testing:
Sampler's Name: Carolyn Meyer
Are any samples NRC licensable material? Yes No

SAMPLE IDENTIFICATION	DATE:TIME	Matrix	# of Containers	soil sieved to < 2mm	Total Copper						
STS-CG-2011-1	10.19.11 - 14:40'	SO	1	☒	☒						
STS-CG-2011-2	10.19.11 - 14:15'	SO	1	☒	☒						
STS-CG-2011-3	10.19.11 - 13:20'	SO	1	☒	☒						
STS-CG-2011-4	10.19.11 - 13:35'	SO	1	☒	☒						
STS-CG-2011-5	10.19.11 - 16:05'	SO	1	☒	☒						
STS-CG-2011-6	10.19.11 - 15:45'	SO	1	☒	☒						
STS-CG-2011-18	10.20.11 - 08:30'	SO	1	☒	☒						
STS-CG-2011-8	10.19.11 - 15:10'	SO	1	☒	☒						
STS-CG-2011-22	10.20.11 - 08:05'	SO	1	☒	☒						
STS-CG-2011-23	10.19.11 - 18:20'	SO	1	☒	☒						

Matrix SW (Surface Water) · GW (Ground Water) · WW (Waste Water) · DW (Drinking Water) · SL (Sludge) · SO (Soil) · OL (Oil) · Other (Specify)

REMARKS

Please send to Sheri Fling at URS for validation. Sieve all soil samples to <2 mm prior to analysis. Soil should be reported on a dry weight basis.
Methods:
Copper - 6010B

Please refer to ACZ's terms & conditions located on the reverse side of this COC.

RELINQUISHED BY	DATE:TIME	RECEIVED BY	DATE:TIME
	10.24.11 15:00		

2

FRMAD050.01.15.09 White - Return with sample. Yellow - Retain for your records.

ACZ Laboratories, Inc.
2773 Downhill Drive   Steamboat Springs, CO 80487   (800) 334-5493

Analytical Report

December 15, 2011

Report to:	Bill to:
Pam Pinson	Accounts Payable
Freeport-McMoRan - Chino Mines Company	Freeport-McMoRan - Chino Mines Company
PO Box 10	P.O. Box 13308
Bayard, NM 88023	Phoenix, AZ 85002-3308

cc: Matthew Barkley, Sheri Fling

Project ID: ZN000000J8
ACZ Project ID: L92172

Pam Pinson:

Enclosed are the analytical results for sample(s) submitted to ACZ Laboratories, Inc. (ACZ) on December 02, 2011. This project has been assigned to ACZ's project number, L92172. Please reference this number in all future inquiries.

All analyses were performed according to ACZ's Quality Assurance Plan. The enclosed results relate only to the samples received under L92172. Each section of this report has been reviewed and approved by the appropriate Laboratory Supervisor, or a qualified substitute.

Except as noted, the test results for the methods and parameters listed on ACZ's current NELAC certificate letter (#ACZ) meet all requirements of NELAC.

This report shall be used or copied only in its entirety. ACZ is not responsible for the consequences arising from the use of a partial report.

All samples and sub-samples associated with this project will be disposed of after January 15, 2012. If the samples are determined to be hazardous, additional charges apply for disposal (typically less than $10/sample). If you would like the samples to be held longer than ACZ's stated policy or to be returned, please contact your Project Manager or Customer Service Representative for further details and associated costs. ACZ retains analytical reports for five years.

If you have any questions or other needs, please contact your Project Manager.

S. Habermehl

Scott Habermehl has reviewed
and approved this report.

Inorganic Analytical Results

Freeport-McMoRan - Chino Mines Company

Project ID:	ZN000000J8	ACZ Sample ID:	***L92172-01***
Sample ID:	STS-PH-2011-FID37	Date Sampled:	*10/11/11 09:45*
		Date Received:	*12/02/11*
		Sample Matrix:	*Soil*

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Sulfur Forms	M600/2-78-054 3.2.4-MOD								
Sulfur HCl Residue		0.05	B	*	%	0.01	0.1	12/12/11 0:00	bsu/brd
Sulfur HNO3 Residue		0.02	B	*	%	0.01	0.1	12/12/11 0:00	bsu/brd
Sulfur Organic Residual Mod		0.02	B	*	%	0.01	0.1	12/12/11 0:00	bsu/brd
Sulfur Pyritic Sulfide		0.03	B	*	%	0.01	0.1	12/12/11 0:00	bsu/brd
Sulfur Sulfate			U	*	%	0.01	0.1	12/12/11 0:00	bsu/brd
Sulfur Total		0.05	B	*	%	0.01	0.1	12/12/11 0:00	bsu/brd
Total Sulfur minus Sulfate		0.05	B	*	%	0.01	0.1	12/12/11 0:00	bsu/brd

** Please refer to Qualifier Reports for details.*

Freeport-McMoRan - Chino Mines Company

Project ID: ZN000000J8
Sample ID: STS-PH-2011-FID101

ACZ Sample ID: ***L92172-02***
Date Sampled: *10/12/11 16:45*
Date Received: *12/02/11*
Sample Matrix: *Soil*

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Sulfur Forms	M600/2-78-054 3.2.4-MOD								
Sulfur HCl Residue		0.15		*	%	0.01	0.1	12/12/11 0:00	bsu/brd
Sulfur HNO3 Residue		0.02	B	*	%	0.01	0.1	12/12/11 0:00	bsu/brd
Sulfur Organic Residual Mod		0.02	B	*	%	0.01	0.1	12/12/11 0:00	bsu/brd
Sulfur Pyritic Sulfide		0.13		*	%	0.01	0.1	12/12/11 0:00	bsu/brd
Sulfur Sulfate		0.06	B	*	%	0.01	0.1	12/12/11 0:00	bsu/brd
Sulfur Total		0.21		*	%	0.01	0.1	12/12/11 0:00	bsu/brd
Total Sulfur minus Sulfate		0.15		*	%	0.01	0.1	12/12/11 0:00	bsu/brd

** Please refer to Qualifier Reports for details.*

Freeport-McMoRan - Chino Mines Company
Project ID: ZN000000J8
Sample ID: STS-PH-2011-REFPLOT3

ACZ Sample ID: ***L92172-03***
Date Sampled: *10/07/11 11:50*
Date Received: *12/02/11*
Sample Matrix: *Soil*

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Sulfur Forms	M600/2-78-054 3.2.4-MOD								
Sulfur HCl Residue		0.09	B	*	%	0.01	0.1	12/13/11 0:00	bsu/brd
Sulfur HNO3 Residue		0.02	B	*	%	0.01	0.1	12/13/11 0:00	bsu/brd
Sulfur Organic Residual Mod		0.02	B	*	%	0.01	0.1	12/13/11 0:00	bsu/brd
Sulfur Pyritic Sulfide		0.07	B	*	%	0.01	0.1	12/13/11 0:00	bsu/brd
Sulfur Sulfate		0.07	B	*	%	0.01	0.1	12/13/11 0:00	bsu/brd
Sulfur Total		0.16		*	%	0.01	0.1	12/13/11 0:00	bsu/brd
Total Sulfur minus Sulfate		0.09	B	*	%	0.01	0.1	12/13/11 0:00	bsu/brd

** Please refer to Qualifier Reports for details.*

Freeport-McMoRan - Chino Mines Company

Project ID:	ZN000000J8	ACZ Sample ID:	***L92172-04***
Sample ID:	STS-PH-2011-REFPLOT4	Date Sampled:	*10/06/11 10:39*
		Date Received:	*12/02/11*
		Sample Matrix:	*Soil*

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Sulfur Forms	M600/2-78-054 3.2.4-MOD								
Sulfur HCl Residue		0.18		*	%	0.01	0.1	12/13/11 0:00	bsu/brd
Sulfur HNO3 Residue		0.04	B	*	%	0.01	0.1	12/13/11 0:00	bsu/brd
Sulfur Organic Residual Mod		0.04	B	*	%	0.01	0.1	12/13/11 0:00	bsu/brd
Sulfur Pyritic Sulfide		0.14		*	%	0.01	0.1	12/13/11 0:00	bsu/brd
Sulfur Sulfate		0.05	B	*	%	0.01	0.1	12/13/11 0:00	bsu/brd
Sulfur Total		0.23		*	%	0.01	0.1	12/13/11 0:00	bsu/brd
Total Sulfur minus Sulfate		0.18		*	%	0.01	0.1	12/13/11 0:00	bsu/brd

** Please refer to Qualifier Reports for details.*

Inorganic Analytical Results

Freeport-McMoRan - Chino Mines Company
Project ID: ZN000000J8
Sample ID: STS-PH-2011-FID105

ACZ Sample ID: ***L92172-05***
Date Sampled: *10/06/11 13:30*
Date Received: *12/02/11*
Sample Matrix: *Soil*

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Sulfur Forms	M600/2-78-054 3.2.4-MOD								
Sulfur HCl Residue		0.09	B	*	%	0.01	0.1	12/13/11 0:00	bsu/brd
Sulfur HNO3 Residue		0.04	B	*	%	0.01	0.1	12/13/11 0:00	bsu/brd
Sulfur Organic Residual Mod		0.04	B	*	%	0.01	0.1	12/13/11 0:00	bsu/brd
Sulfur Pyritic Sulfide		0.05	B	*	%	0.01	0.1	12/13/11 0:00	bsu/brd
Sulfur Sulfate		0.01	B	*	%	0.01	0.1	12/13/11 0:00	bsu/brd
Sulfur Total		0.10		*	%	0.01	0.1	12/13/11 0:00	bsu/brd
Total Sulfur minus Sulfate		0.09	B	*	%	0.01	0.1	12/13/11 0:00	bsu/brd

** Please refer to Qualifier Reports for details.*

Inorganic Analytical Results

Freeport-McMoRan - Chino Mines Company
Project ID: ZN000000J8
Sample ID: STS-PH-2011-REFPLOT1

ACZ Sample ID: ***L92172-06***
Date Sampled: *10/04/11 11:09*
Date Received: *12/02/11*
Sample Matrix: *Soil*

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Sulfur Forms	M600/2-78-054 3.2.4-MOD								
Sulfur HCl Residue		0.05	B	*	%	0.01	0.1	12/13/11 0:00	bsu/brd
Sulfur HNO3 Residue		0.02	B	*	%	0.01	0.1	12/13/11 0:00	bsu/brd
Sulfur Organic Residual Mod		0.02	B	*	%	0.01	0.1	12/13/11 0:00	bsu/brd
Sulfur Pyritic Sulfide		0.03	B	*	%	0.01	0.1	12/13/11 0:00	bsu/brd
Sulfur Sulfate		0.04	B	*	%	0.01	0.1	12/13/11 0:00	bsu/brd
Sulfur Total		0.09	B	*	%	0.01	0.1	12/13/11 0:00	bsu/brd
Total Sulfur minus Sulfate		0.05	B	*	%	0.01	0.1	12/13/11 0:00	bsu/brd

** Please refer to Qualifier Reports for details.*

Freeport-McMoRan - Chino Mines Company

Project ID:	ZN000000J8	ACZ Sample ID:	***L92172-07***
Sample ID:	STS-PH-2011-REFPLOT2	Date Sampled:	*10/05/11 12:30*
		Date Received:	*12/02/11*
		Sample Matrix:	*Soil*

