FREEPORT-McMoRan

Freeport-McMoRan Chino Mines Company
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Bayard, NM 88023

July 1, 2016

Certified Mail #70153010000206571501
Return Receipt Requested

Ms. Trais Kliphuis, Director
New Mexico Environment Department
Water Protection Division
P.O. Box 5469
Santa Fe, New Mexico 87502

Dear Ms. Kliphuis:

Re: Revised Razorback Ridge Area Supplemental Completion Report
Interim Remedial Action, Smelter Tailing Soils Investigation Unit - Chino AOC

Freeport-McMoRan Chino Mines Company (Chino) submits under separate cover the Revised *Razorback Ridge Area Supplemental Completion Report* for the Smelter Tailing Soils Investigation Unit under the Chino Administrative Order on Consent (AOC). The report was revised in response to comments received from the New Mexico Environment Department (NMED) in a letter dated May 26, 2016. The completion report and a document presenting responses to NMED comments were submitted today to Mr. David Mercer.

Please contact Mr. Ned Hall at (520) 393-2292 if you have any questions regarding this supplemental completion report.

Sincerely,

Sherry Burt-Kested, Manager
Environmental Services

SBK:pp
20160701-002

c: David Mercer, NMED
Joseph Fox, NMED
Petra Sanchez, U.S. Environmental Protection Agency
Ned Hall, FCX (via email)

Response to New Mexico Environment Department Comments on the Supplemental Completion Report - Razorback Ridge Area Interim Remedial Action, Smelter/Tailing Soils Investigation Unit (STSIU)

This document presents Freeport-McMoRan Chino Mines Company's (Chino) response to comments received from the New Mexico Environment Department (NMED) in a letter dated May 26, 2016 on the *Supplemental Completion Report Razorback Ridge Area Interim Remedial Action*. The *Completion Report* documents the activities and results as well as the data collected, analyzed, and validated for the soil removal performed by Freeport-McMoRan Reclamation Services (FMRS) in the Razorback Ridge Area targeted for remediation in the 2006 *Draft STSIU Interim Remedial Action (IRA) Work Plan*. The *Completion Report* also serves as a supplement to the first STSIU IRA Completion Report submitted in 2009.

Chino's responses to comments are in **bold** text following each numerated set of NMED comments. NMED's comments are presented in regular font.

1. The report mentions previous agreements made between NMED and FMI but none of those agreements are discussed in detail nor specifically cited in the report. NMED requests that the report includes a more descriptive account of the site history specific to the Razorback Ridge Area. Please describe the determination process as related to clean- up levels for Razorback Ridge Area.

   Chino Response: Citations have been reiterated and/or added to the "Revised Supplemental Completion Report", enclosed. A word search was performed on the report text for "agreement" or "agree" and was found only to be used once, in the context of the NMED approved 2007 IRA STSIU Workplan. A correction was made for clarity as per below:

   > ~~Chino, with NMED agreement, set~~ The HSIU residential Pre-FS RAC *was selected* as the remediation target ~~in the STSIU IRA Work Plan~~ to address horizontal delineation of copper concentrations criterion *as per the NMED approved 2007 STSIU IRA Work Plan*.

   Additional detail has been added to the Introduction in the Revised Report. The Introduction addresses remediation criteria applied to the Razorback Ridge Area IRA. Additional background information as well as a summary of that detail is provided below. Completion report reviews require comparisons against the project workplan(s) which usually summarize background information and previous studies. This helps provide understanding for the purpose and approach for the proposed remediation action. However, based on the comments received, Chino has brought forward into this response document and the revised report, remedial investigation and workplan figures that are the basis of the remediation.

   The cleanup criteria for areas containing soil with copper concentrations above 5,000 mg/kg for human health risk was defined in the NMED-approved IRA Work Plan for the Smelter Tailing Soils Investigation Unit (STSIU) dated 2007. The workplan utilized the pre-FS RAC as issued for the Hurley Soils Investigation Unit (HSIU) by NMED in a letter dated July 27, 2005. Both the 2007 approved workplan and the 2006 Draft IRA Work Plan addressed areas outside

the HSIU where the soil copper concentrations gradient above 5,000 mg/kg continued beyond the Town of Hurley. See Figure 1 in the revised completion report. A figure that was included in both of the 2006 and 2007 workplans has been added to the report showing the areas that were characterized as having surface soil concentrations greater than 5,000 mg/kg of copper. See Figure 2 in the revised report.

Both workplans also included a confirmation cleanup criteria of 2,700 mg/kg copper for areas with newly disturbed soils to minimize exposure to groundfeeding birds. In an area with surface soil copper concentrations greater than 5,000 mg/kg, the excavation would continue vertically until the concentrations of copper were below 2,700 mg/kg. This criteria was developed prior to the issuance of the STSIU pre-FS RAC of 1,600 mg/kg copper, when less data was available on the population of invertebrates in the area. Due to the limitations of operation equipment, Chino recognized that the removal of three to six inches of top soil would not only remove the targeted concentration of >5,000 mg/kg but would most likely remove below the potential ecological risk criteria concentrations. Hence, the vertical confirmation concentration value was utilized in an interim remedial action for addressing copper concentrations exceeding pre-FS RAC determined for human health risk. The pending Draft Feasibility Study for STSIU will address the 1,600 mg/kg ecological risk criteria.

Clarification was added to the report that this cleanup criteria was applied to all of the areas identified in the Draft IRA Work Plan (August 2006). Additionally the vertical criteria utilize for the Golf Course, will be distinguished from the later pre-FS RAC applied to the Hurley Railroad and Razorback Ridge site remedial actions. Following the approval of the IRA Work Plan and completion of remediation of the Golf Course site, NMED issued a pre-FS RAC for the STSIU of 5,000 mg/kg for copper for human health risk (September 16, 2010). Following an informal dispute resolution, the pre-FS RAC was issued for ecological risk, when copper is above 1,600 mg/kg (March 3, 2011).

Discussion of both workplans is provided in the revised report as the 2006 draft workplan proposed remediating the Razorback Ridge area as well as those areas immediately north and west of the HSIU. The 2007 approved workplan states that the Razorback Ridge area will be addressed later during the reclamation of the Lake One site. Please note as previously stated in the 2015 completion report, the final Work Plan (November 2007) stated that the Razorback Ridge Area excavation would be postponed to coincide with closure activities under DP-1340, because the Gila Conglomerate material in the area was needed for fill and soil cover material for closure.

2. Please describe how the requirements from DP-1340 and the Lake One reclamation influenced and directed the remediation of the Razorback Ridge Area. Additional detail should be completed with the purpose of providing all necessary information in this report, instead of merely citing reports elsewhere.

Chino Response: As in the outline and content of previously approved completion reports, Chino has provided information necessary to meeting AOC requirements in the Razorback Ridge Area completion report. In the past, other AOC IRA sites have also utilized removed soils as fill material for DP-1340 although delivered by a Chino contractor performing the remediation. The completion reports document location and use of the borrow material under DP 1340 in a brief statement. Hence the use of references and brief statements pointing to other permit work. Other permit activities are provided as references as this work is already documented and regulated; and is only included in detail when it effects the regulatory process of the AOC and the submitted document. For that purpose, in the 2015 completion report additional information was provided in Section 2 and Section 4 concerning excavation processes, volume and placement of those borrow material,s and timing due to this remediation action being addressed through the DP-1340 reclamation borrow activities. Additional clarification was added to Section 2.4 of the Revised Completion Report.

Requirements for closure of Lake One and the Slag Pile under DP-1340 included sufficient volume of bulk grading fill and soil cover materials, suitability of the materials for compaction, erosion control, growth medium, and proximity to the areas to be closed. These requirements did not "direct" the remediation efforts in the Razorback Ridge Area; the remediation was to be performed using the IRA Work Plan cleanup criteria regardless of the DP-1340 closure activities. More material was excavated from the area of Razorback Ridge than was needed to meet cleanup goals because the material met the suitability criteria for fill and cover, and this material was needed for the DP-1340 closure design. The proximity of the material at Razorback Ridge to Lake One was also a factor in the area being desirable for fill material for closure activities, as this minimized costs, traffic, and dust generation.

3. It appears that most samples indicate that clean-up levels are met for ecological receptors for copper concentrations even though the remediation of the Razorback Ridge Area targeted clean-up levels for the protection of human health. Please include a section that further discusses clean-up levels, current and future land use and how this relates to comment one above.

Chino Response: See response to Comment 1. Additional detail has been added to Section 1 and Section 2.3 discussing the cleanup criteria in the NMED-approved Work Plan. Cleanup levels under the STSIU IRA workplan are 5,000 mg/kg copper in soils defined laterally and 2700 mg/kg (pre 2010) and 1600 mg/kg (2010) for soils defined vertically. The excavation of the area for the purpose of removing soils containing concentrations above cleanup criteria and for the purpose of excavating sufficient suitable material for Lake One and Slag Pile closure activities met the pre-FS RAC of 1,600 mg/kg copper due to deep soil removal; however, the remedial objective was to be protective of human health. Excavation of impacted soil to the most eastern portion of the Razorback Ridge Area was infeasible due to either safety issues pertaining to steep terrain with overhanging boulders or to the upper mesa being bedrock. The excavation of soil to the north and south of the East Removal Borrow Area, which was projected to be below the human health risk criteria (Figure 3), was removed for the purpose of fill material.

Current and anticipated future land use is wildlife habitat. The interim remedial action of removing materials above 5,000 mg/kg copper was performed for future residential use of the site, as per NMED conservative position for rough steep terrain (Chino letter, December 30, 2010).

4. Please include a map depicting the boundary of the New Mexico Mining and Minerals Division permit area for Lake One and the overlap with the AOC and DP-1340 areas of this project, along with a description of the interrelation between these areas.

Chino Response: Attached to this response document is a South Mine Area MMD Boundary Figure. This is a permit boundary which covers more area than the MMD Design Limit Boundary which limits mining disturbances such stockpiles, open pits, and structures, but does not apply to borrow areas. The MMD boundary falls within the AOC boundary. DP-1340 is not defined by boundary lines but by the following regulatory permit language:

> *"The New Mexico Environment Department (NMED) issues this Supplemental Discharge Permit for Closure, DP-1340, (Supplemental Discharge Permit) to Chino Mines Company (Chino) pursuant to the New Mexico Water Quality Act (WQA), NMSA 1978 5 5 74-6- 1 through 74-6- 17 (1993), and the New Mexico Water Quality Control Commission (WQCC) Regulations, 20.6.2 NMAC. The permit contains the closure requirements addressing Chino's discharges of contaminants that may move directly or indirectly into ground water from the Open Pit, Hurley Smelter, Tailing Impoundments, Waste Rock Piles, Leach Ore Stockpiles and associated facilities (the Chino Mines Facility) at its copper mine and mill in Grant and Luna Counties, New Mexico. ……This Supplemental Discharge Permit contains conditions necessary to prevent the exceedence of standards of Section 20.6.2.3 103 NMAC or the presence of a toxic pollutant in ground water during and after the cessation of operations.*
>
> *The Chino Mines Facility encompasses the following facilities in Grant County, New Mexico:*
>
> ***Northern Area:*** *Open Pit, Leach Ore Stockpiles, Waste Rock Piles, solution extraction electrowinning (SX/EW plant, Reservoirs, pumping stations, seepage impoundments, storm water ponds, mill facilities, a maintenance area, a former precipitation plant area, Ground Hog Mine area, Oswaldo Mine Shaft, Star Mine Shaft, and Ivanhoe Concentrator. The Northern Area……*
>
> ***Southern Area:*** *Hurley Smelter, slagpiles, Lake One Area, Chino Tailing Impoundments, Pond 7 seepage interceptor system, Axflo Lake, James Canyon Reservoir, wellfields and Hurley powerplant. ….Slag piles along with the smelter cover approximately 195 acres. The Lake One Area consists of sediment from Whitewater Creek, tailing and concentrate spillage associated with the former concentrator and tailing thickeners as well as tailing recovered from tailing pipeline spills. The Lake One Area covers 230 acres. Tailing from the Ivanhoe Concentrator is disposed of in Pond 7. The Chino Tailing Ponds comprise eight distinct impoundments including Pond 1, Pond 2, Pond B, Pond C, Pond 4, Pond 6E, Pond 6W and Pond 7. The impoundments contain approximately 690 million tons of tailing and cover approximately 3,500 acres. The Pond 7 seepage interceptor system is*

located immediately south of Pond 7 ……Axiflo Lake covers approximately 98 acres. The James Canyon Reservoir …used for storm water retention and … used as part of the upper Whitewater Creek Diversion. The James Canyon Reservoir covers approximately 45 acres. The Hurley power plant provides a portion of the electrical power for the Chino Mines Facility. The Lake One Area, Chino Tailing Impoundments, Axiflo Lake, James Canyon Reservoir, well fields, Hurley Smelter, slag piles and Hurley power plant are located east and south of the town of Hurley in Grant County."

The AOC states under Section II. Purpose of Agreement: "....*to avoid duplication of environmental closure activities to the extent that the Investigation Area is subject to existing Discharge Plans, those Discharge Plans shall not be incorporated into this AOC and shall continue to govern compliance with applicable provisions of the New Mexico Water Quality Act. …and environmental closure actions related to each such Discharge Plan area****."***

Borrow areas per se are not required to be reclaimed under the 1993 New Mexico Mining Act and its implementing regulations found at Title 19, Chapter 10 NMAC. The Act and regulations define "mining" to exclude use of borrow materials. "Reclamation" applies to those areas impacted directly by mining operations. This applies also to remediation soil disturbances from AOC activities on natural ground.

5. The report should summarize the decision making timeline for the excavated soil such as the reason and purpose for the removal (fill for Lake One). The current version cites safety concerns for areas that were not sampled and areas where soil was not removed. In actuality, there were other reasons for removal due to the Razorback Ridge Area AOC remedial investigation and the interests from the FMI reclamation group for fill and borrow material. A map including isoconcentration lines for copper should depict the areas that were determined not to be removed for remediation or for borrow material.

   The report should be expanded to include previous sampling efforts in addition to the ones associated with this specific project, such as an evaluation of the reclaimed site compared to site conditions before remediation. The report should also detail what is known about the concentrations of the contaminants of concern along the east slope and cliff areas that were not sampled during this project.

   Chino Response: Section 2.4 has been clarified with added decision points to the time line presented in the IRA implementation summary for excavation of soils in the Razorback Ridge Area.
   The statement in Section 5 points to safety issues relevant only for equipment access.
   It should be noted that the volume of excavated material required for Lake One reclamation resulted in excavation of areas that were not required to be removed as defined in the 2006 Draft STSIU IRA Work Plan. Figures 2 and 3 have been added to the Revised Report showing the area defined in the Draft IRA Work Plans (2006) for surface soils exceeding 5,000 mg/kg copper. Actual excavated areas shown in Figure 4 that are outside of the originally defined

remediation areas in Figure 3 were sampled to characterize the newly exposed soils for use in the STSIU FS.