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Sulfur Forms	M600/2-78-054 3.2.4-MOD								
Sulfur HCl Residue		0.02	B	*	%	0.01	0.1	12/13/11 0:00	bsu/brd
Sulfur HNO3 Residue		0.05	B	*	%	0.01	0.1	12/13/11 0:00	bsu/brd
Sulfur Organic Residual Mod		0.05	B	*	%	0.01	0.1	12/13/11 0:00	bsu/brd
Sulfur Pyritic Sulfide			U	*	%	0.01	0.1	12/13/11 0:00	bsu/brd
Sulfur Sulfate			U	*	%	0.01	0.1	12/13/11 0:00	bsu/brd
Sulfur Total		0.02	B	*	%	0.01	0.1	12/13/11 0:00	bsu/brd
Total Sulfur minus Sulfate		0.02	B	*	%	0.01	0.1	12/13/11 0:00	bsu/brd

** Please refer to Qualifier Reports for details.*

Freeport-McMoRan - Chino Mines Company

Project ID: ZN000000J8
Sample ID: STS-PH-2011-FID22

ACZ Sample ID: ***L92172-08***
Date Sampled: *10/13/11 16:40*
Date Received: *12/02/11*
Sample Matrix: *Soil*

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Sulfur Forms	M600/2-78-054 3.2.4-MOD								
Sulfur HCl Residue		0.23		*	%	0.01	0.1	12/13/11 0:00	bsu/brd
Sulfur HNO3 Residue		0.03	B	*	%	0.01	0.1	12/13/11 0:00	bsu/brd
Sulfur Organic Residual Mod		0.03	B	*	%	0.01	0.1	12/13/11 0:00	bsu/brd
Sulfur Pyritic Sulfide		0.20		*	%	0.01	0.1	12/13/11 0:00	bsu/brd
Sulfur Sulfate		0.05	B	*	%	0.01	0.1	12/13/11 0:00	bsu/brd
Sulfur Total		0.28		*	%	0.01	0.1	12/13/11 0:00	bsu/brd
Total Sulfur minus Sulfate		0.23		*	%	0.01	0.1	12/13/11 0:00	bsu/brd

** Please refer to Qualifier Reports for details.*

Freeport-McMoRan - Chino Mines Company

Project ID:	ZN000000J8	ACZ Sample ID:	***L92172-09***
Sample ID:	STS-PH-2011-FID10	Date Sampled:	*10/07/11 14:35*
		Date Received:	*12/02/11*
		Sample Matrix:	*Soil*

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Sulfur Forms	M600/2-78-054 3.2.4-MOD								
Sulfur HCl Residue		0.09	B	*	%	0.01	0.1	12/13/11 0:00	bsu/brd
Sulfur HNO3 Residue		0.02	B	*	%	0.01	0.1	12/13/11 0:00	bsu/brd
Sulfur Organic Residual Mod		0.02	B	*	%	0.01	0.1	12/13/11 0:00	bsu/brd
Sulfur Pyritic Sulfide		0.07	B	*	%	0.01	0.1	12/13/11 0:00	bsu/brd
Sulfur Sulfate		0.02	B	*	%	0.01	0.1	12/13/11 0:00	bsu/brd
Sulfur Total		0.11		*	%	0.01	0.1	12/13/11 0:00	bsu/brd
Total Sulfur minus Sulfate		0.09	B	*	%	0.01	0.1	12/13/11 0:00	bsu/brd

** Please refer to Qualifier Reports for details.*

Inorganic Analytical Results

Freeport-McMoRan - Chino Mines Company

Project ID:	ZN000000J8	ACZ Sample ID:	***L92172-10***
Sample ID:	STS-PH-2011-FID15	Date Sampled:	*10/10/11 11:50*
		Date Received:	*12/02/11*
		Sample Matrix:	*Soil*

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Sulfur Forms	M600/2-78-054 3.2.4-MOD								
Sulfur HCl Residue		0.19		*	%	0.01	0.1	12/13/11 0:00	bsu/brd
Sulfur HNO3 Residue		0.02	B	*	%	0.01	0.1	12/13/11 0:00	bsu/brd
Sulfur Organic Residual Mod		0.02	B	*	%	0.01	0.1	12/13/11 0:00	bsu/brd
Sulfur Pyritic Sulfide		0.17		*	%	0.01	0.1	12/13/11 0:00	bsu/brd
Sulfur Sulfate		0.02	B	*	%	0.01	0.1	12/13/11 0:00	bsu/brd
Sulfur Total		0.21		*	%	0.01	0.1	12/13/11 0:00	bsu/brd
Total Sulfur minus Sulfate		0.19		*	%	0.01	0.1	12/13/11 0:00	bsu/brd

** Please refer to Qualifier Reports for details.*

Freeport-McMoRan - Chino Mines Company

Project ID:	ZN000000J8	ACZ Sample ID:	***L92172-11***
Sample ID:	STS-PH-2011-FID16	Date Sampled:	*10/10/11 12:30*
		Date Received:	*12/02/11*
		Sample Matrix:	*Soil*

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Sulfur Forms	M600/2-78-054 3.2.4-MOD								
Sulfur HCl Residue		0.13		*	%	0.01	0.1	12/13/11 0:00	bsu/brd
Sulfur HNO3 Residue		0.14		*	%	0.01	0.1	12/13/11 0:00	bsu/brd
Sulfur Organic Residual Mod		0.14		*	%	0.01	0.1	12/13/11 0:00	bsu/brd
Sulfur Pyritic Sulfide			U	*	%	0.01	0.1	12/13/11 0:00	bsu/brd
Sulfur Sulfate		0.13		*	%	0.01	0.1	12/13/11 0:00	bsu/brd
Sulfur Total		0.26		*	%	0.01	0.1	12/13/11 0:00	bsu/brd
Total Sulfur minus Sulfate		0.13		*	%	0.01	0.1	12/13/11 0:00	bsu/brd

** Please refer to Qualifier Reports for details.*

Freeport-McMoRan - Chino Mines Company		ACZ Sample ID:	***L92172-12***
Project ID:	ZN000000J8	Date Sampled:	*10/11/11 17:35*
Sample ID:	STS-PH-2011-FID17	Date Received:	*12/02/11*
		Sample Matrix:	*Soil*

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Sulfur Forms	M600/2-78-054 3.2.4-MOD								
Sulfur HCl Residue		0.43		*	%	0.01	0.1	12/14/11 0:00	bsu/brd
Sulfur HNO3 Residue		0.05	B	*	%	0.01	0.1	12/14/11 0:00	bsu/brd
Sulfur Organic Residual Mod		0.05	B	*	%	0.01	0.1	12/14/11 0:00	bsu/brd
Sulfur Pyritic Sulfide		0.38		*	%	0.01	0.1	12/14/11 0:00	bsu/brd
Sulfur Sulfate		0.05	B	*	%	0.01	0.1	12/14/11 0:00	bsu/brd
Sulfur Total		0.48		*	%	0.01	0.1	12/14/11 0:00	bsu/brd
Total Sulfur minus Sulfate		0.43		*	%	0.01	0.1	12/14/11 0:00	bsu/brd

** Please refer to Qualifier Reports for details.*

Freeport-McMoRan - Chino Mines Company

Project ID:	ZN000000J8	ACZ Sample ID:	***L92172-13***
Sample ID:	STS-PH-2011-FID18	Date Sampled:	*10/12/11 15:55*
		Date Received:	*12/02/11*
		Sample Matrix:	*Soil*

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Sulfur Forms	M600/2-78-054 3.2.4-MOD								
Sulfur HCl Residue		0.13		*	%	0.01	0.1	12/14/11 0:00	bsu/brd
Sulfur HNO3 Residue		0.02	B	*	%	0.01	0.1	12/14/11 0:00	bsu/brd
Sulfur Organic Residual Mod		0.02	B	*	%	0.01	0.1	12/14/11 0:00	bsu/brd
Sulfur Pyritic Sulfide		0.11		*	%	0.01	0.1	12/14/11 0:00	bsu/brd
Sulfur Sulfate		0.03	B	*	%	0.01	0.1	12/14/11 0:00	bsu/brd
Sulfur Total		0.16		*	%	0.01	0.1	12/14/11 0:00	bsu/brd
Total Sulfur minus Sulfate		0.13		*	%	0.01	0.1	12/14/11 0:00	bsu/brd

** Please refer to Qualifier Reports for details.*

Freeport-McMoRan - Chino Mines Company

Project ID:	ZN000000J8	ACZ Sample ID:	***L92172-14***
Sample ID:	STS-PH-2011-FID106	Date Sampled:	*10/18/11 12:05*
		Date Received:	*12/02/11*
		Sample Matrix:	*Soil*

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Sulfur Forms	M600/2-78-054 3.2.4-MOD								
Sulfur HCl Residue		0.04	B	*	%	0.01	0.1	12/14/11 0:00	bsu/brd
Sulfur HNO3 Residue		0.02	B	*	%	0.01	0.1	12/14/11 0:00	bsu/brd
Sulfur Organic Residual Mod		0.02	B	*	%	0.01	0.1	12/14/11 0:00	bsu/brd
Sulfur Pyritic Sulfide		0.02	B	*	%	0.01	0.1	12/14/11 0:00	bsu/brd
Sulfur Sulfate		0.01	B	*	%	0.01	0.1	12/14/11 0:00	bsu/brd
Sulfur Total		0.05	B	*	%	0.01	0.1	12/14/11 0:00	bsu/brd
Total Sulfur minus Sulfate		0.04	B	*	%	0.01	0.1	12/14/11 0:00	bsu/brd

** Please refer to Qualifier Reports for details.*

Freeport-McMoRan - Chino Mines Company

Project ID:	ZN000000J8	ACZ Sample ID:	***L92172-15***
Sample ID:	STS-PH-2011-FID102	Date Sampled:	*10/19/11 09:15*
		Date Received:	*12/02/11*
		Sample Matrix:	*Soil*

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Sulfur Forms	M600/2-78-054 3.2.4-MOD								
Sulfur HCl Residue		0.56		*	%	0.01	0.1	12/14/11 0:00	bsu/brd
Sulfur HNO3 Residue		0.06	B	*	%	0.01	0.1	12/14/11 0:00	bsu/brd
Sulfur Organic Residual Mod		0.06	B	*	%	0.01	0.1	12/14/11 0:00	bsu/brd
Sulfur Pyritic Sulfide		0.50		*	%	0.01	0.1	12/14/11 0:00	bsu/brd
Sulfur Sulfate		0.36		*	%	0.01	0.1	12/14/11 0:00	bsu/brd
Sulfur Total		0.92		*	%	0.01	0.1	12/14/11 0:00	bsu/brd
Total Sulfur minus Sulfate		0.56		*	%	0.01	0.1	12/14/11 0:00	bsu/brd

** Please refer to Qualifier Reports for details.*

Freeport-McMoRan - Chino Mines Company
Project ID: ZN000000J8
Sample ID: STS-PH-2011-FID7

ACZ Sample ID: ***L92172-16***
Date Sampled: *10/18/11 11:45*
Date Received: *12/02/11*
Sample Matrix: *Soil*

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Sulfur Forms	M600/2-78-054 3.2.4-MOD								
Sulfur HCl Residue		0.06	B	*	%	0.01	0.1	12/14/11 0:00	bsu/brd
Sulfur HNO3 Residue		0.03	B	*	%	0.01	0.1	12/14/11 0:00	bsu/brd
Sulfur Organic Residual Mod		0.03	B	*	%	0.01	0.1	12/14/11 0:00	bsu/brd
Sulfur Pyritic Sulfide		0.03	B	*	%	0.01	0.1	12/14/11 0:00	bsu/brd
Sulfur Sulfate		0.01	B	*	%	0.01	0.1	12/14/11 0:00	bsu/brd
Sulfur Total		0.07	B	*	%	0.01	0.1	12/14/11 0:00	bsu/brd
Total Sulfur minus Sulfate		0.06	B	*	%	0.01	0.1	12/14/11 0:00	bsu/brd

** Please refer to Qualifier Reports for details.*

Freeport-McMoRan - Chino Mines Company

Project ID: ZN000000J8
Sample ID: STS-PH-2011-FID8

ACZ Sample ID: ***L92172-17***
Date Sampled: *10/19/11 17:00*
Date Received: *12/02/11*
Sample Matrix: *Soil*

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Sulfur Forms	M600/2-78-054 3.2.4-MOD								
Sulfur HCl Residue		0.32		*	%	0.01	0.1	12/14/11 0:00	bsu/brd
Sulfur HNO3 Residue		0.06	B	*	%	0.01	0.1	12/14/11 0:00	bsu/brd
Sulfur Organic Residual Mod		0.06	B	*	%	0.01	0.1	12/14/11 0:00	bsu/brd
Sulfur Pyritic Sulfide		0.26		*	%	0.01	0.1	12/14/11 0:00	bsu/brd
Sulfur Sulfate		0.27		*	%	0.01	0.1	12/14/11 0:00	bsu/brd
Sulfur Total		0.59		*	%	0.01	0.1	12/14/11 0:00	bsu/brd
Total Sulfur minus Sulfate		0.32		*	%	0.01	0.1	12/14/11 0:00	bsu/brd

** Please refer to Qualifier Reports for details.*

Inorganic Analytical Results

Freeport-McMoRan - Chino Mines Company

Project ID:	ZN000000J8	ACZ Sample ID:	***L92172-18***
Sample ID:	STS-PH-2011-FID28	Date Sampled:	*10/18/11 15:35*
		Date Received:	*12/02/11*
		Sample Matrix:	*Soil*

Soil Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Sulfur Forms	M600/2-78-054 3.2.4-MOD								
Sulfur HCl Residue		0.12		*	%	0.01	0.1	12/14/11 0:00	bsu/brd
Sulfur HNO3 Residue		0.04	B	*	%	0.01	0.1	12/14/11 0:00	bsu/brd
Sulfur Organic Residual Mod		0.04	B	*	%	0.01	0.1	12/14/11 0:00	bsu/brd
Sulfur Pyritic Sulfide		0.08	B	*	%	0.01	0.1	12/14/11 0:00	bsu/brd
Sulfur Sulfate		0.07	B	*	%	0.01	0.1	12/14/11 0:00	bsu/brd
Sulfur Total		0.19		*	%	0.01	0.1	12/14/11 0:00	bsu/brd
Total Sulfur minus Sulfate		0.12		*	%	0.01	0.1	12/14/11 0:00	bsu/brd

** Please refer to Qualifier Reports for details.*

Report Header Explanations

Batch	A distinct set of samples analyzed at a specific time
Found	Value of the QC Type of interest
Limit	Upper limit for RPD, in %.
Lower	Lower Recovery Limit, in % (except for LCSS, mg/Kg)
MDL	Method Detection Limit. Same as Minimum Reporting Limit. Allows for instrument and annual fluctuations.
PCN/SCN	A number assigned to reagents/standards to trace to the manufacturer's certificate of analysis
PQL	Practical Quantitation Limit, typically 5 times the MDL.
QC	True Value of the Control Sample or the amount added to the Spike
Rec	Amount of the true value or spike added recovered, in % (except for LCSS, mg/Kg)
RPD	Relative Percent Difference, calculation used for Duplicate QC Types
Upper	Upper Recovery Limit, in % (except for LCSS, mg/Kg)
Sample	Value of the Sample of interest

QC Sample Types

AS	Analytical Spike (Post Digestion)	*LCSWD*	Laboratory Control Sample - Water Duplicate
ASD	Analytical Spike (Post Digestion) Duplicate	*LFB*	Laboratory Fortified Blank
CCB	Continuing Calibration Blank	*LFM*	Laboratory Fortified Matrix
CCV	Continuing Calibration Verification standard	*LFMD*	Laboratory Fortified Matrix Duplicate
DUP	Sample Duplicate	*LRB*	Laboratory Reagent Blank
ICB	Initial Calibration Blank	*MS*	Matrix Spike
ICV	Initial Calibration Verification standard	*MSD*	Matrix Spike Duplicate
ICSAB	Inter-element Correction Standard - A plus B solutions	*PBS*	Prep Blank - Soil
LCSS	Laboratory Control Sample - Soil	*PBW*	Prep Blank - Water
LCSSD	Laboratory Control Sample - Soil Duplicate	*PQV*	Practical Quantitation Verification standard
LCSW	Laboratory Control Sample - Water	*SDL*	Serial Dilution

QC Sample Type Explanations

Blanks	Verifies that there is no or minimal contamination in the prep method or calibration procedure.
Control Samples	Verifies the accuracy of the method, including the prep procedure.
Duplicates	Verifies the precision of the instrument and/or method.
Spikes/Fortified Matrix	Determines sample matrix interferences, if any.
Standard	Verifies the validity of the calibration.

ACZ Qualifiers (Qual)

B	Analyte concentration detected at a value between MDL and PQL. The associated value is an estimated quantity.
H	Analysis exceeded method hold time. pH is a field test with an immediate hold time.
L	Target analyte response was below the laboratory defined negative threshold.
U	The material was analyzed for, but was not detected above the level of the associated value. The associated value is either the sample quantitation limit or the sample detection limit.

Method References

(1) EPA 600/4-83-020. Methods for Chemical Analysis of Water and Wastes, March 1983.
(2) EPA 600/R-93-100. Methods for the Determination of Inorganic Substances in Environmental Samples, August 1993.
(3) EPA 600/R-94-111. Methods for the Determination of Metals in Environmental Samples - Supplement I, May 1994.
(4) EPA SW-846. Test Methods for Evaluating Solid Waste, Third Edition with Update III, December 1996.
(5) Standard Methods for the Examination of Water and Wastewater, 19th edition, 1995 & 20th edition (1998).

Comments

(1) QC results calculated from raw data. Results may vary slightly if the rounded values are used in the calculations.
(2) Soil, Sludge, and Plant matrices for Inorganic analyses are reported on a dry weight basis.
(3) Animal matrices for Inorganic analyses are reported on an "as received" basis.
(4) An asterisk in the "XQ" column indicates there is an extended qualifier and/or certification qualifier associated with the result.

For a complete list of ACZ's Extended Qualifiers, please click: http://www.acz.com/public/extquallist.pdf

Freeport-McMoRan - Chino Mines Company
Project ID: ZN000000J8

ACZ Project ID: ***L92172***

Sulfur Organic Residual Mod M600/2-78-054 3.2.4-MOD

ACZ ID	Type	Analyzed	PCN/SCN	QC	Sample	Found	Units	Rec	Lower	Upper	RPD	Limit	Qual
WG315136													
L92172-01DUP	DUP	12/12/11 19:20			.02	.03	%				40	20	RA

Sulfur Pyritic Sulfide M600/2-78-054 3.2.4-MOD

ACZ ID	Type	Analyzed	PCN/SCN	QC	Sample	Found	Units	Rec	Lower	Upper	RPD	Limit	Qual
WG315136													
L92172-01DUP	DUP	12/12/11 19:20			.03	.04	%				28.6	20	RA

Sulfur Sulfate M600/2-78-054 3.2.4-MOD

ACZ ID	Type	Analyzed	PCN/SCN	QC	Sample	Found	Units	Rec	Lower	Upper	RPD	Limit	Qual
WG315136													
L92172-01DUP	DUP	12/12/11 19:20			U	U	%				0	20	RA

Sulfur Total M600/2-78-054 3.2.4-MOD

ACZ ID	Type	Analyzed	PCN/SCN	QC	Sample	Found	Units	Rec	Lower	Upper	RPD	Limit	Qual
WG315136													
WG315136PBS	PBS	12/12/11 10:45				U	%		-0.03	0.03			
WG315136LCSS	LCSS	12/12/11 13:36	PCN38175	4.07		3.93	%	96.6					
L92172-01DUP	DUP	12/12/11 19:20			.05	.05	%				0	20	RA

Total Sulfur Minus Sulfate M600/2-78-054 3.2.4-MOD

ACZ ID	Type	Analyzed	PCN/SCN	QC	Sample	Found	Units	Rec	Lower	Upper	RPD	Limit	Qual
WG315136													
L92172-01DUP	DUP	12/12/11 19:20			.05	.05	%				0	20	RA

ACZ ID	WORKNUM	PARAMETER	METHOD	QUAL	DESCRIPTION
L92172-01	WG315136	Sulfur Organic Residual Mod	M600/2-78-054 3.2.4-MOD	RA	Relative Percent Difference (RPD) was not used for data validation because the sample concentration is too low for accurate evaluation (< 10x MDL).
		Sulfur Pyritic Sulfide	M600/2-78-054 3.2.4-MOD	RA	Relative Percent Difference (RPD) was not used for data validation because the sample concentration is too low for accurate evaluation (< 10x MDL).
		Sulfur Sulfate	M600/2-78-054 3.2.4-MOD	RA	Relative Percent Difference (RPD) was not used for data validation because the sample concentration is too low for accurate evaluation (< 10x MDL).
		Sulfur Total	M600/2-78-054 3.2.4-MOD	RA	Relative Percent Difference (RPD) was not used for data validation because the sample concentration is too low for accurate evaluation (< 10x MDL).
		Total Sulfur minus Sulfate	M600/2-78-054 3.2.4-MOD	RA	Relative Percent Difference (RPD) was not used for data validation because the sample concentration is too low for accurate evaluation (< 10x MDL).
L92172-02	WG315136	Sulfur Organic Residual Mod	M600/2-78-054 3.2.4-MOD	RA	Relative Percent Difference (RPD) was not used for data validation because the sample concentration is too low for accurate evaluation (< 10x MDL).
		Sulfur Pyritic Sulfide	M600/2-78-054 3.2.4-MOD	RA	Relative Percent Difference (RPD) was not used for data validation because the sample concentration is too low for accurate evaluation (< 10x MDL).
		Sulfur Sulfate	M600/2-78-054 3.2.4-MOD	RA	Relative Percent Difference (RPD) was not used for data validation because the sample concentration is too low for accurate evaluation (< 10x MDL).
		Sulfur Total	M600/2-78-054 3.2.4-MOD	RA	Relative Percent Difference (RPD) was not used for data validation because the sample concentration is too low for accurate evaluation (< 10x MDL).
		Total Sulfur minus Sulfate	M600/2-78-054 3.2.4-MOD	RA	Relative Percent Difference (RPD) was not used for data validation because the sample concentration is too low for accurate evaluation (< 10x MDL).
L92172-03	WG315136	Sulfur Organic Residual Mod	M600/2-78-054 3.2.4-MOD	RA	Relative Percent Difference (RPD) was not used for data validation because the sample concentration is too low for accurate evaluation (< 10x MDL).
		Sulfur Pyritic Sulfide	M600/2-78-054 3.2.4-MOD	RA	Relative Percent Difference (RPD) was not used for data validation because the sample concentration is too low for accurate evaluation (< 10x MDL).
		Sulfur Sulfate	M600/2-78-054 3.2.4-MOD	RA	Relative Percent Difference (RPD) was not used for data validation because the sample concentration is too low for accurate evaluation (< 10x MDL).
		Sulfur Total	M600/2-78-054 3.2.4-MOD	RA	Relative Percent Difference (RPD) was not used for data validation because the sample concentration is too low for accurate evaluation (< 10x MDL).
		Total Sulfur minus Sulfate	M600/2-78-054 3.2.4-MOD	RA	Relative Percent Difference (RPD) was not used for data validation because the sample concentration is too low for accurate evaluation (< 10x MDL).
L92172-04	WG315136	Sulfur Organic Residual Mod	M600/2-78-054 3.2.4-MOD	RA	Relative Percent Difference (RPD) was not used for data validation because the sample concentration is too low for accurate evaluation (< 10x MDL).
		Sulfur Pyritic Sulfide	M600/2-78-054 3.2.4-MOD	RA	Relative Percent Difference (RPD) was not used for data validation because the sample concentration is too low for accurate evaluation (< 10x MDL).
		Sulfur Sulfate	M600/2-78-054 3.2.4-MOD	RA	Relative Percent Difference (RPD) was not used for data validation because the sample concentration is too low for accurate evaluation (< 10x MDL).
		Sulfur Total	M600/2-78-054 3.2.4-MOD	RA	Relative Percent Difference (RPD) was not used for data validation because the sample concentration is too low for accurate evaluation (< 10x MDL).
		Total Sulfur minus Sulfate	M600/2-78-054 3.2.4-MOD	RA	Relative Percent Difference (RPD) was not used for data validation because the sample concentration is too low for accurate evaluation (< 10x MDL).