Confirmation sampling following excavation was to confirm that the excavation had removed copper concentrations above 5,000 mg/kg in the area defined in the IRA Work Plan and 1600 mg/kg as the vertical confirmation criteria. Areas within the 2006 Draft IRA Work Plan removal area that were not remediated due to safety concerns were not sampled during confirmation sampling.

The results of previous characterization of copper concentrations in the soil are shown in a new Figure 2 in the Revised Completion Report. The Draft Feasibility Study for the STSIU will address remaining pre-FS RAC constituents and provide remedial objectives and approaches for soils outside the areas remediated for human health risk defined by the Revised Razorback Ridge Area Completion Report.

An isoconcentration map for copper from the STS IU Remedial Investigation (RI) Report (SRK, 2008) is attached to this response document. It illustrates the statistical contouring of copper concentrations from sample sites as seen in Figure 2 in the Revised Completion Report. Isoconcentration maps for all constituents analyzed under the RI are represented including those criteria listed as pre-FS RAC issued by NMED in September 16, 2010 and March 3, 2011. Soils outside the removal area of the IRA Work Plan are not within the scope of this supplemental completion report for Razorback Ridge.

REFERENCES

ARCADIS US, Inc. (ARCADIS), 2007. Administrative Order on Consent, Interim Removal Action Work Plan, Smelter/Tailing Soil Investigation Units. Prepared for Chino Mines Company, November 2007.

ARCADIS, 2009. Administrative Order on Consent, Interim Removal Action Completion Report, Smelter/Tailing Soil Investigation Units. Prepared for Chino Mines Company, March 10, 2009.

BBL, 2006. Administrative Order on Consent, Excavation Interim Action Work Plan, Smelter/Tailing Soil Investigation Units Work Plan, Chino Mines Company. August 2006.

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

Chino, 2005. Amendment to the Administrative Order on Consent, Hurley Soils Investigation Unit. Advisory Group Formal Dispute Resolution. July 28, 2005.

Chino, 2010. STSIU Chino AOC Informal Dispute Resolution Technical Memorandum Addressing Pre-Feasibility Study Remedial Action Criterion Issues. December 30, 2010.

Golder, 2008. Interim Remedial Action Completion Report, Hurley Soils Investigation Unit. Prepared for Chino Mines Company, March 2008.

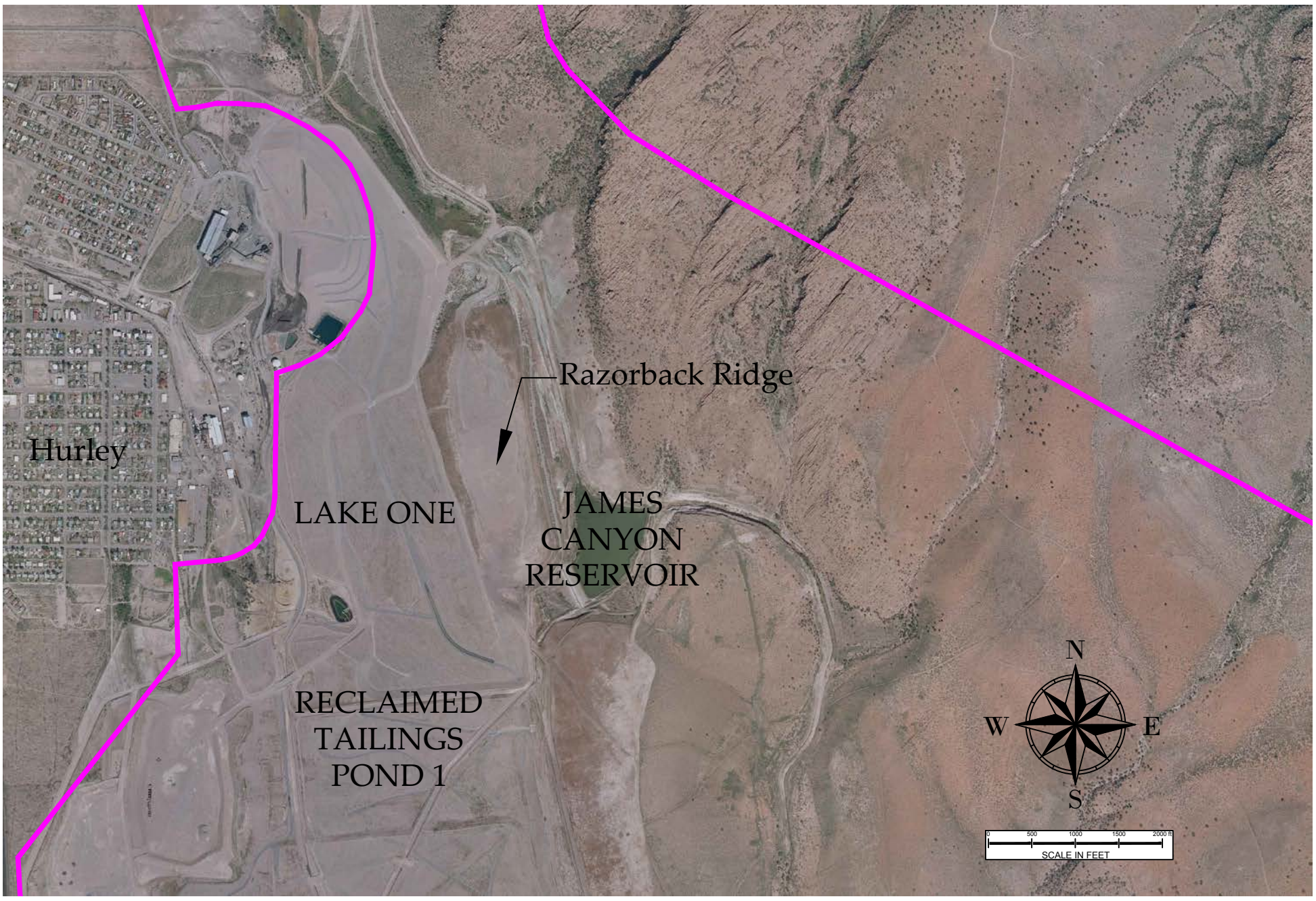
Golder, 2013. Hurley Railroad Interim Remedial Action Supplemental Completion Report, Smelter Tailing Soils Investigation Unit. Prepared for Chino Mines Company, May 2013.

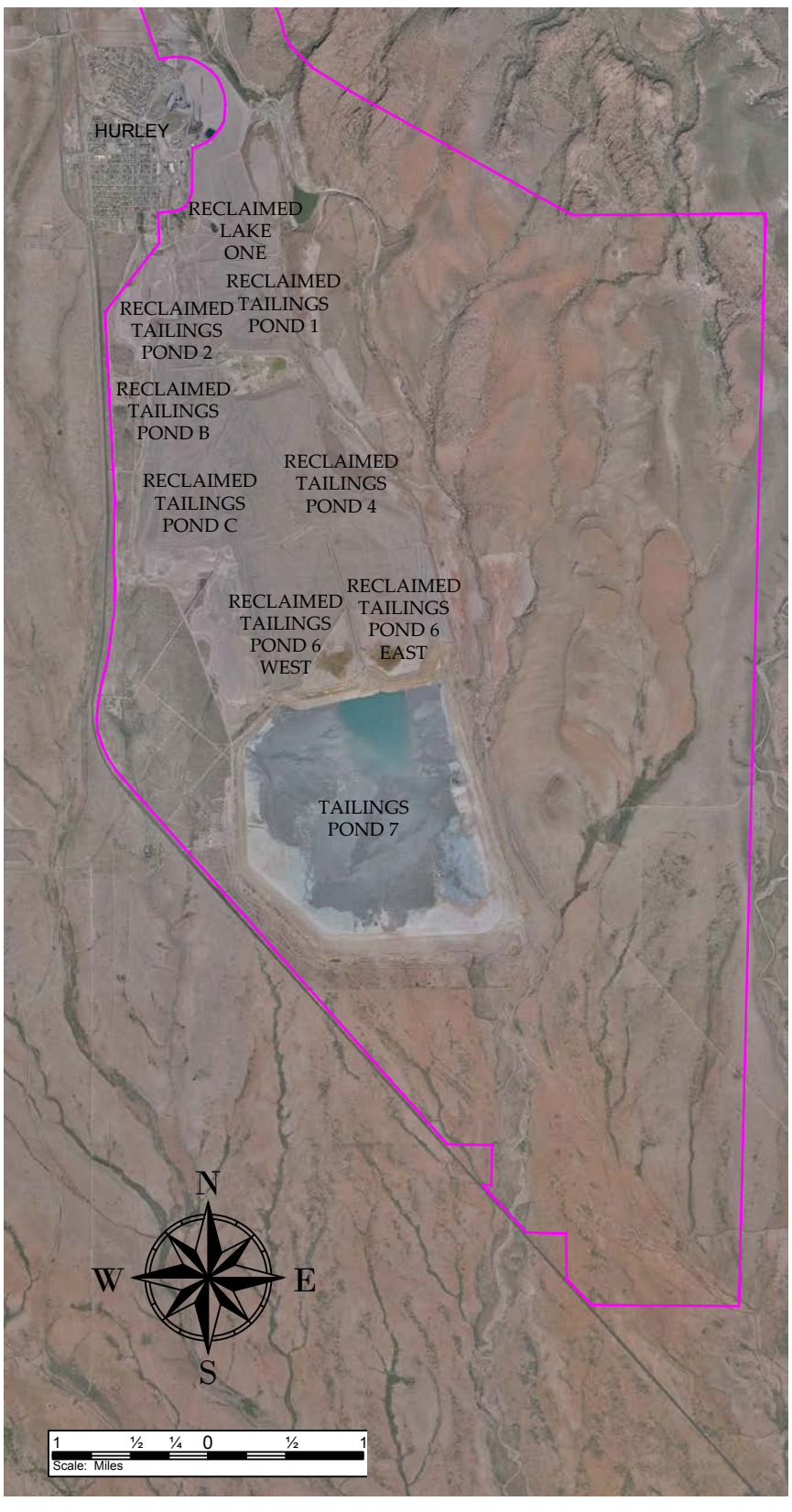
New Mexico Environment Department (NMED), 1994. Administrative Order on Consent, Chino Mines Company and New Mexico Environment Department. December 23, 1994.

NMED, 2010. Letter from Ron Curry (NMED) to Timothy Eastep (Chino) Re: Pre-Feasibility Study Remedial Action Criteria (Pre-FS RAC), Smelter and Tailing Soils Investigation Unit (S/TSIU), Chino Administrative Order on Consent (Chino AOC). September 16, 2010.

NMED, 2011. Letter from William Olsen (NMED) to Ned Hall (Chino) Re: Chino AOC Informal Dispute Resolution, Smelter and Tailing Soils Investigation Unit. March 3, 2011.

SRK Consultants (SRK), 2008. Administrative Order on Consent Remedial Investigation Report, Smelter/Tailing Soil Investigation Unit (revised). Hurley, New Mexico, February 6, 2008.





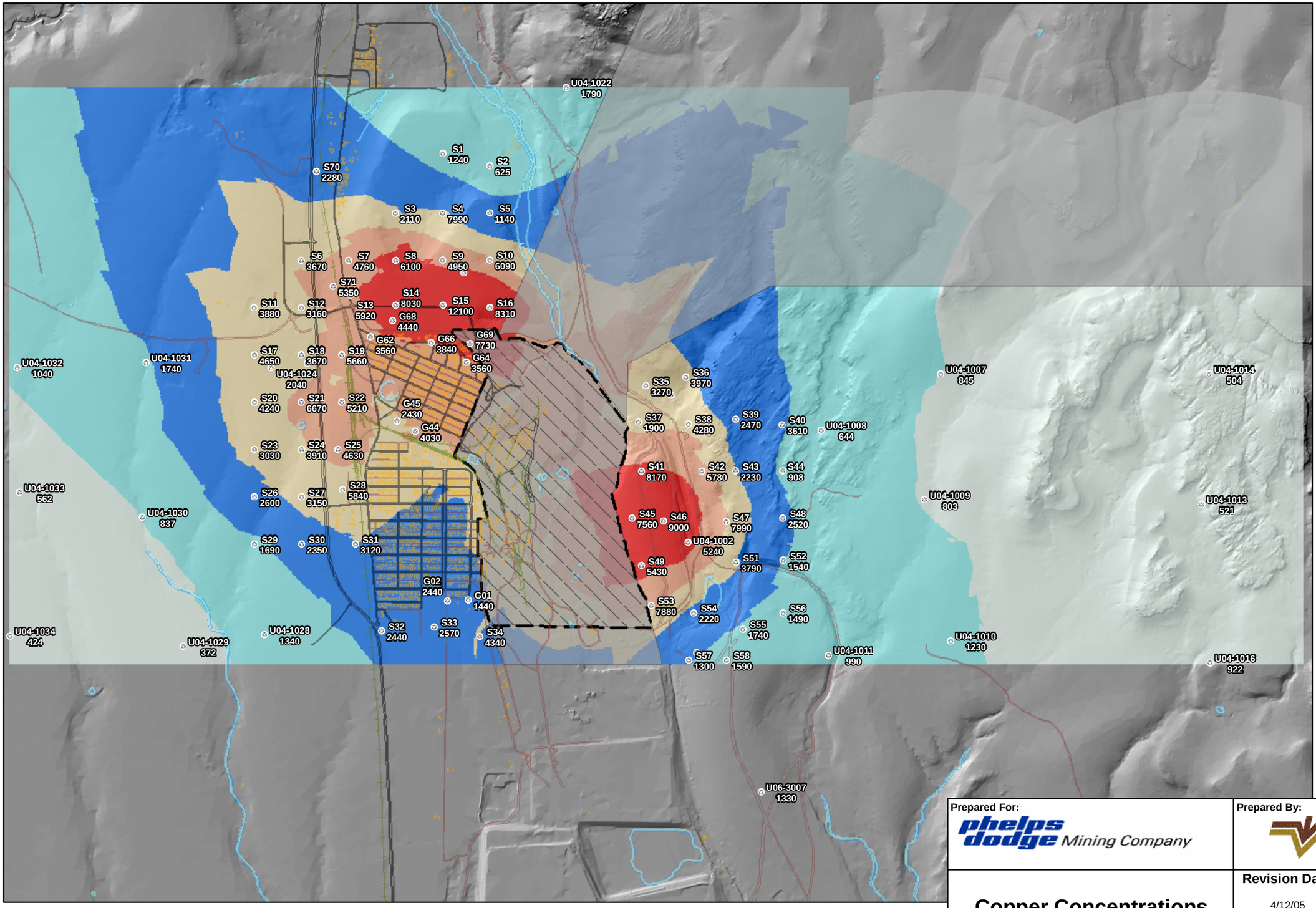
Legend

MMD Boundary

FREEPORT-McMoRan
CHINO MINES COMPANY

South Mine Area MMD Boundary

Scale: As Noted	Date: 6-30-2016	Notes:
Dept. Environmental Services		
Drawn By: SMG	Checked By: PDP	



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Prepared For: phelps dodge Mining Company

Prepared By: SRK Consulting Engineers and Scientists

Copper Concentrations in Surface Soil

Revision Date:	Sheet No.	Figure No:
4/12/05		
Scale:		
Project Number: 069543.01		
Drawing Name: Copper.mxd		

REVISED SUPPLEMENTAL COMPLETION REPORT

RAZORBACK RIDGE AREA

Interim Remedial Action
Smelter/Tailing Soils Investigation Unit

Submitted To: Freeport-McMoRan Chino Mines Company
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Vanadium, New Mexico 88023

Submitted By: Golder Associates Inc.
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Distribution: Pam Pinson, Freeport-McMoRan Chino Mines Co.
Ned Hall, Freeport-McMoRan Inc.