ACZ ID	WORKNUM	PARAMETER	METHOD	QUAL	DESCRIPTION
L92172-05	WG315136	Sulfur Organic Residual Mod	M600/2-78-054 3.2.4-MOD	RA	Relative Percent Difference (RPD) was not used for data validation because the sample concentration is too low for accurate evaluation (< 10x MDL).
		Sulfur Pyritic Sulfide	M600/2-78-054 3.2.4-MOD	RA	Relative Percent Difference (RPD) was not used for data validation because the sample concentration is too low for accurate evaluation (< 10x MDL).
		Sulfur Sulfate	M600/2-78-054 3.2.4-MOD	RA	Relative Percent Difference (RPD) was not used for data validation because the sample concentration is too low for accurate evaluation (< 10x MDL).
		Sulfur Total	M600/2-78-054 3.2.4-MOD	RA	Relative Percent Difference (RPD) was not used for data validation because the sample concentration is too low for accurate evaluation (< 10x MDL).
		Total Sulfur minus Sulfate	M600/2-78-054 3.2.4-MOD	RA	Relative Percent Difference (RPD) was not used for data validation because the sample concentration is too low for accurate evaluation (< 10x MDL).
L92172-06	WG315136	Sulfur Organic Residual Mod	M600/2-78-054 3.2.4-MOD	RA	Relative Percent Difference (RPD) was not used for data validation because the sample concentration is too low for accurate evaluation (< 10x MDL).
		Sulfur Pyritic Sulfide	M600/2-78-054 3.2.4-MOD	RA	Relative Percent Difference (RPD) was not used for data validation because the sample concentration is too low for accurate evaluation (< 10x MDL).
		Sulfur Sulfate	M600/2-78-054 3.2.4-MOD	RA	Relative Percent Difference (RPD) was not used for data validation because the sample concentration is too low for accurate evaluation (< 10x MDL).
		Sulfur Total	M600/2-78-054 3.2.4-MOD	RA	Relative Percent Difference (RPD) was not used for data validation because the sample concentration is too low for accurate evaluation (< 10x MDL).
		Total Sulfur minus Sulfate	M600/2-78-054 3.2.4-MOD	RA	Relative Percent Difference (RPD) was not used for data validation because the sample concentration is too low for accurate evaluation (< 10x MDL).
L92172-07	WG315136	Sulfur Organic Residual Mod	M600/2-78-054 3.2.4-MOD	RA	Relative Percent Difference (RPD) was not used for data validation because the sample concentration is too low for accurate evaluation (< 10x MDL).
		Sulfur Pyritic Sulfide	M600/2-78-054 3.2.4-MOD	RA	Relative Percent Difference (RPD) was not used for data validation because the sample concentration is too low for accurate evaluation (< 10x MDL).
		Sulfur Sulfate	M600/2-78-054 3.2.4-MOD	RA	Relative Percent Difference (RPD) was not used for data validation because the sample concentration is too low for accurate evaluation (< 10x MDL).
		Sulfur Total	M600/2-78-054 3.2.4-MOD	RA	Relative Percent Difference (RPD) was not used for data validation because the sample concentration is too low for accurate evaluation (< 10x MDL).
		Total Sulfur minus Sulfate	M600/2-78-054 3.2.4-MOD	RA	Relative Percent Difference (RPD) was not used for data validation because the sample concentration is too low for accurate evaluation (< 10x MDL).
L92172-08	WG315136	Sulfur Organic Residual Mod	M600/2-78-054 3.2.4-MOD	RA	Relative Percent Difference (RPD) was not used for data validation because the sample concentration is too low for accurate evaluation (< 10x MDL).
		Sulfur Pyritic Sulfide	M600/2-78-054 3.2.4-MOD	RA	Relative Percent Difference (RPD) was not used for data validation because the sample concentration is too low for accurate evaluation (< 10x MDL).
		Sulfur Sulfate	M600/2-78-054 3.2.4-MOD	RA	Relative Percent Difference (RPD) was not used for data validation because the sample concentration is too low for accurate evaluation (< 10x MDL).
		Sulfur Total	M600/2-78-054 3.2.4-MOD	RA	Relative Percent Difference (RPD) was not used for data validation because the sample concentration is too low for accurate evaluation (< 10x MDL).
		Total Sulfur minus Sulfate	M600/2-78-054 3.2.4-MOD	RA	Relative Percent Difference (RPD) was not used for data validation because the sample concentration is too low for accurate evaluation (< 10x MDL).

ACZ ID	WORKNUM	PARAMETER	METHOD	QUAL	DESCRIPTION
L92172-09	WG315136	Sulfur Organic Residual Mod	M600/2-78-054 3.2.4-MOD	RA	Relative Percent Difference (RPD) was not used for data validation because the sample concentration is too low for accurate evaluation (< 10x MDL).
		Sulfur Pyritic Sulfide	M600/2-78-054 3.2.4-MOD	RA	Relative Percent Difference (RPD) was not used for data validation because the sample concentration is too low for accurate evaluation (< 10x MDL).
		Sulfur Sulfate	M600/2-78-054 3.2.4-MOD	RA	Relative Percent Difference (RPD) was not used for data validation because the sample concentration is too low for accurate evaluation (< 10x MDL).
		Sulfur Total	M600/2-78-054 3.2.4-MOD	RA	Relative Percent Difference (RPD) was not used for data validation because the sample concentration is too low for accurate evaluation (< 10x MDL).
		Total Sulfur minus Sulfate	M600/2-78-054 3.2.4-MOD	RA	Relative Percent Difference (RPD) was not used for data validation because the sample concentration is too low for accurate evaluation (< 10x MDL).
L92172-10	WG315136	Sulfur Organic Residual Mod	M600/2-78-054 3.2.4-MOD	RA	Relative Percent Difference (RPD) was not used for data validation because the sample concentration is too low for accurate evaluation (< 10x MDL).
		Sulfur Pyritic Sulfide	M600/2-78-054 3.2.4-MOD	RA	Relative Percent Difference (RPD) was not used for data validation because the sample concentration is too low for accurate evaluation (< 10x MDL).
		Sulfur Sulfate	M600/2-78-054 3.2.4-MOD	RA	Relative Percent Difference (RPD) was not used for data validation because the sample concentration is too low for accurate evaluation (< 10x MDL).
		Sulfur Total	M600/2-78-054 3.2.4-MOD	RA	Relative Percent Difference (RPD) was not used for data validation because the sample concentration is too low for accurate evaluation (< 10x MDL).
		Total Sulfur minus Sulfate	M600/2-78-054 3.2.4-MOD	RA	Relative Percent Difference (RPD) was not used for data validation because the sample concentration is too low for accurate evaluation (< 10x MDL).
L92172-11	WG315136	Sulfur Organic Residual Mod	M600/2-78-054 3.2.4-MOD	RA	Relative Percent Difference (RPD) was not used for data validation because the sample concentration is too low for accurate evaluation (< 10x MDL).
		Sulfur Pyritic Sulfide	M600/2-78-054 3.2.4-MOD	RA	Relative Percent Difference (RPD) was not used for data validation because the sample concentration is too low for accurate evaluation (< 10x MDL).
		Sulfur Sulfate	M600/2-78-054 3.2.4-MOD	RA	Relative Percent Difference (RPD) was not used for data validation because the sample concentration is too low for accurate evaluation (< 10x MDL).
		Sulfur Total	M600/2-78-054 3.2.4-MOD	RA	Relative Percent Difference (RPD) was not used for data validation because the sample concentration is too low for accurate evaluation (< 10x MDL).
		Total Sulfur minus Sulfate	M600/2-78-054 3.2.4-MOD	RA	Relative Percent Difference (RPD) was not used for data validation because the sample concentration is too low for accurate evaluation (< 10x MDL).
L92172-12	WG315136	Sulfur Organic Residual Mod	M600/2-78-054 3.2.4-MOD	RA	Relative Percent Difference (RPD) was not used for data validation because the sample concentration is too low for accurate evaluation (< 10x MDL).
		Sulfur Pyritic Sulfide	M600/2-78-054 3.2.4-MOD	RA	Relative Percent Difference (RPD) was not used for data validation because the sample concentration is too low for accurate evaluation (< 10x MDL).
		Sulfur Sulfate	M600/2-78-054 3.2.4-MOD	RA	Relative Percent Difference (RPD) was not used for data validation because the sample concentration is too low for accurate evaluation (< 10x MDL).
		Sulfur Total	M600/2-78-054 3.2.4-MOD	RA	Relative Percent Difference (RPD) was not used for data validation because the sample concentration is too low for accurate evaluation (< 10x MDL).
		Total Sulfur minus Sulfate	M600/2-78-054 3.2.4-MOD	RA	Relative Percent Difference (RPD) was not used for data validation because the sample concentration is too low for accurate evaluation (< 10x MDL).

ACZ ID	WORKNUM	PARAMETER	METHOD	QUAL	DESCRIPTION
L92172-13	WG315136	Sulfur Organic Residual Mod	M600/2-78-054 3.2.4-MOD	RA	Relative Percent Difference (RPD) was not used for data validation because the sample concentration is too low for accurate evaluation (< 10x MDL).
		Sulfur Pyritic Sulfide	M600/2-78-054 3.2.4-MOD	RA	Relative Percent Difference (RPD) was not used for data validation because the sample concentration is too low for accurate evaluation (< 10x MDL).
		Sulfur Sulfate	M600/2-78-054 3.2.4-MOD	RA	Relative Percent Difference (RPD) was not used for data validation because the sample concentration is too low for accurate evaluation (< 10x MDL).
		Sulfur Total	M600/2-78-054 3.2.4-MOD	RA	Relative Percent Difference (RPD) was not used for data validation because the sample concentration is too low for accurate evaluation (< 10x MDL).
		Total Sulfur minus Sulfate	M600/2-78-054 3.2.4-MOD	RA	Relative Percent Difference (RPD) was not used for data validation because the sample concentration is too low for accurate evaluation (< 10x MDL).
L92172-14	WG315136	Sulfur Organic Residual Mod	M600/2-78-054 3.2.4-MOD	RA	Relative Percent Difference (RPD) was not used for data validation because the sample concentration is too low for accurate evaluation (< 10x MDL).
		Sulfur Pyritic Sulfide	M600/2-78-054 3.2.4-MOD	RA	Relative Percent Difference (RPD) was not used for data validation because the sample concentration is too low for accurate evaluation (< 10x MDL).
		Sulfur Sulfate	M600/2-78-054 3.2.4-MOD	RA	Relative Percent Difference (RPD) was not used for data validation because the sample concentration is too low for accurate evaluation (< 10x MDL).
		Sulfur Total	M600/2-78-054 3.2.4-MOD	RA	Relative Percent Difference (RPD) was not used for data validation because the sample concentration is too low for accurate evaluation (< 10x MDL).
		Total Sulfur minus Sulfate	M600/2-78-054 3.2.4-MOD	RA	Relative Percent Difference (RPD) was not used for data validation because the sample concentration is too low for accurate evaluation (< 10x MDL).
L92172-15	WG315136	Sulfur Organic Residual Mod	M600/2-78-054 3.2.4-MOD	RA	Relative Percent Difference (RPD) was not used for data validation because the sample concentration is too low for accurate evaluation (< 10x MDL).
		Sulfur Pyritic Sulfide	M600/2-78-054 3.2.4-MOD	RA	Relative Percent Difference (RPD) was not used for data validation because the sample concentration is too low for accurate evaluation (< 10x MDL).
		Sulfur Sulfate	M600/2-78-054 3.2.4-MOD	RA	Relative Percent Difference (RPD) was not used for data validation because the sample concentration is too low for accurate evaluation (< 10x MDL).
		Sulfur Total	M600/2-78-054 3.2.4-MOD	RA	Relative Percent Difference (RPD) was not used for data validation because the sample concentration is too low for accurate evaluation (< 10x MDL).
		Total Sulfur minus Sulfate	M600/2-78-054 3.2.4-MOD	RA	Relative Percent Difference (RPD) was not used for data validation because the sample concentration is too low for accurate evaluation (< 10x MDL).
L92172-16	WG315136	Sulfur Organic Residual Mod	M600/2-78-054 3.2.4-MOD	RA	Relative Percent Difference (RPD) was not used for data validation because the sample concentration is too low for accurate evaluation (< 10x MDL).
		Sulfur Pyritic Sulfide	M600/2-78-054 3.2.4-MOD	RA	Relative Percent Difference (RPD) was not used for data validation because the sample concentration is too low for accurate evaluation (< 10x MDL).
		Sulfur Sulfate	M600/2-78-054 3.2.4-MOD	RA	Relative Percent Difference (RPD) was not used for data validation because the sample concentration is too low for accurate evaluation (< 10x MDL).
		Sulfur Total	M600/2-78-054 3.2.4-MOD	RA	Relative Percent Difference (RPD) was not used for data validation because the sample concentration is too low for accurate evaluation (< 10x MDL).
		Total Sulfur minus Sulfate	M600/2-78-054 3.2.4-MOD	RA	Relative Percent Difference (RPD) was not used for data validation because the sample concentration is too low for accurate evaluation (< 10x MDL).

Inorganic Extended Qualifier Report

Freeport-McMoRan - Chino Mines Company

ACZ Project ID: ***L92172***

ACZ ID	WORKNUM	PARAMETER	METHOD	QUAL	DESCRIPTION
L92172-17	WG315136	Sulfur Organic Residual Mod	M600/2-78-054 3.2.4-MOD	RA	Relative Percent Difference (RPD) was not used for data validation because the sample concentration is too low for accurate evaluation (< 10x MDL).
		Sulfur Pyritic Sulfide	M600/2-78-054 3.2.4-MOD	RA	Relative Percent Difference (RPD) was not used for data validation because the sample concentration is too low for accurate evaluation (< 10x MDL).
		Sulfur Sulfate	M600/2-78-054 3.2.4-MOD	RA	Relative Percent Difference (RPD) was not used for data validation because the sample concentration is too low for accurate evaluation (< 10x MDL).
		Sulfur Total	M600/2-78-054 3.2.4-MOD	RA	Relative Percent Difference (RPD) was not used for data validation because the sample concentration is too low for accurate evaluation (< 10x MDL).
		Total Sulfur minus Sulfate	M600/2-78-054 3.2.4-MOD	RA	Relative Percent Difference (RPD) was not used for data validation because the sample concentration is too low for accurate evaluation (< 10x MDL).
L92172-18	WG315136	Sulfur Organic Residual Mod	M600/2-78-054 3.2.4-MOD	RA	Relative Percent Difference (RPD) was not used for data validation because the sample concentration is too low for accurate evaluation (< 10x MDL).
		Sulfur Pyritic Sulfide	M600/2-78-054 3.2.4-MOD	RA	Relative Percent Difference (RPD) was not used for data validation because the sample concentration is too low for accurate evaluation (< 10x MDL).
		Sulfur Sulfate	M600/2-78-054 3.2.4-MOD	RA	Relative Percent Difference (RPD) was not used for data validation because the sample concentration is too low for accurate evaluation (< 10x MDL).
		Sulfur Total	M600/2-78-054 3.2.4-MOD	RA	Relative Percent Difference (RPD) was not used for data validation because the sample concentration is too low for accurate evaluation (< 10x MDL).
		Total Sulfur minus Sulfate	M600/2-78-054 3.2.4-MOD	RA	Relative Percent Difference (RPD) was not used for data validation because the sample concentration is too low for accurate evaluation (< 10x MDL).

Soil Analysis

The following parameters are not offered for certification or are not covered by NELAC certificate #ACZ.

Sulfur HCl Residue	M600/2-78-054 3.2.4-MOD
Sulfur HNO3 Residue	M600/2-78-054 3.2.4-MOD
Sulfur Organic Residual Mod	M600/2-78-054 3.2.4-MOD
Sulfur Pyritic Sulfide	M600/2-78-054 3.2.4-MOD
Sulfur Sulfate	M600/2-78-054 3.2.4-MOD
Sulfur Total	M600/2-78-054 3.2.4-MOD
Total Sulfur minus Sulfate	M600/2-78-054 3.2.4-MOD

ACZ Laboratories, Inc.
2773 Downhill Drive Steamboat Springs, CO 80487 (800) 334-5493

Sample Receipt

Freeport-McMoRan - Chino Mines Company
ZN000000J8

ACZ Project ID: L91358
Date Received: 10/18/2011 09:23
Received By: ksj
Date Printed: 10/19/2011

Receipt Verification

	YES	NO	NA
1) Does this project require special handling procedures such as CLP protocol?			X
2) Are the custody seals on the cooler intact?	X		
3) Are the custody seals on the sample containers intact?			X
4) Is there a Chain of Custody or other directive shipping papers present?	X		
5) Is the Chain of Custody complete?	X		
6) Is the Chain of Custody in agreement with the samples received?	X		
7) Is there enough sample for all requested analyses?	X		
8) Are all samples within holding times for requested analyses?	X		
9) Were all sample containers received intact?	X		
10) Are the temperature blanks present?			X
11) Are the trip blanks (VOA and/or Cyanide) present?			X
12) Are samples requiring no headspace, headspace free?			X
13) Do the samples that require a Foreign Soils Permit have one?			X

Exceptions: If you answered no to any of the above questions, please describe

N/A

Contact (For any discrepancies, the client must be contacted)

N/A

Shipping Containers

Cooler Id		Temp (°C)	Rad (µR/hr)
3282		9.2	18
3164		10.4	18
3045		13.6	20

Client must contact ACZ Project Manager if analysis should not proceed for samples received outside of thermal preservation acceptance criteria.

Notes

Sample Receipt

Freeport-McMoRan - Chino Mines Company
ZN000000J8

ACZ Project ID: L91358
Date Received: 10/18/2011 09:23
Received By: ksj
Date Printed: 10/19/2011

Sample Container Preservation

SAMPLE	CLIENT ID	R < 2	G < 2	BK < 2	Y< 2	YG< 2	B< 2	O < 2	T >12	N/A	RAD	ID
L91358-01	STS-PH-2011-FID37									X		☐
L91358-02	STS-PCUG-2011-40									X		☐
L91358-03	STS-PH-2011-FID101									X		☐
L91358-04	STS-PH-2011-REFPLOT3									X		☐
L91358-05	STS-PH-2011-REFPLOT4									X		☐
L91358-06	DUP11									X		☐
L91358-07	STS-PH-2011-FID105									X		☐
L91358-08	DUP12									X		☐
L91358-09	STS-PH-2011-REFPLOT1									X		☐
L91358-10	STS-PH-2011-REFPLOT2									X		☐
L91358-11	STS-PH-2011-FID22									X		☐
L91358-12	STS-PH-2011-FID10									X		☐
L91358-13	STS-PH-2011-FID15									X		☐
L91358-14	STS-PH-2011-FID16									X		☐
L91358-15	STS-PH-2011-FID17									X		☐
L91358-16	STS-PH-2011-FID18									X		☐

Sample Container Preservation Legend

Abbreviation	**Description**	**Container Type**	**Preservative/Limits**
R	Raw/Nitric	RED	pH must be < 2
B	Filtered/Sulfuric	BLUE	pH must be < 2
BK	Filtered/Nitric	BLACK	pH must be < 2
G	Filtered/Nitric	GREEN	pH must be < 2
O	Raw/Sulfuric	ORANGE	pH must be < 2
P	Raw/NaOH	PURPLE	pH must be > 12 *
T	Raw/NaOH Zinc Acetate	TAN	pH must be > 12
Y	Raw/Sulfuric	YELLOW	pH must be < 2
YG	Raw/Sulfuric	YELLOW GLASS	pH must be < 2
N/A	No preservative needed	Not applicable	
RAD	Gamma/Beta dose rate	Not applicable	must be < 250 µR/hr

* pH check performed by analyst prior to sample preparation

Sample IDs Reviewed By: ksj

L92172-Reloq.

ACZ Laboratories, Inc. ~~L91358~~
2773 Downhill Drive Steamboat Springs, CO 80487 (800) 334-5493
LSO 12.2.11

Name: Pam Pinson	Address: P.O. Box 10
Company: Chino Mines Company	Bayard, NM 88023
E-mail: Pamela_Pinson@FMI.com	Telephone: 575-912-5213

Name: Matthew Barkley	E-mail: Matthew.Barkley@arcadis-us.com
Company: ARCADIS	Telephone: 303-231-9115 ext 157

Name: Pam Pinson	Address: P.O. Box 10
Company: Chino Mines Company	Bayard, NM 88023
E-mail: Pamela_Pinson@FMI.com	Telephone: 575-912-5213

If sample(s) received past holding time (HT), or if insufficient HT remains to complete analysis before expiration, shall ACZ proceed with requested short HT analyses? YES ☒ NO ☐
If "NO" then ACZ will contact client for further instruction. If neither "YES" nor "NO" is indicated, ACZ will proceed with the requested analyses, even if HT is expired, and data will be qualified.

Are samples for CO DW Compliance Monitoring? YES ☐ NO ☒
If yes, please include state forms. Results will be reported to PQL.

Quote #:
Project/PO #:
Reporting state for compliance testing:
Sampler's Name: Carolyn Meyer
Are any samples NRC licensable material? Yes No

			# of Containers	soil sieved to < 2mm	pH	Total CU	ABA	
STS-PH-2011-FID37	10.11.11 : 09:45"	SO	1	x	x	x	x	L91358-01
STS-PCUG-2011-40	10.13.11 : 13:55"	SO	1	x	x	x		
STS-PH-2011-FID101	10.12.11 : 16:45"	SO	1	x	x	x	x	L91358-~~02~~03
STS-PH-2011-REFPLOT3	10.7.11 : 11:50"	SO	1	x	x	x	x	L91358-~~03~~04
STS-PH-2011-REFPLOT4	10.6.11 : 10:39"	SO	1	x	x	x	x	L91358-05
DUP11	10.12.11 : ---"	SO	1	x	x	x	x	
STS-PH-2011-FID105	10.6.11 : 13:30"	SO	1	x	x	x	x	L91358-07
DUP12	10.13.11 : ---"	SO	1	x	x	x	x	
STS-PH-2011-REFPLOT1	10.4.11 : 11:09"	SO	1	x	x	x	x	L91358-~~08~~09
STS-PH-2011-REFPLOT2	10.5.11 : 12:30"	SO	1	x	x	x	x	L91358-10

LSO 12.2.11

LSO 12.2.11

LSO 12.2.11

Matrix SW (Surface Water) · GW (Ground Water) · WW (Waste Water) · DW (Drinking Water) · SL (Sludge) · SO (Soil) · OL (Oil) · Other (Specify)

Please send to Sheri Fling at URS for validation. Sieve all soil samples to <2 mm prior to analysis. Soil should be reported on a dry weight basis.
Methods:
pH - 9045C, Total Copper - 6010B

Please refer to ACZ's terms & conditions located on the reverse side of this COC.