June 30, 2016 **Project No. 14-00277**

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1.0 INTRODUCTION

Freeport-McMoRan Chino Mines Company (Chino) conducted an interim remedial action (IRA) within the Smelter/Tailing Soil Investigation Unit (STSIU) east of Lake One in areas adjacent to the Whitewater Creek Diversion Channel and James Canyon in 2013 and 2014 as part of an Administrative Order on Consent (AOC) with the New Mexico Environment Department (NMED 1994). This area is referred to as the Razorback Ridge Area (Figure 1).

The Interim Removal Action Work Plan for the STSIU (Work Plan) presented an interim action to NMED, to address elevated copper in surface soils to the north and west of Hurley (ARCADIS 2007). The objective of the IRA, as defined in the Work Plan, was to remove soils in areas with copper concentrations higher than 5,000 milligrams per kilogram (mg/kg), delineated laterally. Chino applied this residential remedial action criteria (RAC) for the Hurley Soils Investigation Unit (HSIU) to be conservative. The IRA also proposed that soils in areas with higher than or equal to 5,000 mg/kg copper concentrations would be removed vertically until the copper concentrations were less than 2,700 mg/kg to minimize exposure of newly exposed soils to ground-feeding birds Following the completion of the Golf Course IRA, NMED determined the pre-feasibility study remedial action criteria (Pre-FS RAC) for the STSIU using the HSIU residential copper criteria as well as a copper criteria for ecological risk of 1,600 mg/kg (NMED 2010 and 2011). The STSIU IRA was implemented for areas north and west of Hurley in 2008, the Hurley Golf Course being the majority of the acreage, as detailed in the Interim Removal Action Completion Report, STSIU (ARCADIS 2009). Additional areas identified in the 2007 Work Plan (ARCADIS) as exceeding the RAC along the non-operational areas of the Southwestern Railroad (SWRR) corridor north and west of the Town of Hurley were not addressed in 2008 because access had not been granted by SWRR. Access was granted in 2012 by SWRR and a second interim action for soil removal was implemented that year. The 2008 Golf Course IRA and 2012 Hurley Railroad IRA sites, including the STSIU boundary, are shown in Figure 1.

The Razorback Ridge Area had originally been identified in the earlier Draft IRA Work Plan for the STSIU (Draft Work Plan; BBL 2006) for soil removal action, but was subsequently designated as a future borrow area for eventual closure of the adjacent historical Lake One and Slag Pile (Figure 1) under Discharge Permit 1340 (DP-1340). Future planned excavation of the soils in the Razorback Ridge Area was discussed in the final Work Plan (ARCADIS 2007), documenting that borrow activities for the DP-1340 closure of Lake One and the Slag Pile would remove impacted surface soils in this area. Combining the removal of impacted surface soils in the Razorback Ridge Area with borrow activities for DP-1340 closure optimized the excavation, hauling, and reclamation activities for both project objectives, and incidentally removed impacted soils in the area that were above the pre-FS RAC for ecological risk. The impacted soils would be used as fill and the deeper more extensive borrowing would also provide fill material as well as cover material. Although the objective of the STSIU IRA, including the areas to the west (Hurley Railroad), north

(Golf Course), and east (Razorback Ridge area) of Hurley, was to remove soils exceeding the pre-FS RAC of 5,000 mg/kg for human health, these soils as well were utilized as fill material for DP-1340 reclamation closure of the older tailings. Figure 2 shows the extent of these areas, as defined in the Draft Work Plan (BBL 2006), exceeding the 5,000 mg/kg remedial action criteria. Figure 3 shows the extent of the 5,000 mg/kg copper criteria in the Razorback Ridge area determined statistically from the sample locations denoted in Figure 2. See the STSIU Remedial Investigation Report (SRK, 2008).

In 2013 and 2014, remediation of the Razorback Ridge Area was completed through the Lake One and Slag Pile closure activities under DP-1340 and not under a formal AOC IRA. The Razorback Ridge Area soil excavation and removal activities were reported in detail specific to Razorback Ridge, in the Lake One Construction Design Quality Assurance Report (CDQAR; EMC^2 2014). Post-excavation soil sampling and analysis were completed in accordance with the NMED approved STSIU Work Plan using X-ray fluorescence (XRF) to confirm the removal of copper concentrations below the IRA cleanup criteria.

Borrow activities specific to the Razorback Ridge Area, which removed the impacted soils as discussed in the 2006 and 2007 Work Plans (BBL and ARCADIS), was performed by Freeport-McMoRan Reclamation Services (FMRS) in 2013 and 2014. FMRS also performed surface reclamation (surface preparation and revegetation) for the majority of the site in June 2014. This Completion Report for the Razorback Ridge Area is a supplement to the first IRA Completion Report (ARCADIS 2009). This supplemental completion report documents the activities and results as well as the data collected, analyzed, and validated for the soil removal performed by FMRS in the Razorback Ridge Area targeted for remediation in the Draft Work Plan (BBL 2006). This report is organized into the following eight sections and three appendices:

- **Section 1.0 – Introduction** summarizes the project objectives and provides an overview of the Razorback Ridge IRA.
- **Section 2.0 – Project Overview** summarizes the background for the site and work conducted before the IRA, and discusses the interim remedial action objectives for the Razorback Ridge IRA.
- **Section 3.0 – Pre-Excavation Activities** describes the activities conducted prior to soil removal.
- **Section 4.0 – Excavation Activities** describes the soil removal activities, soil management, materials handling, and final excavation area and removal volumes.
- **Section 5.0 – Confirmation Sampling** presents the field sampling and analysis methods, and analytical results for XRF samples and laboratory split samples.
- **Section 6.0 – Post-Excavation Activities** summarizes final site grading, surface preparation, and revegetation.
- **Section 7.0 – Closing** provides closing statements and Golder Associates Inc. (Golder) key project staff and review signatures.
- **Section 8.0 – References** lists the documents and other resources cited in this report.

- **Appendix A – Site Photographs** shows overview if site conditions during and after excavation, and representative sample location and collection method.
- **Appendix B – Data Validation Report** presents an evaluation of the data quality for samples collected and analyzed at Razorback Ridge and the East Removal Borrow Area.
- **Appendix C – East Removal Borrow Area BMPs** includes a map produced by the Freeport-McMoRan Reclamation and Closure Planning Team showing the post-excavation locations of surface water controls in the East Removal Borrow Area.

2.0 PROJECT OVERVIEW

2.1 Site Location and Description

The Razorback Ridge Area is located east of the Town of Hurley in southwestern New Mexico. The area is divided into two sub-areas noted as Razorback Ridge and the East Removal Borrow Area on Figure 4. The two areas are separated by the operational pipeline corridor and the Whitewater Creek Diversion Channel.

The STSIU was described in detail in the Remedial Investigation (RI) Background Report – Chino Mine Investigation Area (Chino 1995) and in the RI Report Smelter/Tailing Soil Investigation Unit (SRK 2008). The following description focuses on the characteristics and historical operations impacting the Razorback Ridge Area, originally referred to as the "East Area" in the 2006 Draft Work Plan (BBL).

The STSIU surrounds the former smelter, ancillary facilities, historical Hurley Concentrator site, and tailings impoundments. Surface soils in the Razorback Ridge Area were impacted mostly by fallout from historical smelter emissions. This report specifically addresses surface soil impacts where copper concentrations were equal to or exceeded 5,000 mg/kg in the STSIU in non-operational areas of Razorback Ridge and the East Removal Borrow Area. Chino owns all of the property in the removal area, and access to the public is restricted under trespass laws.

The soils targeted in Razorback Ridge for borrow materials for Lake One and Slag Pile fill and soil cover are primarily alluvium and colluvium derived from the Gila Conglomerate geologic unit. Gila Conglomerate alluvial deposits on Razorback Ridge were present in thickness over 40 feet at the south end of the ridge thinning to a few inches at the north end. Borrow material at Razorback Ridge was investigated and characterized in accordance with the Lake One Construction Design and Quality Assurance Plan (CDQAP; EMC^2 2012). The East Removal Borrow Area was primarily a thinner deposit of colluvium from the up-gradient rhyolite units on the east slope of the Whitewater Diversion Creek Channel.

The Whitewater Diversion Channel was excavated through the area in 2000 to divert Whitewater Creek around Lake One, separating Razorback Ridge from the East Removal Borrow Area. An access road on the west side of the Whitewater Diversion Channel and a pipeline corridor on the east hillside of Razorback Ridge remain as operational corridors and were not affected by closure borrow activities nor subject to the AOC remediation requirements.

2.1.1 Historical Operations

The Hurley Smelter was constructed in 1939 and was in operation from 1939 to 2003. The original smelter relied on a single 500-foot-high stack for emissions generated by the furnace and converters in the smelter. In 1967, Chino constructed a 626-foot-high stack for exhaust gas from the converters. The Hurley smelter facility and smelter stacks were dismantled in 2006 and 2007.

2.2 Previous Investigations

Chino conducted two investigations in accordance with the AOC to characterize the STSIU, which incorporates the Razorback Ridge Area. The investigations performed include.

- Chino prepared a background report in 1995 to assess existing environmental conditions; to describe site history, geology, and hydrogeology; and to identify data needs for further investigations for each Investigation Unit (IU). The background report presented an inventory of constituents associated with smelter emissions and fugitive emissions from tailings.
- A STSIU RI was performed by SRK Consultants (SRK) in October and November 2004 and in July and August 2006. The results were summarized in the final STSIU RI (SRK 2008). Data collected during the remedial investigation confirmed a spatial trend in surface soil for several constituents, including copper, which followed the prevailing wind directions with a predominantly eastern component in constituent concentrations in surface soils, primarily in the upper 1 inch.

Remedial actions objectives base on these studies are presented in section 2.3 below.

2.3 Interim Remedial Action Objective and Extent of Contamination

The remedial action objectives were specified in the Draft IRA Work Plan (BBL 2006) and the NMED-approved Work Plan (ARCADIS 2007) for the STSIU soil removal. Figure 1 shows the areas included in the Draft IRA Work Plan, including the Razorback Ridge area east of the former smelter. Copper was identified as the constituent of concern. A Pre-FS RAC for the HSIU of 5,000 mg/kg for copper in soil was deemed to be protective of human health in a residential exposure scenario in the Town of Hurley (Chino 2005). The HSIU residential Pre-FS RAC was selected as the remediation target to address horizontal delineation of copper concentrations criterion as per the NMED approved 2007 STSIU IRA Work Plan. Figure 2 shows copper concentrations in surface soils in the STSIU in the smelter area, with copper concentrations exceeding 5,000 mg/kg highlighted in red. Figure 3 shows the Razorback Ridge Area with exceedances of 5,000 mg/kg copper concentration criterion.

Additionally, the Work Plan proposed removal of soil vertically down to 2,700 mg/kg of copper for areas with newly disturbed soils to minimize exposure to ground feeding birds.. Following the completion of the Golf Course IRA, NMED determined the Pre-FS RAC for the STSIU using the HSIU residential copper criteria as well as a copper criteria for ecological risk of 1,600 mg/kg (NMED 2010 and 2011).

2.4 IRA Implementation Summary

The area identified for soil removal in the Razorback Ridge Area in the Draft IRA Work Plan (BBL 2006) was approximately 123 acres (Figures 2 and 3). This area was characterized during the background investigation (Chino 1995) and the STSIU RI (SRK 2008) as having elevated copper concentrations. As updated in Figure 4, the excavated Razorback Ridge Area perimeter defined in the Draft IRA Work Plan (BBL 2006) was adjusted as described below:

- Areas in the originally defined boundary in Figure 3 were statistically determined from data presented in the 2008 RI report as seen in Figure 2. Actual removal areas were adjusted to remove operational areas, inaccessible areas due to safety or grade, or expanded to add additional fill material volumes.
- For both borrow sites of the Razorback Ridge Area, soil removal was performed to where slopes were too steep, or vertical to flat bedrock, to conduct earthmoving activities safely or to where it was infeasible for the equipment whether or not these areas were targeted for excavation as shown in Figure 4. Areas that were not excavated were not included in the post excavation sampling. These excluded areas will be addressed in the STSIU Draft FS.
- Areas requiring remediation that were excavated in 2014 and 2015 were reclaimed as part of the Lake One reclamation/borrow area footprint. For the East Removal Borrow Area, large trees were not removed and boulders were consolidated to form habitats for wildlife.
- Areas that remain operational, such as active roads and pipeline corridors, were not excavated.
- Additional area outside of the originally targeted 123 acres was excavated due to the need for bulk grading fill and soil cover materials. Materials in this area, specifically Razorback Ridge, were desirable for reclamation materials due to the suitability of the materials for compaction, erosion control, growth medium, and proximity to the areas to be closed. Borrow areas outside the required remediation area shown in Figure 4, including the Historic Borrow Area, were included in post excavation sampling and presented in this report, though the surface soil concentrations did not exceed 5,000 mg/kg.
- The proposed excavation boundaries in both of the 2006 and 2007 workplans are only a statistical representation of the impacted areas, and the confirmation sampling actually defines where the remedial action is completed. Actual remedial action boundaries tend to expand and contract compared to the workplan outline. Pre-removal grid sampling was not utilized for this IRA since Operations had determined to remove soil to resistance (safety issues or infeasibility) for borrow purposes. In Razorback Ridge's case, removal at depth ceased when cover material volumes were no longer needed.
-

The final excavation area for the Razorback Ridge Area addressed in 2013 and 2014 was 94 acres. An additional 29 acres within the IRA Area were remediated through operational construction excavation and borrow activities prior to 2002, and was included in this IRA confirmation sampling documentation. These 123 acres are denoted in Figure 4. Areas excluded from borrow excavation are noted in Figure 4 on the northeast and northwest flanks of Razorback Ridge and the north and south end of the East Removal Borrow Area in which upon close field inspection, it was deemed unsafe to use as additional borrow material.

Soils were excavated to a depth of approximately 12 inches down to 40 feet during excavation for borrow material. In all areas of removal, the Pre-FS RAC for human health for the STSIU of 5,000 mg/kg for copper was achieved. The Pre-FS RAC for ecological risk of 1,600 mg/kg was also achieved in almost all sample locations. Approximately 113,000 cubic yards of soil (73 acres) from Razorback Ridge and 34,000 cubic yards of soil (21 acres) from the East Removal Borrow Area were removed between 2013 and 2014 and used for borrow material, specific to the IRA requirements.