	10.14.11 10:50		[illegible] 9:22

①

L92172 Chain of Custody

~~L91358 Chain of Custody~~

FRMAD050.01.15.09 White - Return with sample. Yellow - Retain for your records.

ACZ Laboratories, Inc. L91358

2773 Downhill Drive Steamboat Springs, CO 80487 (800) 334-5493

Name: Pam Pinson
Company: Chino Mines Company
E-mail: Pamela_Pinson@FMI.com

Address: P.O. Box 10
Bayard, NM 88023
Telephone: 575-912-5213

Name: Matthew Barkley
Company: ARCADIS

E-mail: Matthew.Barkley@arcadis-us.com
Telephone: 303-231-9115 ext 157

Name: Pam Pinson
Company: Chino Mines Company
E-mail: Pamela_Pinson@FMI.com

Address: P.O. Box 10
Bayard, NM 88023
Telephone: 575-912-5213

If sample(s) received past holding time (HT), or if insufficient HT remains to complete analysis before expiration, shall ACZ proceed with requested short HT analyses? If "NO" then ACZ will contact client for further instruction. If neither "YES" nor "NO" is indicated, ACZ will proceed with the requested analyses, even if HT is expired, and data will be qualified. YES ☒ NO ☐

Are samples for CO DW Compliance Monitoring? If yes, please include state forms. Results will be reported to PQL. YES ☐ NO ☒

Quote #:
Project/PO #:
Reporting state for compliance testing:
Sampler's Name: Carolyn Meyer
Are any samples NRC licensable material? Yes No

			# of Containers	soil sieved to < 2mm	pH	Total CU	ABA				
STS-PH-2011-FID22	10.13.11 : 16:40	SO	1	x	x	x	x	L91358-11			
nb ~~STS-PH-2011-FID8~~	~~10.12.11 : 15:55~~	~~SO~~	~~1~~	~~x~~	~~x~~	~~x~~	~~x~~				
STS-PH-2011-FID10	10.7.11 : 14:35	SO	1	x	x	x	x	L91358-12			
STS-PH-2011-FID15	10.10.11 : 11:50	SO	1	x	x	x	x				-13
STS-PH-2011-FID16	10.10.11 : 12:30	SO	1	x	x	x	x				-14
STS-PH-2011-FID17	10.11.11 : 17:35	SO	1	x	x	x	x				-15
STS-PH-2011-FID18	10.12.11 : 15:55	SO	1	x	x	x	x				-16

Matrix: SW (Surface Water) · GW (Ground Water) · WW (Waste Water) · DW (Drinking Water) · SL (Sludge) · SO (Soil) · OL (Oil) · Other (Specify)

Please send to Sheri Fling at URS for validation. Sieve all soil samples to <2 mm prior to analysis. Soil should be reported on a dry weight basis.
Methods:
pH - 9045C, Total Copper - 6010B

Please refer to ACZ's terms & conditions located on the reverse side of this COC.

	10.14.11 10:50		
			-11 9:12

②

ACZ Laboratories, Inc. L91526

2773 Downhill Drive Steamboat Springs, CO 80487 (800) 334-5493 LCG 10·26·11

CHAIN of CUSTODY

Name: Pam Pinson
Company: Chino Mines Company
E-mail: Pamela_Pinson@FMI.com

Address: P.O. Box 10
Bayard, NM 88023
Telephone: 575-912-5213

Name: Matthew Barkley
Company: ARCADIS

E-mail: Matthew.Barkley@arcadis-us.com
Telephone: 303-231-9115 ext 157

Name: Pam Pinson
Company: Chino Mines Company
E-mail: Pamela_Pinson@FMI.com

Address: P.O. Box 10
Bayard, NM 88023
Telephone: 575-912-5213

If sample(s) received past holding time (HT), or if insufficient HT remains to complete analysis before expiration, shall ACZ proceed with requested short HT analyses? YES ☒ NO ☐
If "NO" then ACZ will contact client for further instruction. If neither "YES" nor "NO" is indicated, ACZ will proceed with the requested analyses, even if HT is expired, and data will be qualified.

Are samples for CO DW Compliance Monitoring? YES ☐ NO ☒
If yes, please include state forms. Results will be reported to PQL.

Quote #:
Project/PO #:
Reporting state for compliance testing:
Sampler's Name: Carolyn Meyer
Are any samples NRC licensable material? Yes No

			# of Containers	soil sieved to < 2mm	pH	Total CU	ABA				
STS-PH-2011-FID106	10.18.11 - 12:05'	SO	1	x	x	x	x	L91526-09			
STS-PCUG-2011-32	10.19.11 - 11:25'	SO	1	x	x	x					
STS-PCUG-2011-34	10.19.11 - 12:00'	SO	1	x	x	x					
STS-PCUG-2011-35	10.18.11 - 13:30'	SO	1	x	x	x					
STS-PCUG-2011-36	10.18.11 - 12:40'	SO	1	x	x	x					
STS-PCUG-2011-37	10.19.11 - 10:05'	SO	1	x	x	x					

Matrix SW (Surface Water) · GW (Ground Water) · WW (Waste Water) · DW (Drinking Water) · SL (Sludge) · SO (Soil) · OL (Oil) · Other (Specify)

Please send to Sheri Fling at URS for validation. Sieve all soil samples to <2 mm prior to analysis. Soil should be reported on a dry weight basis.
Methods:
pH - 9045C and Copper - 6010B

Please refer to ACZ's terms & conditions located on the reverse side of this COC.

10.24.11	1500		
		10.26.11	9:47

2

FRMAD050.01.15.09 White - Return with sample. Yellow - Retain for your records.

ACZ Laboratories, Inc. L91528

2773 Downhill Drive Steamboat Springs, CO 80487 (800) 334-5493

Name: Pam Pinson	Address: P.O. Box 10 Bayard, NM 88023
Company: Chino Mines Company	
E-mail: Pamela_Pinson@FMI.com	Telephone: 575-912-5213

Name: Matthew Barkley	E-mail: Matthew.Barkley@arcadis-us.com
Company: ARCADIS	Telephone: 303-231-9115 ext 157

Name: Pam Pinson	Address: P.O. Box 10 Bayard, NM 88023
Company: Chino Mines Company	
E-mail: Pamela_Pinson@FMI.com	Telephone: 575-912-5213

If sample(s) received past holding time (HT), or if insufficient HT remains to complete analysis before expiration, shall ACZ proceed with requested short HT analyses? YES ☒ NO ☐

If "NO" then ACZ will contact client for further instruction. If neither "YES" nor "NO" is indicated, ACZ will proceed with the requested analyses, even if HT is expired, and data will be qualified.

Are samples for CO DW Compliance Monitoring? YES ☐ NO ☒

If yes, please include state forms. Results will be reported to PQL.

Quote #:

Project/PO #:

Reporting state for compliance testing:

Sampler's Name: Carolyn Meyer

Are any samples NRC licensable material? Yes No

			# of Containers	soil sieved to < 2mm	pH	Total CU	ABA				
STS-PH-2011-FID102	10.19.11 - 09:15'	SO	1	x	x	x	x	L91528-01			
STS-PH-2011-FID7	10.18.11 - 11:45'	SO	1	x	x	x	x	-02			
STS-PH-2011-FID8	10.19.11 - 17:00'	SO	1	x	x	x	x	-03			
STS-PH-2011-FID28	10.18.11 - 15:35'	SO	1	x	x	x	x	-04			

Matrix SW (Surface Water) · GW (Ground Water) · WW (Waste Water) · DW (Drinking Water) · SL (Sludge) · SO (Soil) · OL (Oil) · Other (Specify)

Please send to Sheri Fling at URS for validation. Sieve all soil samples to <2 mm prior to analysis. Soil should be reported on a dry weight basis.

Methods:

pH - 9045C, Total Copper - 6010B

Please refer to ACZ's terms & conditions located on the reverse side of this COC.

	10.24.11 15:00		10.26.11

FRMAD050.01.15.09 White - Return with sample. Yellow - Retain for your records.

Appendix E

Methods for Surface Water Analysis

Freeport McMoRan Chino Mines Company

APPENDIX E – SURFACE WATER RUNOFF QUALITY AND DURATION REPORT

SMELTER/TAILING SOILS INVESTIGATION UNIT FEASIBILITY STUDY

March 2023

Contents

Tables

Figures

1. Introduction

This Report documents the collection and analysis of surface water runoff samples for the Smelter/Tailing Soils Unit (STSIU) Feasibility Study (FS) Proposal (FS Proposal; Arcadis 2011). The FS Proposal was designed to generate data necessary to evaluate the area affected by pre-FS remedial action criteria (RAC) issued by New Mexico Environment Department (NMED) on March 3, 2011. The purpose of the investigation presented in this Report was to refine the site conceptual model for surface water in STSIU drainage channels during precipitation runoff events and to monitor the depth and duration of flow in the drainage channels during and following precipitation events. Surface water samples have historically been collected from stock tanks and rainfall pools within the STSIU shortly after precipitation events (Newfields, 2005; Chino, 2008; SRK, 2008); however, until the implementation of the work described in this Report, surface water samples had not been collected during the period of runoff initially generated by precipitation events. This Report presents the objectives of the surface water investigation, and describes the sampling, analysis, and data gathering methods used in the investigation.

The objectives of data collection efforts included:

- Provide additional surface water quality data to support refinement of the surface water conceptual site model and to support the STSIU FS;
- Gain additional insight into the potential variability of surface water quality during precipitation runoff events and to compare surface water quality for several separate runoff events during a single monsoon season;
- Define the duration of flow and presence of water to support classification of drainage channels in the STSIU (i.e., perennial, intermittent, or ephemeral).

Section 4 of the STSIU FS provides an updated site conceptual model for surface water based on the data included in this Report and thus the model is not discussed further. Additionally, as described in Section 2 of the FS, Arcadis conducted an expedited Use Attainability Analysis (UAA) based on NMED Surface Water Quality Board's (SWQB's) Hydrology Protocol and established revised drainage classifications (Arcadis, 2012). Because these data were already reported through the UAA process, the water level and water duration monitoring data are not discussed further in this Report.

This Report references the policy, functional activities, and quality assurance/quality control (QA/QC) protocols used in the investigation, which are specifically stated in the RI Quality Assurance Project Plan (QAPP) (Chino/SRK, 1997). The QAPP defines how site-wide QA/QC activities will be implemented during the RI sampling and analysis. The objective of the QAPP is to ensure that data are of adequate quality for its intended use. Standard Operating Procedures (SOPs) have been developed as part of the QAPP and are incorporated by reference in this Report.

2. Site Background

The NMED pre-FS RAC for metals in surface waters was based on NMAC §20.6.4, including all the tools and approaches listed in the Code which provide for site specific application. At the time the surface water investigation was completed, the 2010 – 2011 State of New Mexico Clean Water Act 303(d)/305(b) Integrated Report applied NM Water Quality Standards (WQS) to Whitewater Creek.

In 2011, Arcadis conducted a copper WER study for the STSIU surface waters and results from the WER study were described in the Development of Site-Specific Copper Criteria Interim Report submitted to NMED in March 2013 (Arcadis 2013a). A site-specific copper WER model was subsequently developed to derive adjusted copper criteria in STSIU surface waters in the Revised Site-Specific Copper Toxicity Model Report submitted to NMED in October 2013 (Arcadis 2013b, Fulton and Meyer 2013). The site-specific criteria for STSIU surface waters were adopted by NMED and are contained in NMAC §20.6.4.809.