A summary of the IRA implementation is as follows:

- The Draft IRA Work Plan delineated the area that exceeded the cleanup criteria of 5,000 mg/kg copper in August 2006.
- The final IRA Work Plan (November 2007) specified that the Razorback Ridge area excavation would be postponed until reclamation of Lake One.
- Tailing reclamation for all tailing impoundments were reclaimed from 2008 to 2013, using other borrow sources.
- Excavation of borrow materials from Razorback Ridge began in the first quarter of 2013 for use as fill at the Lake One project site under DP-1340, and was completed in June 2014 with completion of the Slag Pile closure.
- Excavation of soil from the East Removal Borrow Area was conducted during February and March of 2014 to supplement the fill volume needed for Lake One and Slag Pile closure.
- Sampling was performed at the East Removal Borrow Area during February and March 2014 and on Razorback Ridge during September 2014.
- Following soil removal and confirmatory sampling, the site was mulched and seeded in June 2014, with the exception of an area that was still being used as a borrow source through the end of June 2014, where revegetation activities were completed in April and May 2015.

3.0 PRE-EXCAVATION ACTIVITIES

3.1 Project Area Delineation

The Razorback Ridge Area is delineated as two sub-areas, Razorback Ridge and the East Removal Borrow Area, separated by the operational pipeline corridor and the Whitewater Creek Diversion channel, as shown in Figure 4.

Razorback Ridge is a topographic high formed from a remnant Gila Conglomerate alluvial fan, and the surface soils on the majority of the ridge area were identified as having elevated copper concentrations (SRK 2008). Razorback Ridge is bounded on the west by the Lake One closure area and on the north, east, and south by an operational road and pipeline corridor. The north end of the ridge, where the alluvial deposits are thin or pinched out, has been used for historical borrow activities. The south end of the ridge, where the alluvial deposits were over 40 feet thick, has also been used historically for borrow, with additional borrow excavation in 2013 and 2014 during closure activities. The Lake One Haul Road traversed the length of the ridge and was used to haul Lake One sediments for reprocessing in the early 2000s. The Razorback Ridge main borrow area (Figure 4) is the primary source of cover material for Lake One and the Slag Pile closure work. Several feet, and up to several tens of feet of material were removed from this area. Outside of the main borrow area, additional material was removed to an average depth of 12 inches, which on the northern section of the ridge was down to bedrock (Sugarlump Formation), but only from non-operational surface areas of the ridge that could be safely accessed. Soils in the inaccessible areas and along the operational corridor were not removed.

The East Removal Borrow Area is bounded on the west by the Whitewater Creek Diversion channel; on the south end by the James Canyon reservoir; and on the east and north by steep rocky cliffs of the Kneeling Nun Formation. An average depth of 12 inches of material was removed down to bedrock (Sugarlump Formation) on the remaining undisturbed surface areas within the East Removal Borrow Area that could be safely accessed.

3.2 Site Preparation

The site preparation was performed in accordance with the Lake One CDQAP (EMC^2 2012), and included obtaining a blue stake (buried utility locate) permit for excavation activities, clearing and grubbing vegetation in the excavation areas, and installation of stormwater best management practices (BMPs) to manage erosion during construction. BMPs are discussed in Section 3.3.

3.3 Best Management Practices

BMPs were installed and maintained on site to limit sediment erosion, control surface water runoff, and minimize dust exposure to workers and fugitive dust emissions.

3.3.1 Erosion and Runoff Controls

Erosion and runoff controls were installed prior to excavation to control erosion during active borrow excavation on both Razorback Ridge and the East Removal Borrow Area. Post-excavation surface water controls are discussed in Section 6.0.

Razorback Ridge drained surface water runoff to operational areas during borrow activities. There is no surface water run-on to the ridge. Runoff on the east slope drained to the access road and then south to the Lake One area prior to and during excavation. An earthen berm approximately 2 to 3 feet high was built at the toe of the west slope to prevent transport of sediment from the hillside onto the Lake One closure area which was undergoing closure.

Earthen berms were used to contain runoff from the slope of the East Removal Borrow Area. Some existing berms were already located along the access road to James Canyon Reservoir. These berms were supplemented as necessary during soil removal in February and March 2014. Run-on control measures were not necessary for the East Removal Borrow Area because the only source of run-on was from steep cliffs where BMP installation was not practical. Furthermore, the amount of run-on from that area was minimal. A 1- to 2-foot run-on control soil berm was installed on the east and upgradient side of the slope immediately following removal activities to prevent erosion of the reclaimed slope (Appendix C).

3.3.2 Dust Control

During excavation activities, dust was controlled by applying water via water trucks to soils where excavation and loading took place, and along adjacent access roads and the Lake One Haul Road. Revegetation of the area will function as the long-term dust control measure.

4.0 EXCAVATION ACTIVITIES

This section describes excavation methods and soil management during soil removal activities. Field photographs showing soil excavation activities are included in Appendix A.

4.1 Soil Excavation

Excavation began in the first quarter of 2013 from the Razorback Ridge borrow area and was completed in June 2014. The main borrow area was (Figure 4) the primary source of fill and soil cover for Lake One and the Slag Pile. The upper foot of surface soil at the main borrow, and the surface material removed from the Razorback Ridge hillsides and the East Removal Borrow Area, were considered impacted and were used as construction fill beneath clean soil cover material, in accordance with the CDQAP. All soil removal activities were performed by FMRS. Soils removal in the East Removal Borrow Area was initiated in February 2014 and completed in March 2014. The East Removal Borrow Area includes a steep mountain slope on its east boundary, the broad toe of the slope, and an access road along the toe. Soil was removed down to resistance (bedrock).

Soil removal was accomplished using bull dozers and a front end loader. Large bull dozers were used to push the soil to staging areas where it was loaded in haul trucks with the front end loader. Small bull dozers were used along excavation boundaries, around trees on the East Removal Borrow Area slope, and to achieve final grade following excavation activities.

FMRS removed an average of 12 inches of soil across the excavation area, which was shown to be sufficient to achieve the RAC of 5,000 mg/kg in the areas excavated during the Hurley Golf Course IRA in surface soils more proximal to the smelter stack (ARCADIS 2009). In the main borrow area, soil removal depths were up to 40 feet.

In accordance with DP-1340, excavated surface soils with elevated copper concentrations were placed on Lake One (Chino 2012). Care was taken to limit the amount of debris, rocks, and vegetation transported to Lake One, since these materials are undesirable for construction fill material.

Clearing and grubbing removal were necessary prior to soil excavation. Clearing and grubbing efforts resulted in piles of vegetative debris that were hauled to the construction and debris landfill south of Lake One. In addition, four piles of cobbles, boulders, and grubbed shrub debris were left along the toe of the slope to serve as wildlife habitat.

4.2 Final Excavation Volumes and Areas

Figure 4 shows the final areas of excavation, based on a pre-excavation survey and 2014 aerial photographs. The excavated areas, which include pre-2002 as well as recent disturbed acres, are as follows:

- Razorback Ridge Main Borrow Area: 57.5 acres
- Razorback Ridge Hillsides: 27.7 acres
- East Removal Borrow Area: 37.5 acres

The total area of the recent borrow and pre-2002 excavation is 122.7 acres. The total volume of soil, within the 1-foot surface cut removal, excavated and transported to Lake One and the Slag Pile during this IRA was approximately 147,000 banked cubic yards as reported by FMRS. An additional 1,335,288 banked cubic yards was excavated from the Razorback Ridge Main Borrow Area for the closure project.

5.0 SOIL SAMPLING AND ANALYSIS

Confirmation sampling methods and results are presented in this section. Sampling and analyses were conducted in accordance with the Work Plan (ARCADIS 2007). Per the IRA objective, surface soil was removed from the Razorback Ridge Area where total copper concentrations were expected to be higher than 5,000 mg/kg during Lake One and Slag Pile closure. The objective of the sampling and analysis was to confirm that the RAC had been achieved by soil removal. Analyses were performed using XRF in Golder's field laboratory in the town of Hurley, or shipped to our field office in Ohio, in accordance with the Work Plan.

Soil sampling on the Razorback Ridge hillsides and the East Removal Borrow Area was performed as proposed in the Draft Work Plan (BBL 2006) using the grid spacing established in the Work Plan (ARCADIS 2007), and consistent with the Hurley Golf Course and Hurley Railroad IRAs. Sampling in the main borrow area, was performed on a coarser grid, as approved by NMED in an email dated September 19, 2014 (NMED 2014).

5.1 Sample Size and Locations

The sample locations used for confirmation sampling over the majority of the site were selected using a grid spacing of 132 feet that resulted from the statistical calculation as per United States Environmental Protection Agency (USEPA) Methods for Evaluating Attainment of Cleanup Standards (USEPA 1995), as prescribed in the Work Plan (ARCADIS 2007). The main borrow area, where soil removal thickness was up to 40 feet, was sampled at 10 randomly selected locations, determined using a geographical information system random location generator. The alternate, more limited grid sample density proposed to NMED was developed due to copper migrating no deeper than a few inches whether sourced from smelter fallout or windblown tailing as documented in past AOC IRAs (Golder 2008, 2013; ARCADIS 2009).

A total of 251 potential sample locations were generated for the project areas using the methodology described above. Sample locations are shown in Figure 4. Golder collected a total of 209 confirmation samples from these locations following cessation of closure borrow activities. Of which, 96 samples were collected from Razorback Ridge hillsides and 113 samples were collected in the East Removal Borrow Area. Within this East Removal Borrow Area, 42 locations on the sampling grid were not sampled because they fell more than 10 feet beyond the boundary where excavation efforts could not be performed safely due to steep, rocky slopes. The sampling grid, developed prior to soil removal, extends to the north and south outside of the actual excavation boundary due to uncertainty about how much additional fill material Tailings Operations would remove for borrow material while performing the actual remedial action. These 42 sample locations remain on Figure 4 to avoid gaps in the numbering system

In the sample areas where the 132-foot sampling grid was used, a random point was selected for the initial grid location. A hand-held global positioning system (GPS) unit was used to locate grid points in the field.

Some locations were adjusted slightly if the original grid point was located on bedrock or other non-soil surfaces. Additionally, some locations that fell outside, but within 10 feet of the boundary of excavation, were moved from the original grid point so the sample point was slightly inside the boundary.

5.2 Post-Excavation Confirmation Sampling

Soil samples were collected in the field in general accordance with applicable Standard Operating Procedures (SOPs) included in the Work Plan (ARCADIS 2007). In the East Removal Borrow Area, confirmation samples were collected immediately following soil excavation to confirm the RAC had been achieved, in case additional removal was required to meet the RAC. However, all XRF confirmation samples met the RAC and no additional excavation was required. East Removal Borrow Area samples were collected in February and March 2014. At Razorback Ridge, sampling was performed in September 2014 following completion of borrow activities. The excavated hillsides for both the East Removal Borrow Area and Razorback Ridge had been reclaimed by scarifying, mulching, and seeding prior to sampling. Photographs showing representative sampling locations and methods are included in Appendix A.

5.3 Field Sampling Methods

The following methods were used to collect soil samples for XRF analyses.

1. Following excavation, Golder personnel located the confirmation sampling site using a hand-held GPS unit.
2. Samples were collected from the surface to 1 inch below ground surface.
3. Soil samples were collected using a new, clean, disposable, plastic trowel and placed in a new, clean, zippered plastic bag.
4. Plastic bags were labeled with the sample identifier (ID), round number, sampler's initials, date, and time immediately after sample collection.
5. Sample holes were backfilled to grade with surrounding native material.
6. Sampling equipment was disposed of and replaced with new equipment before proceeding to the next sample location.
7. Samples remained in control of field personnel or were stored securely, until they were delivered to the field laboratory or Golder's Silver City office. Samples were promptly sieved and prepared for XRF analysis. Samples were generally dry and no sample drying was required for preparation.
8. Samples collected from the East Removal Borrow Area were shipped with chain of custody to the Golder XRF laboratory where they were analyzed by XRF immediately or securely stored until analyzed.
9. Samples collected from the Razorback Ridge Area were analyzed by Golder personnel in Golder's field laboratory in the Hurley Operations Area immediately after collection.

The following SOPs were provided in the Work Plan (ARCADIS 2007) and were utilized during this field sampling program.

- Field and laboratory samples were numbered and recorded in accordance with Field Document Control (SOP-1).
- Field logbooks were maintained in accordance with Field Logbook and Field Sample Data Sheets (SOP-2).
- Quality control of samples, including sample preparation, was completed in accordance with Field Quality Control (SOP-3).
- Chain of custody procedures, as outlined in Sample Custody Procedures (SOP-4), were followed during sample collection and shipping to the laboratory.
- Field samples from the East Removal Borrow Area were prepared in Golder's Silver City office and subsequently shipped for XRF analysis to Golder's laboratory in Columbus, Ohio, following procedures in Packaging and Shipping of Environmental Sample Containers (SOP-5).
- Split-sample analyses conducted by SVL Laboratory (SVL) in Kellogg, Idaho, were requested in accordance with Requesting Environmental Laboratory Services (SOP-7).
- Quality control measures outlined in Sampling, Preservation, and Containerization (SOP-14) were followed to ensure soil was sampled, prepared, and handled accordingly.

5.4 XRF Analysis

Sample preparation followed the guidelines of USEPA Method 6200 (USEPA 1998) and the applicable SOPs in the Work Plan (ARCADIS 2007). Soil samples collected in the East Removal Borrow Area were prepared at Golder's Silver City office and shipped to Golder's Ohio XRF laboratory for analysis. Subsequent to soil sampling at the East Removal Borrow Area, Golder established a field laboratory in Hurley where samples from the Razorback Ridge area were prepared and analyzed by Golder personnel. One zippered plastic bag of soil was collected for each sample. XRF analysis results are summarized in Table 1. The general procedure was:

1. At the soil preparation location, the bag of soil was shaken and rolled to mix material that may have separated after collection.
2. Typically, soils from the STSIU site were dry and sandy; however, some samples were wet and required drying prior to XRF analysis. A microwave oven was used to dry the wet samples.
3. The soil was disaggregated by screening through a United States Standard 10-mesh sieve (2 millimeters [mm]).
4. The less than 2-mm fraction of each soil sample was placed into a new polypropylene sample cup using a new, clean, plastic spoon, and covered with Mylar film. The sample ID and round number were written on the side of the cup. Material left over after collecting the required volume was discarded in the Lake One staging area.
5. The XRF samples collected from the East Removal Borrow Area were shipped via Federal Express for overnight delivery to Golder's Columbus, Ohio, XRF laboratory for analysis. These XRF samples were analyzed using an Innov-X Model DS-4000™ portable XRF unit. Calibration and standardization of the XRF unit were in accordance with USEPA Method 6200 (1998) and the manufacturer's recommendations.
6. The XRF samples collected for the Razorback Ridge Area were analyzed in Golder's field laboratory in the Hurley Operations Area using an Innov-X Model Alpha-5957 portable XRF

unit. Calibration and standardization of the XRF unit were in accordance with USEPA Method 6200 (1998) and the manufacturer's recommendations.

7. After analysis, a minimum of 10 percent of the samples were shipped to an analytical laboratory for split-sample analysis, as described in Section 5.5.
8. To avoid cross-contamination, sieves were thoroughly brushed. If any soil remained on the sieve after bushing, the sieve was washed with soap and water and dried before reuse.