In 2011, Arcadis also conducted an expedited UAA based on NMED SWQB's Hydrology Protocol to determine the appropriate hydrologic regime of STSIU surface water drainages. Hydrologic classifications of STSIU drainages were proposed in the Application of the Hydrology Protocol to STSIU Drainages report submitted in October 2012 (Arcadis, 2012). The revised hydrologic classifications were accepted by the New Mexico Water Quality Control Commission without comment. Non-ephemeral drainages include Rustler Canyon, Martin Canyon, Bolton Canyon, and immediately downstream of Ash Springs. All other STSIU drainage areas are now designated as ephemeral.

3. Data Quality Objectives

This section describes the Data Quality Objectives (DQO) process that was intended to be used to address the potential impacts to surface water from leaching of soil and sediments in STSIU drainages. The primary objective of this pathway was to assess whether leaching of sediment or soil effects surface water quality. The primary objective was supported by the following decision and criteria:

Decision: Are constituent concentrations in STSIU surface water runoff greater than decision criteria?

Criteria: Site Specific Surface Water Quality Standards in accordance with §20.6.4.809 NMAC.

Per the FS Proposal (Arcadis 2011), a direct numerical comparison of surface water runoff constituent concentration to decision criteria was to be performed on the data. In addition, all data were to be used to allocate metals load in surface water to upgradient sources, soil sources, or legacy sediment sources. However, most samplers contained substantial quantities of sediment entrained within the samplers and the sample bottles at the time of sample retrieval and the presence of these sediments may have resulted in elevated concentrations of total metals in the stormwater samples. These sediments coupled with the uncertainty regarding the amount of time samples were in the sample bottles prior to retrieval introduced uncertainty in the quality of the data. Because of this, the data in this Report were evaluated qualitatively to refine the conceptual site model and the water quality data were not compared to surface water criteria.

4. Sample Collection and Laboratory Analysis

The surface water runoff quality and duration sampling program was intended to address the following specific sampling objectives:

- assess quality of surface water in STSIU drainages during precipitation runoff events at select locations within the STSIU with the greatest potential for exceeding site-specific water quality standards;
- measure the depth and duration of flow in STSIU drainages during precipitation runoff events at select locations within the STSIU with the greatest potential for exceeding site-specific water quality standards; and
- measure the duration of flow in drainage channels at additional STSIU locations with lower potential for exceeding site-specific water quality standards.

As described in Section 2 of the FS, Arcadis conducted an expedited Use Attainability Analysis (UAA) based on NMED Surface Water Quality Board's (SWQB's) Hydrology Protocol and established revised drainage classifications (Arcadis, 2012). Because these data were already reported through the UAA process, the water level and water duration monitoring data are not discussed further in this Report.

Collection of surface water samples and data quality assessment followed SOPs included as part the AOC Quality Assurance Project Plan (QAPP) (Chino/SRK, 1997) adopted by Chino. This section provides specific details associated with the sampling.

Surface water runoff samples were collected from a total of nine proposed drainage channel locations within the STISU boundary (Figure 1). Drainage channels upgradient of stock ponds and other drainage locations with previous elevated detections of copper were targeted for proposed surface water sampling locations. Surface water samplers were installed at two to three different heights above the channel at each location, depending upon channel geometry, to collect samples from different portions of the precipitation runoff hydrograph. Surface water samples were to be collected during three separate precipitation events at each location for a total of 24 samples (maximum number), plus two field duplicate samples, and one MS/MSD sample per sampling event); however, dry weather conditions prevented this at all locations except for location C-5, where samples were collected for two separate precipitation events. Two surface water samplers were placed at two heights in all locations except C-1 (Table 1), where only one sampler could be installed.

The initial surface water sampler installation involved setting up surface water sampler mounting kits at the nine surface water sampling locations. One mounting kit was installed for each sampler. Each mounting kit contained a reusable mounting tube that was secured to a post in the water channel. Once the mounting kits were in place, the surface water samplers were inserted in the mounting tubes prior to each sampling event. Surface water samplers were sent directly to the lab for processing, as there was no need to transfer the sample to another sample container.

Following a significant rain event, surface water samplers were retrieved from each sample location and shipped on ice to ACZ Laboratory, Inc. (ACZ) in Steamboat Springs, CO for analysis following appropriate chain of custody SOPs provided in the AOC QAPP (SRK, 1997). All sample preservation (other than shipment of samples on ice) and filtration was conducted at the lab. Surface water samples were analyzed for analytes listed in Table 2.

Table 2. Surface Water Analyses

Analyte	**Method**
Inorganic Constituents	
Aluminum, Total and Dissolved	M200.8 ICP-MS
Cadmium, Total and Dissolved	M200.8 ICP-MS
Calcium, Total and Dissolved	M200.7 ICP
Copper, Total and Dissolved	M200.8 ICP-MS
Lead, Total and Dissolved	M200.8 ICP-MS
Magnesium, Total and Dissolved	M200.7 ICP
Zinc, Total and Dissolved	M200.8 ICP-MS
Sulfate	D516-02 - Turbidimetric
Alkalinity as CaCO3	SM2320B - Titration
Organic Constituents	
Carbon, Dissolved Organic (DOC)	SM5310B

5. Surface Water Quality Results

5.1 Results

This section presents results of analyses conducted for surface water as part of this investigation. Analytical results for total and dissolved (0.45 micron) metals are summarized in Table 1 and discussed below.

Total aluminum concentrations ranged from 6.92 mg/L to 563 mg/L and dissolved (0.45-micron size fraction) aluminum concentrations ranged from 0.013 mg/L to 0.187 mg/L. Dissolved aluminum concentrations were less than total aluminum concentrations with 0.45-micron concentrations averaging 0.2% of total aluminum concentrations (Table 1).

Total cadmium concentrations ranged from an estimated concentration of 0.0004 mg/L to 0.017 mg/L and dissolved cadmium concentrations ranged from less than the laboratory detection limit of 0.0001 mg/L to 0.0008 mg/L. Dissolved cadmium concentrations were less than total cadmium concentrations with 0.45-micron concentrations averaging 10.5% of total cadmium concentrations (Table 1).

Total copper concentrations ranged from 0.143 mg/L to 6.9 mg/L and dissolved copper concentrations ranged from 0.0233 mg/L to 0.2046 mg/L. Dissolved copper concentrations were less than total copper concentrations with 0.45-micron concentrations averaging 6.9% of total copper concentrations (Table 1).

Total lead concentrations ranged from 0.0069 mg/L to 0.342 mg/L and dissolved lead concentrations ranged from less than the laboratory detection limit of 0.0001 mg/L to 0.001 mg/L. Dissolved lead concentrations were less than total lead concentrations with 0.45-micron concentrations averaging 0.9% of total lead concentrations (Table 1).

Total zinc concentrations ranged from 0.055 mg/L to 1.14 mg/L and dissolved zinc concentrations ranged from 0.007 mg/L to 0.374 mg/L (Table 1). Dissolved zinc concentrations were generally less than total zinc concentrations with 0.45-micron concentrations averaging 85% of total zinc concentrations (Table 1).

Total calcium concentrations ranged from 3.3 mg/L to 148 mg/L and dissolved calcium concentrations ranged from 1.7 mg/L to 23.4 mg/L. Dissolved calcium concentrations were less than total calcium concentrations with 0.45-micron concentrations averaging 41.3% of total calcium concentrations (Table 1).

Total magnesium concentrations ranged from 2.1 mg/L to 112 mg/L and dissolved magnesium concentrations ranged from an estimated concentration of 0.3 mg/L to 4.3 mg/L. Dissolved magnesium concentrations were less than total magnesium concentrations with 0.45-micron concentrations averaging 14.8% of total magnesium concentrations (Table 1).

5.1 Discussion

The objectives of the surface water runoff investigation included providing additional surface water quality data to support refinement of the conceptual site model and to support the STSIU FS. The objectives of the sampling also included defining the duration of flow and presence of water and temperature to support classification of drainage channels in the STSIU. However, the data associated with this classification was used in the expedited UAA described above and is thus not included in in this Report.

Both dissolved and total concentrations of metals in stormwater samples were typically higher in samples collected from stormwater samplers installed at higher elevations above the creek channel (Table 1). This may be due to a longer contact time between runoff and COC-containing soil and sediment or may be due to greater entrainment of COC-containing sediments at higher flows. Concentrations of total metals were generally substantially higher than concentrations of dissolved metals. Most samplers contained substantial quantities of sediment entrained within the samplers and the sample bottles at the time of sample retrieval and the presence of these sediments may have resulted in elevated concentrations of total metals in the stormwater samples. These sediments coupled with the uncertainty regarding the amount of time samples were in the sample bottles prior to retrieval introduced uncertainty in the quality of the data. Because of this, the data in this Report were evaluated qualitatively to refine the conceptual site model and the water quality data were not compared to surface water criteria. The current site conceptual model for STSIU surface water is described in Section 4.1 of the FS.

6. References

Arcadis. 2011. Administrative Order on Consent Feasibility Study Proposal. Smelter Tailings Soils Investigation Unit. Prepared for Chino Mines Company, Hurley, New Mexico. October.

Arcadis. 2012. Application of the Hydrology Protocol to STSIU Drainages. October.

Arcadis. 2013a. Development of Site-Specific Copper Criteria Interim Report. Prepared for Chino Mines Company. Submitted to NMED. March.

Arcadis. 2013b. Revised Site-Specific Copper Toxicity Model Report. Prepared for Chino Mines Company. Submitted to NMED. October 2013.

Chino/SRK. 1997. Administrative Order on Consent, Quality Assurance Plan, Chino Mine Investigation Area. March.

Chino, 2008. Technical Memorandum Surface Water Sampling & Analysis of Rainfall Pools, Addendum to Administrative Order on Consent Revised Remedial Investigation Report for the Smelter/Tailing Soils Investigation Unit. June.

Fulton, B.A. and J.S. Meyer. 2014. Development of a regression model to predict toxicity to *Daphnia magna* and site-specific copper criteria across multiple surface water drainages in an arid landscape. Environmental Toxicology and Chemistry 33:1865-1873.

NewFields, 2005. Chino Mines Administrative Order on Consent, Site-Wide Ecological Risk Assessment. February

Ritchie, J.C., Rango, A., Schumgge, T.J. 2008. Remote sensing studies of arid rangelands in the southwestern United States [abstract]. Abstracts of the Annual Meeting of The Society for Range Management. Abstract No. 1504.

SCS. 1976. National Range Handbook. Soil Conservation Service, U.S. Department of Agriculture. July 13.

Soil Conservation Service (SCS). 1983. Soil Survey – Grant County, New Mexico, Central and Southern Parts.

SRK. 2008. Administrative Order on Consent Remedial Investigation Report for the Smelter/Tailing Soils Investigation Unit, Revision 3. May.

URS Corporation. 2012. Data validation report feasibility study proposal- Smelter/Tailings Soil Investigation Unit. Prepared for Freeport-McMoRan Copper & Gold. May 21.

U.S. Environmental Protection Agency (USEPA). 2000. Guidance for the Data Quality Objectives Process. Office of Environmental Information. EPA QA/G-4. EPA/600/R-96/055.

USEPA. 2004. Developing Spatially Interpolated Surfaces and Estimating Uncertainty. U.S. Environmental Protection Agency, 454/R-04-004.

USEPA. 2010. ProUCL Version 4.1.00 Technical Guide. Office of Research and Development. EPA-600-R-07-041. Draft. May.