5.5 Laboratory Confirmation Sample Results

At least 10 percent of the samples analyzed by XRF were submitted for independent analysis, as outlined in the Work Plan (ARCADIS 2007). Of the 209 samples that were analyzed by XRF during the IRA confirmation periods, 22 (or 10.5 percent) were submitted for laboratory analysis at SVL.

Laboratory Confirmation samples were selected from every 10th soil sample as shown in alphanumeric order in Table 2. One additional split sample was selected from a sample (RR-213) that exhibited higher than typical copper concentrations (2,010 mg/kg) when tested with the field XRF unit in order to confirm accuracy of the Innov-X unit in the upper range of copper concentrations.

The laboratory confirmation samples that were shipped to SVL were the same aliquots of the samples analyzed with the Innov-X unit. After XRF analysis, the split sample was placed in a new zippered plastic bag. One sample batch was shipped under chain of custody to SVL for laboratory analysis. Laboratory confirmation sample results are listed in Table 2.

5.6 Quality Assurance / Quality Control

5.6.1 Field and Laboratory Quality Control

Field and laboratory quality assurance / quality control (QA/QC) procedures performed for the Razorback Ridge Area IRA were consistent with procedures followed during the HSIU, Hurley Railroad, and the Golf Course IRAs. Procedures are documented in the IRA Completion Report (ARCADIS 2009).

5.6.2 Data Validation Review of XRF and Laboratory Data

A data validation review was conducted by Golder and the results are in Appendix B. Data validation is assessed by reviewing parameters that define the data quality objectives, including precision, accuracy, representativeness, comparability, and completeness.

Remedial decisions for the Razorback Ridge Area were made based on XRF analysis of the soil samples. Data validation of the XRF data was completed by comparing the XRF data to split-sample results from SVL. Results of the data validation review indicated that the XRF unit used for the project was sufficiently accurate for screening soil at the 5,000-mg/kg copper criteria.

As detailed in Appendix B, qualification of selected laboratory based copper and iron results was applied dure to exceeded holding times for the laboratory based analyses for the East Removal Borrow Area confirmation samples. Qualification of selected laboratory based copper and iron results was applied as a consequence of the data validation actions due to the issue of exceeded holding times for the laboratory based analyses. However, the estimated qualifiers applied for the selected samples are not a determining factor in data quality. This is because the comparison of laboratory based analyses with the field XRF analyses exhibits that nearly 50 percent of the samples of concern have a positive percent difference of copper values, and the balance shows a negative percent difference of copper values (Appendix B). This implies that exceeded holding times for this set of samples does not confirm a bias to the values for copper. In addition, the percent difference of iron is consistently biased low for the laboratory based analysis, which is expected due to the difference in analyte quantitation between the two analytical methods. Therefore, the data validation review has applied the qualification of estimated for detected results ('J' qualifier) to these copper and iron results, which should be considered as an advisory condition to the data user, and not an analytical data quality deficiency.

5.7 Razorback Ridge Area Post Excavation Sampling Results

Confirmation soil samples were collected on a grid as proposed in the Draft Work Plan (BBL 2006) on the Razorback Ridge hillsides and the East Removal Borrow Area. Soil samples in the main borrow area were collected at 10 randomly selected sample locations, as approved by NMED (NMED 2014). All soil samples were collected following removal of soils during excavation of borrow materials for Lake One and Slag Pile closure under DP-1340.

Concentrations of copper in all samples collected following cessation of closure borrow activities and analyzed by XRF, were below the Pre-FS RAC of 5,000 mg/kg for human health in a residential scenario. Analytical results are listed in Table 1 and shown in Figure 4. The maximum concentration of copper in all samples collected was 2,371 mg/kg at sample location R-213. The average concentration was less than 400 mg/kg. Laboratory confirmation sample results verified that the soils with copper concentrations greater than 5,000 mg/kg in the Razorback Ridge Area were removed.

6.0 POST-EXCAVATION ACTIVITIES

6.1 Final Grading and Surface Water Controls

BMPs for erosion control described in Section 3.3 were modified after completion of soil removal as appropriate for long-term surface water controls. At Razorback Ridge following completion of the borrow activities, the berm along the toe of the west hillside was removed and a drainage ditch was installed to discharge surface water off site via the historic Whitewater Creek diversion ditch at the southeast corner of Lake One. The access road along the east side of Razorback Ridge was routed to a sedimentation trap and also now flows to the diversion ditch for off-site discharge. The revegetated surface of the excavated soil also minimize erosion and transport of sediments. These surface water controls are described in detail in the CDQAR.

The East Removal Borrow Area BMPs were replaced with long-term surface water controls and the area was not included in the CDQAP nor was it tied into the overall reclamation drainage controls, being separated from the Lake One area by the Whitewater Creek Diversion Channel. The East Removal Borrow Area surface water controls were developed by FMRS and are shown on a map included in Appendix C. The surface water controls include berms or swales on the upgradient and downgradient edges of the excavated slope to route water surface water from the reclaimed surface to James Canyon Reservoir. Rock armor was placed along the slopes at the south and north ends of the East Removal Borrow Area to stabilize the transition from the reclaimed slope to the unexcavated native soil. Rock armor was also placed in a native channel that drains upgradient run-on across the excavated surface to the swale at the slope toe. Along the access road at the toe of the slope, water bars were placed at intervals of approximately 600 feet to prevent scour from runoff and to drop out sediment. The water bars are approximately 2 to 3 feet wide and 1 foot high. The revegetated surface of the excavated soil also acts as a long-term BMP to minimize erosion and transport of sediments.

Monitoring of the on-site surface water controls and off-site stormwater discharge from the Razorback Ridge Area will be performed as part of the Chino Site-Wide Storm Water Pollution Prevention Plan (USEPA Stormwater Multi-Sector General Permit [MSGP-2008] Number NMR05GD16).

Minimal post-excavation grading was required. Excavation at the main borrow area of Razorback Ridge removed a wedge of alluvial material from a foot thick or less at the north end to approximately 40 feet thick at the south end, but maintained positive drainage to the south and resulted in shallower slope than the original surface. Post-excavation slopes of Razorback Ridge hillsides and the East Removal Borrow Area generally mimicked the pre-excavation topography due to the close proximity to bedrock. The surface was smoothed and minor grading was performed to tie in the excavated slope areas to the adjacent existing ground surface.

6.2 Revegetation

Revegetation of the excavation area is a BMP to limit erosion. The Lake One CDQA sets additional reclamation success criteria for Razorback Ridge. Revegetation was initiated in June 2014, when the East Removal Borrow Area, Razorback Ridge hillsides, and a portion of the main borrow area were seeded and mulched. Revegetation was completed on the remaining portion of the main borrow area in April and May 2015. Seeding rates were consistent with the Work Plan (ARCADIS 2007), although the seed mix was adjusted slightly to reflect the more recent changes in the Chino Closure/Closeout requirements. The seed mixture and application rates are listed in Table 3.

FMRS scarified the surface to approximately 6 inches deep to prepare the seedbed using a grader equipped with ripper shanks on flat areas and a dozer on slopes. Seeding was accomplished using a combined drill and broadcast process. After seeding, straw mulch was spread at a rate of 2 tons per acre and crimped into the soil surface with a disk.

Razorback Ridge is identified in the CDQAP as a borrow area for the Lake One closure project and will be managed under closure/closeout requirements. Additionally, Razorback Ridge may be reopened as a borrow source for future operational projects. The East Removal Borrow Area, which is not identified in the CDQAP, will be monitored under the AOC according to the IRA Work Plan (ARCADIS 2007). Current and anticipated future land use is wildlife habitat, although this IRA was conducted to address residential land use.

Quarterly inspections will be performed for erosional features for 4 years following seeding and mulching in April 2015 to confirm that vegetation is sufficiently established for erosion and control. After the 4th year of monitoring, Chino will submit a vegetation monitoring report to NMED with recommendations for either continued monitoring or cessation of monitoring, based on vegetation success, as detailed in the IRA Completion Report (ARCADIS 2009).

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TABLES

Table 1: XRF Analytical Results

Sample ID	Sample Date	Longitude NAD 83 Decimal Degrees	Latitude NAD 83 Decimal Degrees	Analysis Date	XRF Copper (ppm)	Copper +/- (ppm)
RR-012	3/10/2014	-108.11011	32.70257	3/12/2014	**176**	4.0
RR-013	3/10/2014	-108.10972	32.70257	3/12/2014	**50**	3.0
RR-014	3/10/2014	-108.10933	32.70257	3/12/2014	**1235**	9.7
RR-015	3/1/2014	-108.11206	32.70224	3/5/2014	**123**	4.0
RR-016	3/1/2014	-108.11167	32.70224	3/5/2014	**141**	4.0
RR-019	3/10/2014	-108.11049	32.70224	3/12/2014	**390**	6.0
RR-020	3/10/2014	-108.11010	32.70224	3/12/2014	**989**	8.7
RR-021	3/10/2014	-108.10971	32.70224	3/12/2014	**61**	3.0
RR-023	3/1/2014	-108.11127	32.70191	3/5/2014	**303**	5.0
RR-024	3/1/2014	-108.11088	32.70191	3/5/2014	**1578**	12.0
RR-026	3/10/2014	-108.11010	32.70191	3/12/2014	**1265**	10.0
RR-027	3/10/2014	-108.10971	32.70191	3/12/2014	**465**	6.0
RR-029	3/1/2014	-108.11088	32.70158	3/5/2014	**23**	3.0
RR-030	3/10/2014	-108.11049	32.70158	3/12/2014	**573**	7.0
RR-031	3/10/2014	-108.11010	32.70158	3/12/2014	**16**	3.0
RR-032	3/10/2014	-108.10971	32.70158	3/12/2014	**284**	4.7
RR-033	3/10/2014	-108.10932	32.70158	3/12/2014	**1312**	10.3
RR-035	3/1/2014	-108.11088	32.70125	3/5/2014	**697**	7.7
RR-036	3/10/2014	-108.11049	32.70125	3/12/2014	**108**	4.0
RR-037	3/10/2014	-108.11010	32.70125	3/12/2014	**851**	8.0
RR-038	3/10/2014	-108.10971	32.70125	3/12/2014	**590**	6.7
RR-041	3/1/2014	-108.11088	32.70092	3/5/2014	**484**	6.7
RR-042	3/10/2014	-108.11049	32.70092	3/12/2014	**79**	3.0
RR-043	3/10/2014	-108.11010	32.70092	3/12/2014	**780**	8.0
RR-044	3/10/2014	-108.10971	32.70092	3/12/2014	**660**	7.0
RR-045	3/10/2014	-108.10932	32.70092	3/12/2014	**40**	3.0
RR-047	3/1/2014	-108.11088	32.70059	3/5/2014	**50**	3.0
RR-048	3/1/2014	-108.11049	32.70059	3/5/2014	**271**	5.0
RR-049	3/1/2014	-108.11010	32.70059	3/5/2014	**39**	3.0
RR-050	3/10/2014	-108.10971	32.70059	3/12/2014	**955**	9.0
RR-051	3/10/2014	-108.10932	32.70059	3/12/2014	**761**	7.7
RR-053	3/1/2014	-108.11049	32.70026	3/5/2014	**165**	4.0
RR-054	3/1/2014	-108.11010	32.70026	3/5/2014	**367**	6.0
RR-055	3/1/2014	-108.10971	32.70026	3/5/2014	**54**	3.0
RR-056	3/1/2014	-108.10932	32.70026	3/6/2014	**982**	9.0
RR-058	3/1/2014	-108.11049	32.69993	3/6/2014	**496**	6.7
RR-059	3/1/2014	-108.11010	32.69993	3/6/2014	**842**	8.0
RR-060	3/1/2014	-108.10971	32.69993	3/6/2014	**820**	8.0
RR-061	3/1/2014	-108.10932	32.69993	3/6/2014	**707**	7.7
RR-063	3/1/2014	-108.11049	32.69960	3/6/2014	**597**	7.0
RR-064	3/1/2014	-108.11010	32.69960	3/6/2014	**1006**	9.0
RR-065	3/1/2014	-108.10971	32.69960	3/6/2014	**1154**	10.0
RR-066	3/1/2014	-108.10932	32.69960	3/6/2014	**1479**	11.3
RR-069	3/1/2014	-108.11010	32.69927	3/6/2014	**369**	5.7
RR-070	3/1/2014	-108.10971	32.69927	3/6/2014	**585**	7.0
RR-071	3/1/2014	-108.10932	32.69927	3/6/2014	**97**	3.3
RR-072	3/1/2014	-108.10893	32.69927	3/6/2014	**93**	3.0
RR-074	3/1/2014	-108.11009	32.69894	3/6/2014	**363**	6.0
RR-075	3/1/2014	-108.10970	32.69894	3/6/2014	**615**	7.0
RR-076	3/1/2014	-108.10931	32.69894	3/6/2014	**1008**	9.3
RR-077	3/1/2014	-108.10892	32.69894	3/6/2014	**63**	3.0

Table 1: XRF Analytical Results

Sample ID	Sample Date	Longitude NAD 83 Decimal Degrees	Latitude NAD 83 Decimal Degrees	Analysis Date	XRF Copper (ppm)	Copper +/- (ppm)
RR-079	3/1/2014	-108.11009	32.69861	3/6/2014	**673**	7.3
RR-080	3/1/2014	-108.10970	32.69861	3/6/2014	**473**	6.0
RR-081	3/1/2014	-108.10931	32.69861	3/6/2014	**1330**	10.7
RR-082	3/1/2014	-108.10892	32.69861	3/6/2014	**416**	6.0
RR-084	3/1/2014	-108.11009	32.69828	3/6/2014	**79**	3.0
RR-085	3/1/2014	-108.10970	32.69828	3/6/2014	**1319**	11.0
RR-086	3/1/2014	-108.10931	32.69828	3/6/2014	**89**	3.7
RR-087	3/1/2014	-108.10892	32.69828	3/6/2014	**822**	8.0
RR-089	3/1/2014	-108.10970	32.69795	3/6/2014	**273**	5.0
RR-090	3/1/2014	-108.10931	32.69795	3/6/2014	**475**	6.0
RR-091	3/1/2014	-108.10892	32.69795	3/6/2014	**427**	5.7
RR-092	3/1/2014	-108.10853	32.69796	3/6/2014	**38**	3.0
RR-094	3/1/2014	-108.10970	32.69762	3/6/2014	**298**	5.0
RR-095	3/1/2014	-108.10931	32.69762	3/6/2014	**461**	6.0
RR-096	3/1/2014	-108.10892	32.69762	3/6/2014	**558**	6.7
RR-097	3/1/2014	-108.10853	32.69763	3/6/2014	**187**	4.0
RR-099	3/1/2014	-108.10970	32.69729	3/6/2014	**366**	6.0
RR-100	3/1/2014	-108.10931	32.69729	3/6/2014	**720**	7.3
RR-101	3/1/2014	-108.10892	32.69729	3/6/2014	**183**	4.0
RR-102	3/1/2014	-108.10853	32.69730	3/6/2014	**24**	3.0
RR-103	3/1/2014	-108.10814	32.69730	3/6/2014	**527**	6.7
RR-104	3/1/2014	-108.10970	32.69696	3/6/2014	**372**	6.0
RR-105	3/1/2014	-108.10931	32.69696	3/6/2014	**374**	6.0
RR-106	3/1/2014	-108.10892	32.69696	3/6/2014	**237**	5.0
RR-107	3/1/2014	-108.10853	32.69697	3/6/2014	**514**	6.3
RR-108	3/1/2014	-108.10814	32.69697	3/6/2014	**346**	5.0
RR-109	3/1/2014	-108.10931	32.69663	3/6/2014	**302**	5.0
RR-110	3/1/2014	-108.10892	32.69664	3/6/2014	**311**	5.0
RR-111	3/1/2014	-108.10853	32.69664	3/6/2014	**538**	7.0
RR-112	3/1/2014	-108.10814	32.69664	3/6/2014	**49**	3.0
RR-113	3/1/2014	-108.10931	32.69630	3/6/2014	**222**	5.0
RR-114	3/1/2014	-108.10892	32.69631	3/6/2014	**504**	6.3
RR-115	3/1/2014	-108.10853	32.69631	3/6/2014	**986**	9.0
RR-116	3/1/2014	-108.10814	32.69631	3/6/2014	**36**	3.0
RR-118	3/1/2014	-108.10931	32.69597	3/6/2014	**219**	5.0
RR-119	3/1/2014	-108.10892	32.69598	3/7/2014	**146**	4.0
RR-120	3/1/2014	-108.10853	32.69598	3/7/2014	**577**	7.0
RR-121	3/1/2014	-108.10814	32.69598	3/7/2014	**277**	5.0
RR-123	3/1/2014	-108.10930	32.69564	3/7/2014	**375**	6.0
RR-124	3/1/2014	-108.10891	32.69565	3/7/2014	**187**	4.3
RR-125	3/1/2014	-108.10852	32.69565	3/7/2014	**426**	6.3
RR-126	3/1/2014	-108.10813	32.69565	3/7/2014	**53**	3.0
RR-128	3/1/2014	-108.10930	32.69531	3/7/2014	**227**	4.3
RR-129	3/1/2014	-108.10891	32.69532	3/7/2014	**460**	6.0
RR-130	3/1/2014	-108.10852	32.69532	3/7/2014	**497**	6.3
RR-131	3/1/2014	-108.10813	32.69532	3/7/2014	**134**	4.0
RR-132	3/1/2014	-108.10774	32.69532	3/7/2014	**539**	6.3
RR-133	3/1/2014	-108.10891	32.69499	3/7/2014	**38**	3.0
RR-134	3/1/2014	-108.10852	32.69499	3/7/2014	**334**	5.3
RR-135	2/28/2014	-108.10813	32.69499	3/7/2014	**558**	6.7
RR-136	3/1/2014	-108.10774	32.69499	3/7/2014	**479**	6.0

Table 1: XRF Analytical Results

Sample ID	Sample Date	Longitude NAD 83 Decimal Degrees	Latitude NAD 83 Decimal Degrees	Analysis Date	XRF Copper (ppm)	Copper +/- (ppm)
RR-137	3/1/2014	-108.10891	32.69466	3/7/2014	**313**	5.0
RR-138	3/1/2014	-108.10852	32.69466	3/7/2014	**478**	6.3
RR-139	2/28/2014	-108.10813	32.69466	3/7/2014	**25**	3.0
RR-140	3/1/2014	-108.10774	32.69466	3/7/2014	**178**	4.0
RR-142	3/1/2014	-108.10852	32.69433	3/7/2014	**407**	6.0
RR-143	2/28/2014	-108.10813	32.69433	3/7/2014	**83**	3.3
RR-144	3/1/2014	-108.10774	32.69433	3/7/2014	**207**	4.3
RR-147	2/28/2014	-108.10852	32.69400	3/7/2014	**661**	7.7
RR-148	2/28/2014	-108.10813	32.69400	3/7/2014	**292**	5.0
RR-149	2/28/2014	-108.10774	32.69400	3/7/2014	**74**	3.3
RR-152	3/1/2014	-108.10774	32.69367	3/7/2014	**228**	4.7
RR-156	9/24/2014	-108.11244	32.69960	9/29/2014	**125**	10
RR-157	9/25/2014	-108.11205	32.69960	9/29/2014	**181**	13
RR-158	9/25/2014	-108.11322	32.69926	9/29/2014	**130**	11
RR-159	9/25/2014	-108.11283	32.69927	9/29/2014	**123**	11
RR-160	9/25/2014	-108.11244	32.69927	9/29/2014	**151**	12
RR-161	9/25/2014	-108.11205	32.69927	9/29/2014	**172**	12
RR-162	9/25/2014	-108.11166	32.69927	9/29/2014	**958**	24
RR-163	9/24/2014	-108.11400	32.69893	9/29/2014	**197**	13
RR-164	9/25/2014	-108.11322	32.69893	9/29/2014	**621**	21
RR-165	9/25/2014	-108.11283	32.69894	9/29/2014	**989**	25
RR-166	9/25/2014	-108.11244	32.69894	9/29/2014	**645**	21
RR-167	9/25/2014	-108.11205	32.69894	9/29/2014	**601**	20
RR-168	9/25/2014	-108.11166	32.69894	9/29/2014	**559**	19
RR-169	9/24/2014	-108.11399	32.69860	9/29/2014	**361**	16
RR-170	9/25/2014	-108.11321	32.69860	9/29/2014	**708**	22
RR-171	9/25/2014	-108.11282	32.69861	9/29/2014	**331**	16
RR-172	9/25/2014	-108.11243	32.69861	9/29/2014	**909**	25
RR-173	9/25/2014	-108.11204	32.69861	9/29/2014	**480**	18
RR-174	9/25/2014	-108.11165	32.69861	9/29/2014	**200**	13
RR-175	9/24/2014	-108.11438	32.69827	9/29/2014	**255**	14
RR-176	9/24/2014	-108.11399	32.69827	9/29/2014	**1889**	36
RR-177	9/25/2014	-108.11321	32.69827	9/29/2014	**221**	14
RR-178	9/25/2014	-108.11282	32.69828	9/29/2014	**427**	17
RR-179	9/25/2014	-108.11243	32.69828	9/29/2014	**245**	14
RR-180	9/25/2014	-108.11204	32.69828	9/29/2014	**216**	14
RR-181	9/25/2014	-108.11165	32.69828	9/29/2014	**247**	13
RR-182	9/24/2014	-108.11438	32.69794	9/29/2014	**261**	14
RR-183	9/24/2014	-108.11399	32.69794	9/29/2014	**199**	13
RR-184	9/25/2014	-108.11282	32.69795	9/29/2014	**204**	13
RR-185	9/24/2014	-108.11243	32.69795	9/29/2014	**402**	17
RR-186	9/25/2014	-108.11204	32.69795	9/29/2014	**265**	14
RR-187	9/25/2014	-108.11165	32.69795	9/29/2014	**223**	13
RR-188	9/24/2014	-108.11516	32.69761	9/29/2014	**278**	15
RR-189	9/24/2014	-108.11477	32.69761	9/29/2014	**136**	12
RR-190	9/24/2014	-108.11438	32.69761	9/29/2014	**191**	12
RR-191	9/24/2014	-108.11399	32.69761	9/29/2014	**165**	12
RR-192	9/25/2014	-108.11165	32.69762	9/29/2014	**186**	12
RR-193	9/24/2014	-108.11477	32.69728	9/29/2014	**179**	12
RR-194	9/24/2014	-108.11438	32.69728	9/29/2014	**158**	12
RR-195	9/24/2014	-108.11399	32.69728	9/29/2014	**200**	13

Table 1: XRF Analytical Results

Sample ID	Sample Date	Longitude NAD 83 Decimal Degrees	Latitude NAD 83 Decimal Degrees	Analysis Date	XRF Copper (ppm)	Copper +/- (ppm)
RR-196	9/25/2014	-108.11165	32.69729	9/29/2014	**190**	13
RR-197	9/24/2014	-108.11477	32.69695	9/29/2014	**311**	15
RR-198	9/24/2014	-108.11438	32.69695	9/29/2014	**366**	16
RR-199	9/24/2014	-108.11399	32.69695	9/29/2014	**170**	12
RR-200	9/25/2014	-108.11126	32.69696	9/29/2014	**667**	21
RR-201	9/24/2014	-108.11477	32.69662	9/29/2014	**401**	16
RR-202	9/24/2014	-108.11438	32.69662	9/29/2014	**116**	11
RR-203	9/24/2014	-108.11399	32.69662	9/29/2014	**273**	15
RR-204	9/25/2014	-108.11126	32.69663	9/29/2014	**83**	10
RR-205	9/24/2014	-108.11477	32.69629	9/29/2014	**108**	11
RR-206	9/24/2014	-108.11438	32.69629	9/30/2014	**176**	12
RR-207	9/24/2014	-108.11399	32.69629	9/30/2014	**244**	14
RR-208	9/25/2014	-108.11126	32.69630	9/30/2014	**333**	16
RR-209	9/24/2014	-108.11438	32.69596	9/30/2014	**600**	20
RR-210	9/24/2014	-108.11399	32.69596	9/30/2014	**121**	11
RR-211	9/24/2014	-108.11438	32.69563	9/30/2014	**1063**	25
RR-212	9/24/2014	-108.11399	32.69563	9/30/2014	**544**	19
RR-213	9/24/2014	-108.11437	32.69530	9/30/2014	**2371**	41
RR-214	9/24/2014	-108.11398	32.69530	9/30/2014	**511**	18
RR-215	9/24/2014	-108.11398	32.69497	9/30/2014	**163**	12
RR-216	9/24/2014	-108.11359	32.69498	9/30/2014	**85**	10
RR-217	9/24/2014	-108.11398	32.69464	9/30/2014	**323**	15
RR-218	9/24/2014	-108.11359	32.69465	9/30/2014	**63**	9
RR-219	9/24/2014	-108.11086	32.69465	9/30/2014	**149**	11
RR-220	9/24/2014	-108.11398	32.69431	9/30/2014	**168**	12
RR-221	9/24/2014	-108.11359	32.69432	9/30/2014	**158**	11
RR-222	9/24/2014	-108.11398	32.69399	9/30/2014	**158**	12
RR-223	9/24/2014	-108.11359	32.69399	9/30/2014	**939**	25
RR-224	9/24/2014	-108.11359	32.69366	9/30/2014	**221**	13
RR-225	9/24/2014	-108.11320	32.69366	9/30/2014	**98**	10
RR-226	9/24/2014	-108.11359	32.69333	9/30/2014	**257**	14
RR-227	9/24/2014	-108.11320	32.69333	9/30/2014	**221**	13
RR-228	9/24/2014	-108.11359	32.69300	9/30/2014	**174**	13
RR-229	9/24/2014	-108.11320	32.69300	9/30/2014	**409**	17
RR-230	9/24/2014	-108.11047	32.69300	9/30/2014	**357**	15
RR-231	9/24/2014	-108.11320	32.69267	9/30/2014	**126**	11
RR-232	9/24/2014	-108.11281	32.69267	9/30/2014	**135**	11
RR-233	9/24/2014	-108.11047	32.69267	9/30/2014	**64**	8
RR-234	9/24/2014	-108.11319	32.69234	9/30/2014	**237**	13
RR-235	9/24/2014	-108.11280	32.69234	9/30/2014	**119**	11
RR-236	9/24/2014	-108.11085	32.69234	9/30/2014	**74**	8
RR-237	9/24/2014	-108.11046	32.69234	9/30/2014	**48**	8
RR-238	9/24/2014	-108.11319	32.69201	9/30/2014	**177**	13
RR-239	9/24/2014	-108.11280	32.69201	9/30/2014	**161**	12
RR-240	9/24/2014	-108.11241	32.69201	9/30/2014	**130**	11
RR-241	9/24/2014	-108.11085	32.69201	9/30/2014	**76**	10
RR-242	9/24/2014	-108.11046	32.69201	9/30/2014	**126**	11
RR-243	9/25/2014	-108.11308	32.70075	9/30/2014	**176**	10
RR-244	9/25/2014	-108.11244	32.70024	9/30/2014	**169**	12
RR-245	9/25/2014	-108.11330	32.70012	9/30/2014	**139**	11
RR-246	9/24/2014	-108.11258	32.69649	9/30/2014	**252**	14

Table 1: XRF Analytical Results

Sample ID	Sample Date	Longitude NAD 83 Decimal Degrees	Latitude NAD 83 Decimal Degrees	Analysis Date	XRF Copper (ppm)	Copper +/- (ppm)
RR-247	9/24/2014	-108.11313	32.69458	9/30/2014	**96**	11
RR-248	9/24/2014	-108.11218	32.69328	9/30/2014	**63**	10
RR-249	9/24/2014	-108.11161	32.69142	9/30/2014	**83**	10
RR-250	9/24/2014	-108.11241	32.69134	9/30/2014	**98**	11
RR-251	9/25/2014	-108.11375	32.70162	9/30/2014	**457**	17

Notes:
All samples collected at 0- to 1-inch sampling depth. Sampling by EG, SK, and YM - Golder Associates Inc. (Golder).
X-ray fluorescence (XRF) analyses by Golder: B. Ireson for RR-001 - RR-155 and S. Keller for the remainder.
Sample type is "Cup" and XRF instrument was "Innov-X" for each sample.
ppm = parts per million

Table 2: Split Sample Analytical Results

Sample ID	Sample Date	XRF Data (Golder)			Total Metals Data (SVL Lab)	
		Analysis Date	Copper (ppm)	Copper +/- (ppm)	Total Copper (mg/kg)	Report Date
RR-024	3/1/2014	3/5/2014	1578	12.0	1750	10/24/2014
RR-037	3/10/2014	3/12/2014	851	8.0	771	10/24/2014
RR-050	3/10/2014	3/12/2014	955	9.0	863	10/24/2014
RR-063	3/1/2014	3/6/2014	597	7.0	747	10/24/2014
RR-076	3/1/2014	3/6/2014	1008	9.3	773	10/24/2014
RR-089	3/1/2014	3/6/2014	273	5.0	275	10/24/2014
RR-101	3/1/2014	3/6/2014	183	4.0	152	10/24/2014
RR-111	3/1/2014	3/6/2014	538	7.0	523	10/24/2014
RR-123	3/1/2014	3/7/2014	375	6.0	523	10/24/2014
RR-134	3/1/2014	3/7/2014	334	5.3	351	10/24/2014
RR-147	2/28/2014	3/7/2014	661	7.7	730	10/24/2014
RR-162	9/25/2014	9/29/2014	958	24	987	10/24/2014
RR-172	9/25/2014	9/29/2014	909	25	875	10/24/2014
RR-182	9/24/2014	9/29/2014	261	14	216	10/24/2014
RR-192	9/25/2014	9/29/2014	186	12	93	10/24/2014
RR-202	9/24/2014	9/29/2014	116	11	78	10/24/2014
RR-212	9/24/2014	9/30/2014	544	19	435	10/24/2014
RR-213	9/24/2014	9/30/2014	2371	41	2010	10/24/2014
RR-222	9/24/2014	9/30/2014	158	12	128	10/24/2014
RR-232	9/24/2014	9/30/2014	135	11	124	10/24/2014
RR-242	9/24/2014	9/30/2014	126	11	97	10/24/2014
RR-251	9/25/2014	9/30/2014	457	17	520	10/24/2014

Notes:

X-ray fluorescence (XRF) analyses by Golder Associates Inc. labs in Columbus, Ohio and Hurley, New Mexico.