Vanderpost, C; Ringrose, S; Matheson, W; Arntzen, J. 2011. Satellite based long-term assessment of rangeland condition in semi-arid areas: An example from Botswana. Journal of Arid Environments 75:383-389.

Weltz, M. and M.K. Wood. 1986. Short Duration Grazing in Central New Mexico: Effects on Infiltration Rates. J. of Range Management 39(4). July.

Woodward Clyde. 1997. Administrative Order on Consent Phase I Ecological Remedial Investigation Proposal, Chino Mine Investigation Area. Prepared for New Mexico Environmental Department and Chino Mines Company.

TABLE 1
STSIU STORM WATER SAMPLE DATA

FREEPORT-MCMORAN CHINO MINES COMPANY
VANADIUM, NEW MEXICO
SMELTER/TAILING SOILS IU FEASIBILITY STUDY

Sample Name and Height Above Channel	Storm-A-2A 0.5"		Storm-A-2A 2"		Storm-A-2B 0.5"		Storm-A-2B 2"		Storm-A-3A 2"		Storm-A-3A 4"		Storm-A-3A-DUP 4"		Storm-B-1 0.5"		Storm-B-1 1.5"		Storm-B-3 0.5"		Storm-B-3 2"		Storm-C-1 2"		Storm-C-3 0.5"		Storm-C-3 2"		Storm C-5 2"		Storm C-5 0.5"		Storm-C-5 2"		Storm CDW-1 0.5"		Storm-CDW-1 2"	
Sample Collection Date	8/8/11		8/8/11		8/8/11		8/8/11		8/31/2011		8/31/2011		8/31/2011		8/16/2011		8/16/2011		8/16/2011		8/16/2011		8/16/2011		8/16/2011		8/16/2011		8/8/2011		8/16/2011		8/16/2011		8/8/11		8/8/11	
Analyte																																						
Aluminum, dissolved	*0.12*		0.079		0.187		0.046		0.013		0.154		0.025		0.053		0.09		*0.083*		*0.165*		*0.061*		0.106		0.042		0.147		0.036		0.057		0.064		0.073	
Aluminum, total	146		18.7		67.3		77.1		333		563		118		68.7		110		114		119		11		87.4		25.5		317		107		35		6.92		15	
Cadmium, dissolved	0.0001	U	0.0001	B	0.0001	U	0.0001	U	0.0001	B	0.0001	B	0.0001	U	**0.0007**		**0.0008**		0.0001	B	*0.0002*	B	0.0001	U	*0.0002*	B	0.0001	B	*0.0004*	B	0.0001	U	0.0001	B	**0.0005**		*0.0005*	B
Cadmium, total	0.0041		0.0005	B	0.0021	B	0.0026	B	0.01		0.017		0.0028	B	0.0066		0.0097		0.0038		0.0042		0.0004	B	0.0024	B	0.0009	B	0.011		0.0039		0.001		0.001		0.0019	
Calcium, dissolved	4.8		12.8		12.9		19.2		23.4		15.5		10.8		7.3		7.6		4.1		4.4		1.7		4.5		2.8		9.2		7.6		7.3		6.9		7.9	
Calcium, total	28		14.5		25.2		35.9		108		148		29.9		16.3		20.8		21.9		21.2		3.3		17		6.9		49.7		27		14.1		7.5		10.4	
Copper, dissolved	**0.0651**		**0.079**		**0.0327**		**0.0475**		**0.0481**		**0.0361**		**0.0241**		**0.1861**		**0.1813**		**0.0468**		**0.0549**		**0.0233**		**0.0384**		**0.0342**		**0.1737**		**0.036**		**0.0379**		**0.1778**		**0.2046**	
Copper, total	2.4		0.299		1.5		1.76		2.79		4.09		0.752		4.68		6.9		1.9		1.81		0.143		0.654		0.339		4.47		1.89		0.582		0.741		1.77	
Lead, dissolved	0.0001	B	0.0003	B	0.0005	B	0.0003	B	0.0004	B	0.0009		0.0004	B	0.0005	B	*0.0008*		*0.0006*		*0.001*		0.0001	U	*0.0006*		0.0006		0.0002	B	0.0001	U	0.0005		0.0001	U	0.0002	B
Lead, total	0.1032		0.0109		0.0554		0.0712		0.199		0.342		0.0506		0.0983		0.1425		0.0975		0.099		0.0069		0.0445		0.0181		0.163		0.0979		0.0281		0.0168		0.0428	
Magnesium, dissolved	0.8	B	2.1		1.3		1.3		4.3		2.7		1.8		1.3		1.4		0.7	B	0.9	B	0.3	B	1		0.7	B	1.9		1.7		1.6		1.6		1.7	
Magnesium, total	22.2		4.7		11		14.1		82		112		21.1		12.2		18		20.6		21.2		2.1		14.2		5.1		42		17.2		7.7		2.6		4.4	
Zinc, dissolved	**0.205**		**0.173**		**0.137**		**0.145**		0.007		0.011		0.007		**0.199**		**0.342**		**0.332**		**0.335**		**0.221**		**0.374**		**0.191**		**0.28**		0.014		**0.23**		**0.085**		**0.047**	
Zinc, total	0.39		0.055		0.25		0.29		0.71		1.14		0.23		0.28		0.35		0.33		0.43		0.407		0.214		0.088		0.67		0.28		0.126		0.1		0.15	
Carbon, dissolved organic (DOC)	9		9		9		7		4.4	B	3.1	B	3.4		5		6		7		7		3	B	9		NA		9		10		8		11		12	
Sulfate	28		22		4	B	3	B	14		10		10		24		31		14		13		2	B	8		5	B	40		22		20		21		25	
Bicarbonate as CaCO3	8	B	23		37		46		81		59		41		5	B	6	B	8	B	6	B	2	B	11	B	5	B	29		14	B	12	B	5	B	7	B
Carbonate as CaCO3	2	U	2	U	2	U	2	U	2	U	2	U	2	U	2	U	2	U	2	U	2	U	2	U	2	U	2	U	2	U	2	U	2	U	2	U	2	U
Hydroxide as CaCO3	2	U	2	U	2	U	2	U	2	U	2	U	2	U	2	U	2	U	2	U	2	U	2	U	2	U	2	U	2	U	2	U	2	U	2	U	2	U
Total Alkalinity	8	B	23		37		46		81		59		41		5	B	6	B	8	B	6	B	2	B	11	B	5	B	29		14	B	12	B	5	B	7	B
Hardness as CaCO3	15		41		38		53		76		50		34		24		25		13		15		5		15		10		31		26		25		24		27	

Notes:

All concentrations are in units of milligram per liter (mg/L)

B = Analyte concentration detected at a value between MDL and PQL. The associated value is an estimated quantity.

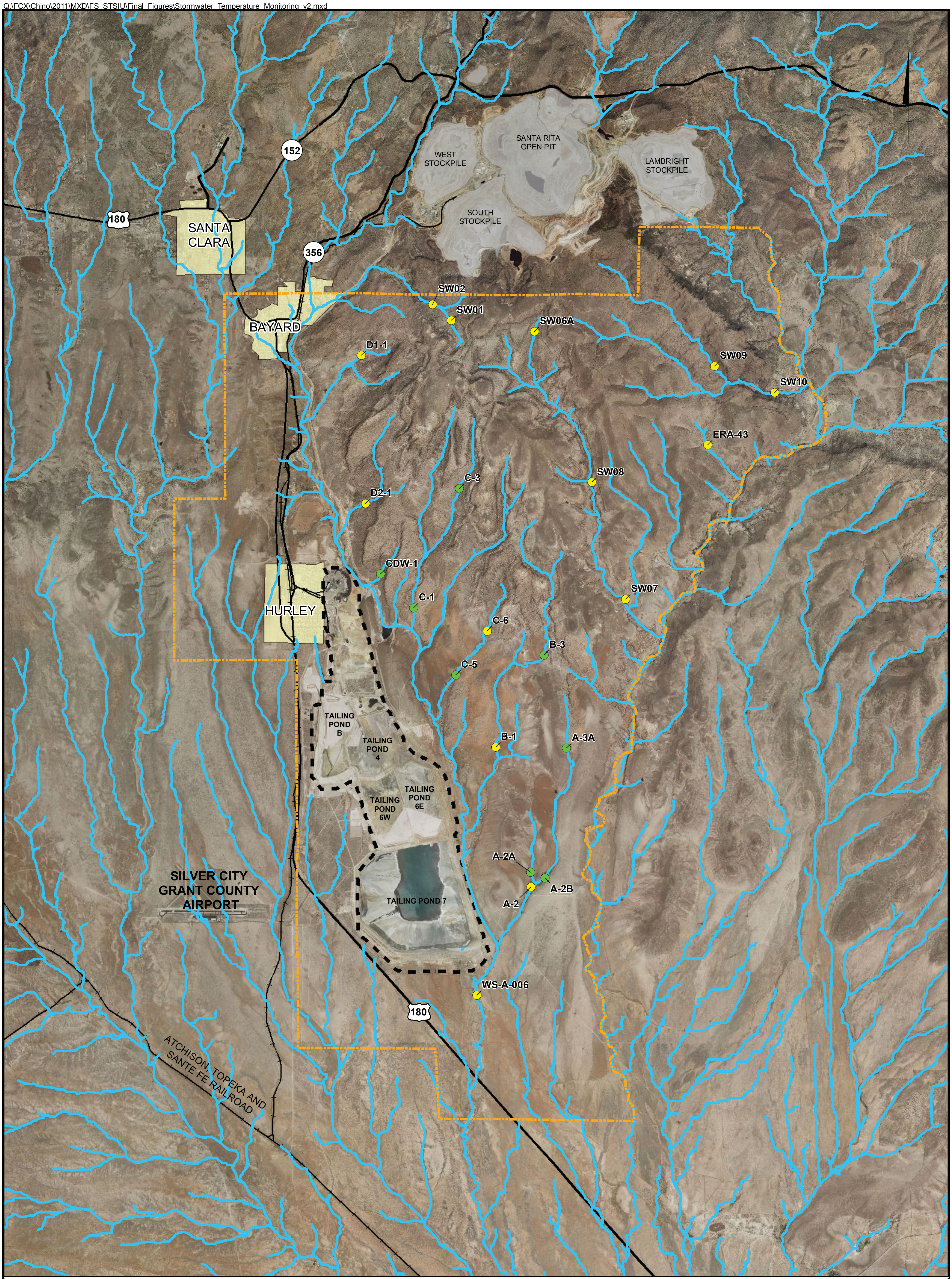
MDL = method detection limit

NA - not analyzed, bottle in sampler was broken

PQL = practical quantitation limit, typical 5 times the MDL.

U = The material was analyzed for, but was not detected above the level of the associated value. The associated value is either the sample quantitation limit or the sample detection limit.

OFFICE: LAKEWOOD DB: MLM TM: MB PM: AT
PROJECT# B0063543.0000
Q:\FCX\Chino\2011\MXD\FS_STSIU\Final_Figures\Stormwater_Temperature_Monitoring_v2.mxd



LEGEND

● Temperature Monitoring Location

● Stormwater Temperature and Pressure Monitoring Location

STSIU Boundary

Smelter Tailing boundary

Highway

Railroad

▨ Stockpiles

▨ Local Cities

0 7,000 14,000 Feet

GRAPHIC SCALE

FREEPORT-MCMORAN CHINO MINES COMPANY
VANADIUM, NEW MEXICO

SMELTER/TAILINGS SOILS IU FS PROPOSAL

STORM WATER AND TEMPERATURE MONITORING LOCATIONS

ARCADIS

FIGURE
1

Arcadis U.S., Inc.
630 Plaza Drive, Suite 200
Highlands Ranch
Colorado 80129
Phone: 720 344 3500
Fax: 720 344 3535
www.arcadis.com