Total metals analyses by SVL Analytical Lab using United States Environmental Protection Agency 6000/7000 Methods.

ppm = parts per million

mg/kg = milligrams per kilogram

Table 3: Seed Mix Used for the Razorback Ridge Area Borrow Sites

Species	Life Form	Duration	Seasonality	Approximate Application Rate[a]
Blue grama (*Bouteloua gracilis*)	Grass	Perennial	Warm	0.24
Side-oats grama (*Bouteloua curtipendula*)	Grass	Perennial	Warm	1.09
Indian Ricegrass (*Achnatherum hymenoides*)	Grass	Perennial	Cool	1.42
Green sprangletop (*Leptochloa dubia*)	Grass	Perennial	Warm	0.48
James' Galleta (p*leuraphisc jamesii*)	Grass	Perennial	Warm	0.38
Streambank wheatgrass (*Elymus lanceolatus*)	Grass	Perennial	Cool	0.47
Sand dropseed (*Sporobolus cryptandrus*)	Grass	Perennial	Warm	0.08
Bottlebrush Squirreltail (*Elymus elymoides*)	Grass	Perennial	Cool	1.21
Blue flax (*Linum lewisii*)	Forb	Perennial	NA	0.16
Prairie coneflower (*Ratibida columnifera*)	Forb	Perennial	NA	0.29
White prairie clover (*Dalea candida*)	Forb	Perennial	NA	0.18
Fairyduster (*Calliandra humilis*)	Shrub	Perennial	NA	0.03
Rubber rabbitbrush (*Ericameria nauseosa*)	Shrub	Perennial	NA	0.21
Winterfat (*Krascheninnikovia lanata*)	Shrub	Perennial	NA	0.55
Fourwing saltbush (*Atriplex canescens*)	Shrub	Perennial	NA	1.57
Total PLS (lb/acre)				**8.37**

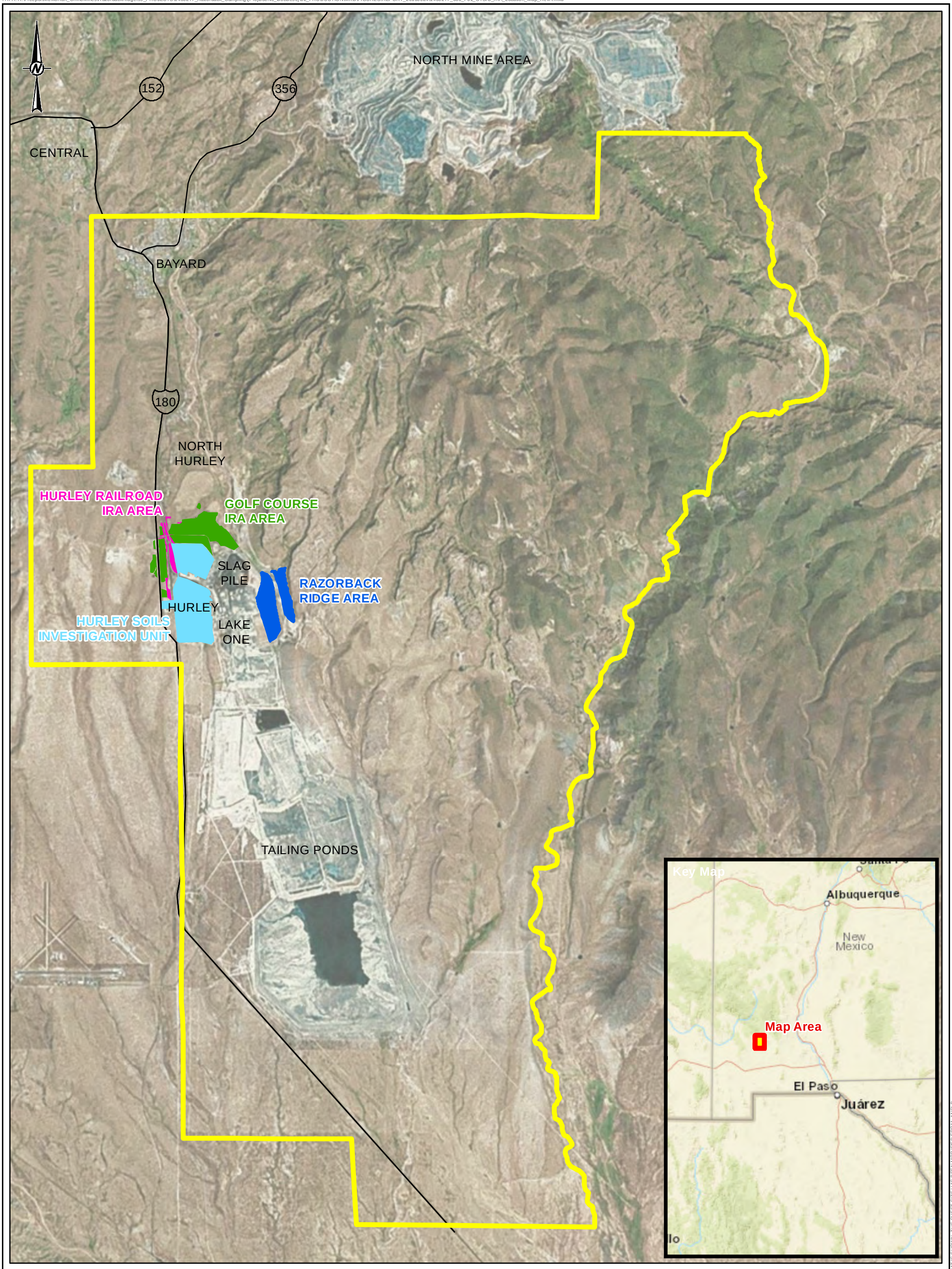
Notes:

a = Rate is in pounds of pure live seed (PLS) per acre (lb/ac)

NA = Not applicable

FIGURES

PATH: H:\FreeportMcMoRan_ChinoMines\RazorbackRidge\99_PROJECTS\1400277_Razorback_Sampling\{ProjDocNo_DocDesc}\02_PRODUCTION\MXD\FIGURES\REPORT_20160624\1400277_000_F01_STSIU_IRA_Location_Map_RevA.mxd



LEGEND

- SMELTER/TAILING SOILS INVESTIGATION UNIT BOUNDARY (STSIU)
- RAZORBACK RIDGE AREA
- HURLEY RAILROAD IRA AREA
- GOLF COURSE IRA AREA
- HURLEY SOILS INVESTIGATION UNIT

NOTE(S)

REFERENCE(S)

1. COORDINATE SYSTEM: SANTA RITA LOCAL
2. AERIAL IMAGERY: SOURCES: ESRI, DELORME, NAVTEQ, USGS, INTERMAP, IPC, NRCAN, ESRI JAPAN, METI, ESRI CHINA (HONG KONG), ESRI (THAILAND), TOMTOM, 2013
SOURCE: ESRI, DIGITALGLOBE, GEOEYE, EARTHSTAR GEOGRAPHICS, CNES/AIRBUS DS, USDA, USGS, AEX, GETMAPPING, AEROGRID, IGN, IGP,

0 0.5 1 2
Miles

CLIENT
FREEPORT-MCMORAN
CHINO MINES COMPANY

PROJECT
RAZORBACK RIDGE IRA PROJECT

TITLE
STSIU IRA LOCATION MAP

CONSULTANT
Golder Associates

YYYY-MM-DD	2016-06-24
DESIGNED	GVL
PREPARED	GVL
REVIEWED	JP
APPROVED	DC

PROJECT NO. 140-0277 | REV. A | FIGURE 1

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B
1in
0

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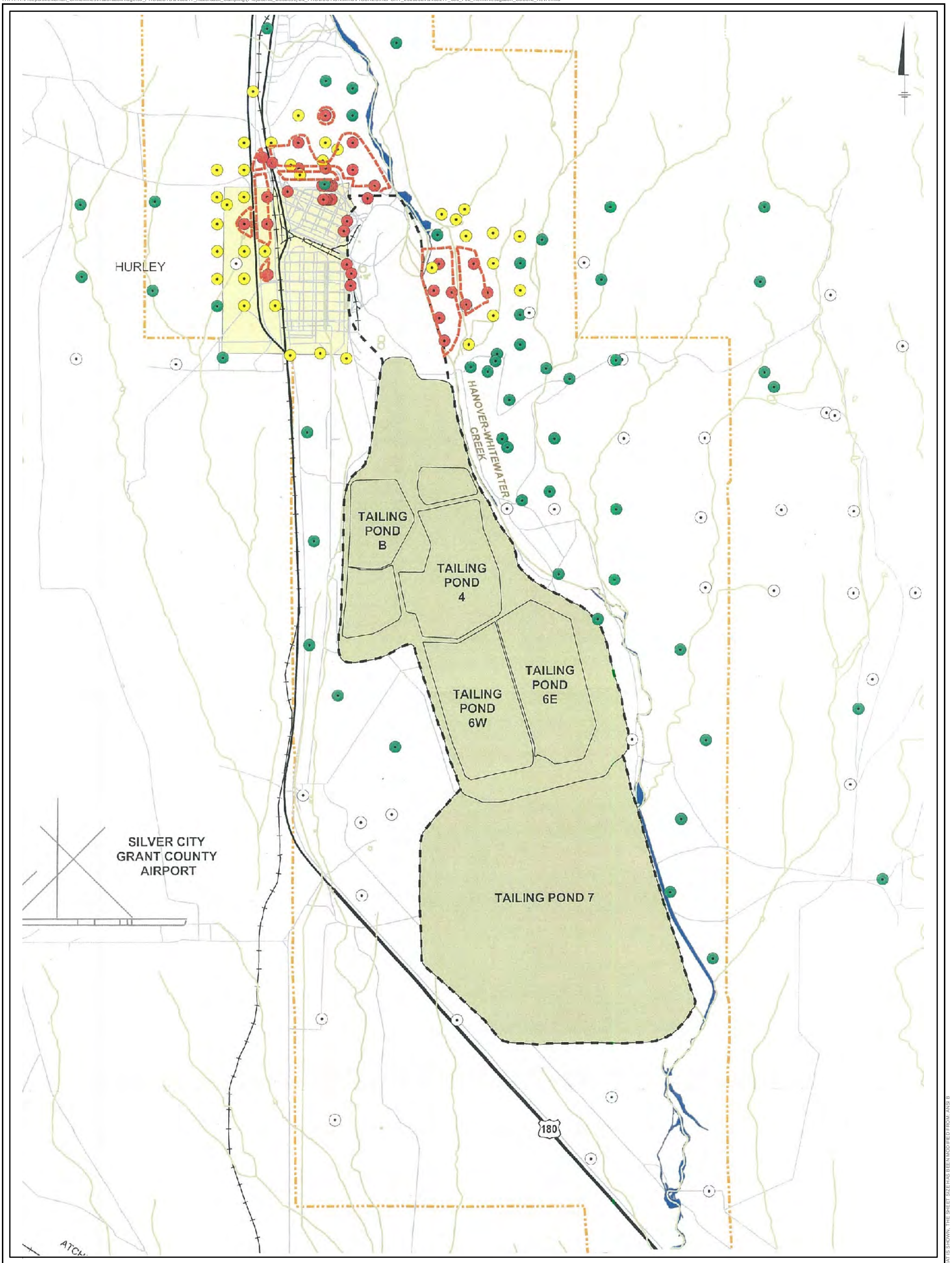

LEGEND:

Cu CONCENTRATIONS (mg/kg)
- 0 to 500
- 500 to 2000
- 2000 to 5000
- 5000+
- APPROXIMATE REMOVAL AREA WITH SOIL COPPER > 5,000 MG/KG
- TAILING PONDS
- CITY LIMITS
- AOC BOUNDARY
- DRAINAGE
- SMELTER / TAILING OPERATIONAL AREA

0 0.5 1 Miles

GRAPHIC SCALE

REFERENCE(S)

1. FIGURE FROM: BBL, 2006. ADMINISTRATIVE ORDER ON CONSENT, EXCAVATION INTERIM ACTION WORK PLAN, SMELTER/TAILING SOIL INVESTIGATION UNITS WORK PLAN, CHINO MINES COMPANY. AUGUST 2006.
2. ORIGINAL FIGURE SOURCES: CHINO (1995), ARCADIS JSA (2001), SRK (2005)

CLIENT
FREEPORT-MCMORAN
CHINO MINES COMPANY

PROJECT
RAZORBACK RIDGE IRA AREA

TITLE
REMEDIAL INVESTIGATION - COPPER CONCENTRATIONS IN SOILS

CONSULTANT
Golder Associates

YYYY-MM-DD	2016-06-24
DESIGNED	GVL
PREPARED	HJ
REVIEWED	JP
APPROVED	DC

PROJECT NO. 140-0277 | REV. A | FIGURE 2

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B

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LEGEND

- 5 FT. CONTOURS
- APPROXIMATE REMOVAL AREA WITH SOIL COPPER > 5,000 MG/KG

0 300 600 Feet

REFERENCE(S)

1. FIGURE FROM: BBL, 2006. ADMINISTRATIVE ORDER ON CONSENT, EXCAVATION INTERIM ACTION WORK PLAN, SMELTER/TAILING SOIL INVESTIGATION UNITS WORK PLAN, CHINO MINES COMPANY. AUGUST 2006.

CLIENT
FREEPORT-MCMORAN
CHINO MINES COMPANY

PROJECT
RAZORBACK RIDGE IRA AREA

TITLE
IRA WORK PLAN - PROPOSED LIMITS OF EXCAVATION (>5000MG/KG COPPER)

CONSULTANT
Golder Associates

YYYY-MM-DD	2016-06-24
DESIGNED	GVL
PREPARED	HJ
REVIEWED	JP
APPROVED	DC

PROJECT NO. 140-0277 | REV. A | FIGURE 3

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B

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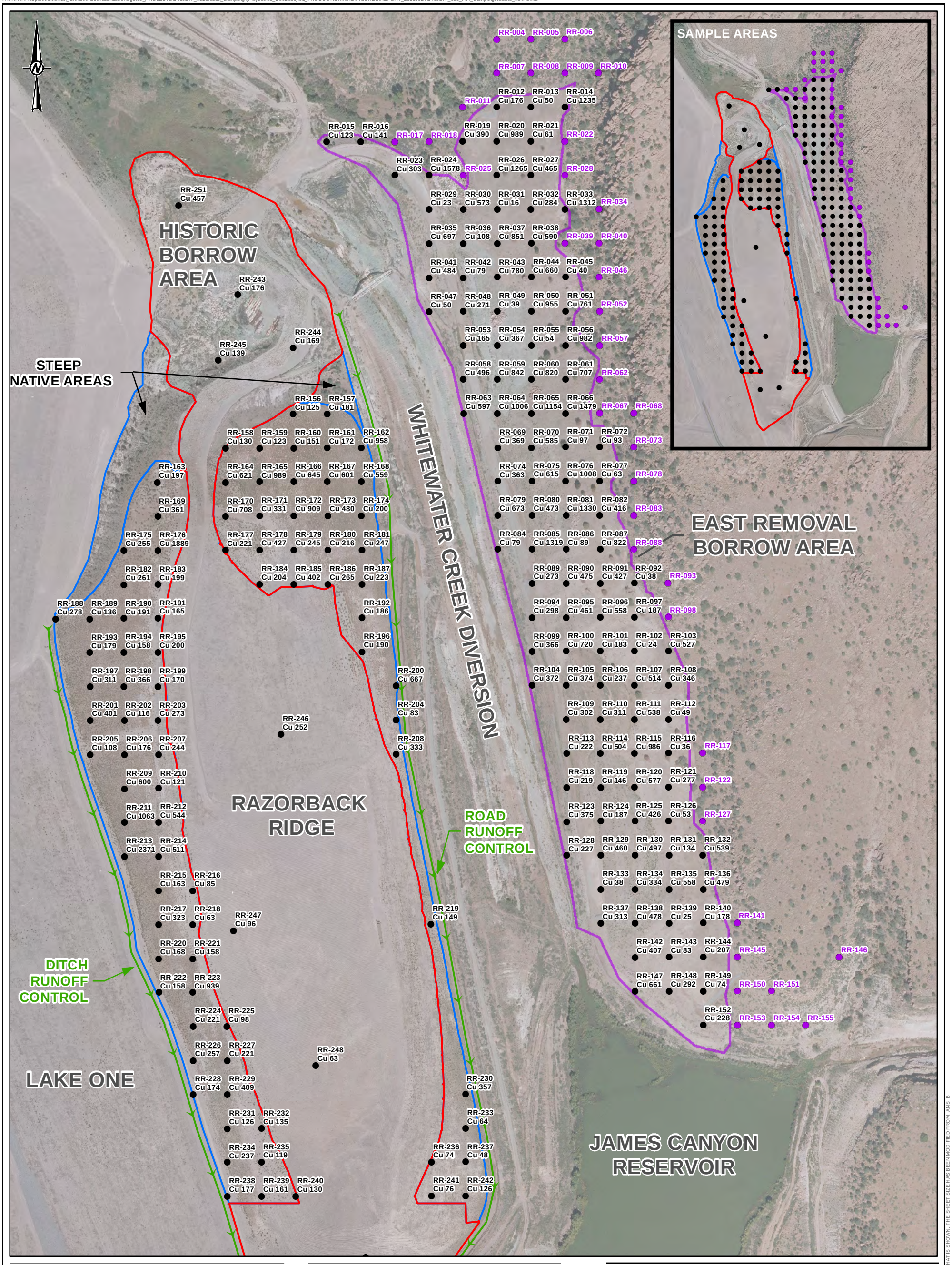


LEGEND

- POST SOIL REMOVAL CONFIRMATION SAMPLING
- UNSAMPLED LOCATION
- FLOW DIRECTION

SAMPLING BOUNDARIES

- RAZORBACK RIDGE HILLSIDE BORROW AREA
- MAIN BORROW AREA
- EAST REMOVAL BORROW AREA

NOTE(S)

1. CU VALUES REPRESENT COPPER CONCENTRATION IN PPM
2. ALL SAMPLES COLLECTED IN FEBRUARY AND SEPTEMBER 2014 AT 0-1" SAMPLING DEPTH.
3. BMP = BEST MANAGEMENT PRACTICE

REFERENCE(S)

1. COORDINATE SYSTEM: SANTA RITA LOCAL
2. AERIAL IMAGERY: CHINO 2014 AERIAL PHOTO

0 150 300 600
Feet

CLIENT
FREEPORT-MCMORAN
CHINO MINES COMPANY

PROJECT
RAZORBACK RIDGE IRA AREA

TITLE
POST SOIL REMOVAL CONFIRMATION SAMPLING

CONSULTANT
Golder Associates

YYYY-MM-DD	2015-9-30
DESIGNED	GVL
PREPARED	HJ
REVIEWED	JP
APPROVED	DC

PROJECT NO. 140-0277 | REV. 1 | FIGURE **4**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B
1in
0

APPENDIX A
SITE PHOTOGRAPHS

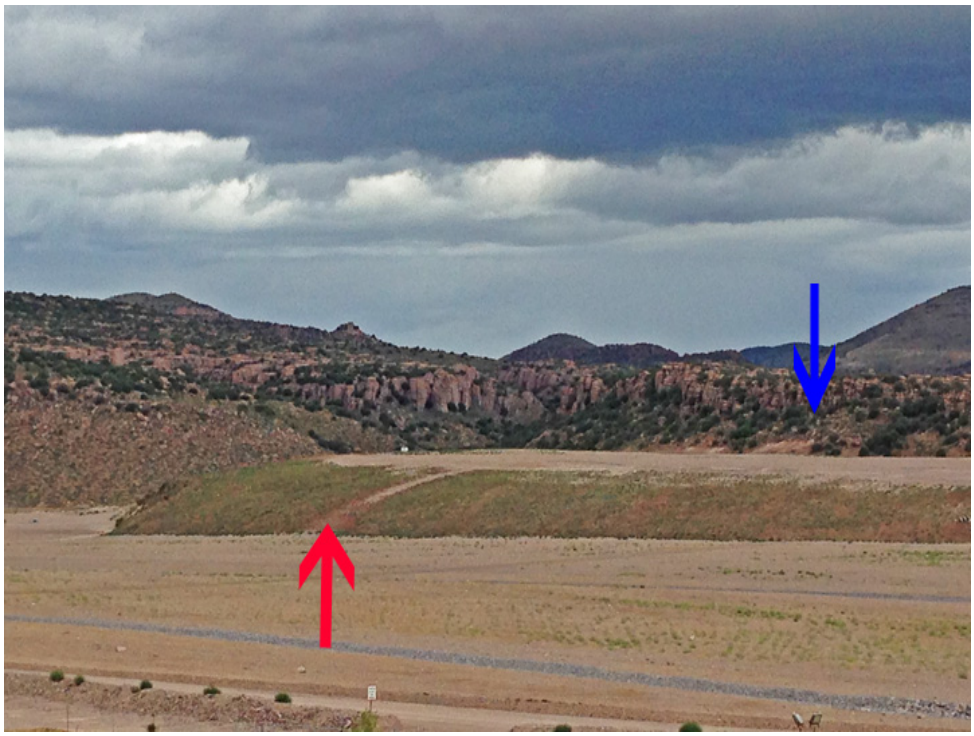
Razorback Ridge Area Excavation Photographs	
PHOTO 1 Facing east – north end of Razorback Ridge (red) with East Removal Borrow Area in background (blue).	
PHOTO 2 Facing east – center of Razorback Ridge (red) with East Removal Borrow Area in background.	

PHOTO 3 Facing east – south end of Razorback Ridge (red) with East Removal Borrow Area in background.	
PHOTO 4 Facing east – northern end of East Removal Borrow Area (center).	

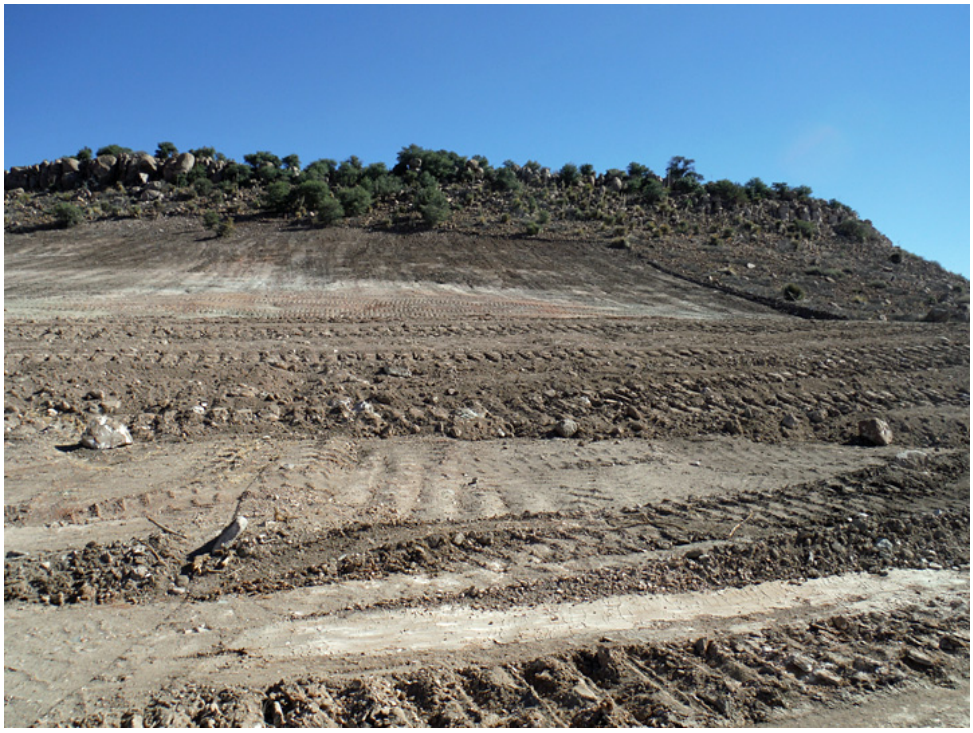
PHOTO 5 Facing east – southern end of East Removal Borrow Area at southeast corner of site.	
PHOTO 6 Facing east – center of East Removal Borrow Area. Only a thin layer of soil was removed from around drip lines in effort to save trees.	

PHOTO 7 Facing northwest – East Removal Borrow Area and toe in foreground. Razorback Ridge on horizon.	
PHOTO 8 Facing southwest – East Removal Borrow Area, toe, and road in foreground with James Canyon Reservoir and Razorback Ridge in background.	

PHOTO 9 Facing north – East Removal Borrow Area, toe, and road.	
PHOTO 10 Facing north – Historic stockpiled borrow material at toe of East Removal Borrow Area with Razorback Ridge at upper left horizon (northwest).	

PHOTO 11 Facing north – soil removal activities at toe of East Removal Borrow Area.	
PHOTO 12 Facing south/southwest – soil removal activities near center of toe of East Removal Borrow Area with Razorback Ridge in background to right (southwest).	

PHOTO 13 Facing south– soil removal activities in East Removal Borrow Area showing excavation around trees.	
PHOTO 14 Facing northeast – East Removal Borrow Area view from across James Canyon Reservoir.	

PHOTO 15 Facing south/southwest – representative sample location east of Whitewater Diversion with Razorback Ridge in back.	
PHOTO 16 Facing north/northeast – representative sample location on northeast portion of Razorback Ridge.	

PHOTO 17 Facing east – representative sample location on southwest portion of Razorback Ridge.	
PHOTO 18 Facing north – representative sample location in Borrow Area at north end of Razorback Ridge.	

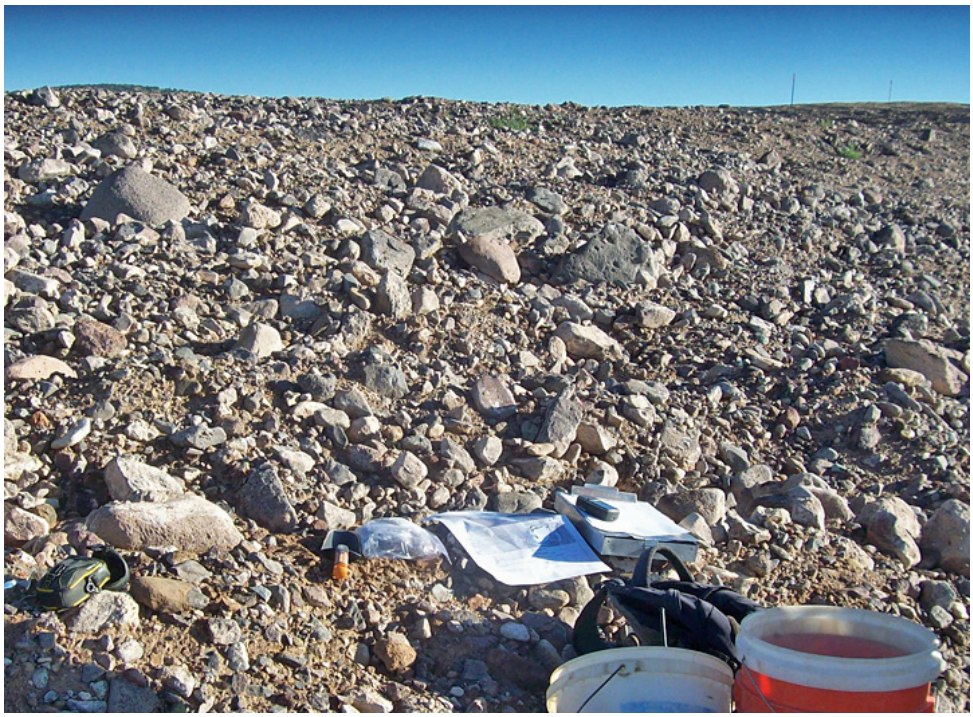
PHOTO 19 Facing west – representative sample location in Borrow Area near center of Razorback Ridge.	
PHOTO 20 Representative sample location in Borrow Area at south end of Razorback Ridge.	

PHOTO 21 Representative soil sampling effort.	
PHOTO 22 Panorama of mulched and seeded surface of Razorback Ridge in foreground and east area in background.	

APPENDIX B
DATA VALIDATION REPORT

MEMORANDUM

Date:	March 3, 2015	**Project No.:**	14-00277
To:	Jen Pepe and Diane Crawford	**Company:**	Golder Associates Inc.
From:	Tom Stapp, Senior Chemist, Golder Associates Inc.		
RE:	**DATA VALIDATION SUMMARY OF XRF SOIL TESTING AND SVL LABORATORY SDG #W4J0298 CONFIRMATION ANALYSES**		

1.0 INTRODUCTION

This memorandum presents the results of data validation on the Razorback Ridge Excavated Soil Field Laboratory testing performed with an X-Ray Fluorescence (XRF) spectrophotometer and the confirmation tests performed by SVL Analytical Inc. (SVL) of Kellogg, Idaho for Sample Delivery Group (SDG) W4J0298. This work was performed in accordance with the Interim Remedial Action Work Plan (Work Plan) for the Smelter/Tailing Soil Investigation Units (ARCADIS 2007). XRF sample acquisition, preparation, and analysis was performed in accordance with Golder Associates Inc. (Golder) Technical Procedure "X-Ray Fluorescence On-Site Measurement Standard Operating Procedure" (Golder 1995a). Confirmation test sample handling, preparation, and analysis was performed in accordance with United States Environmental Protection Agency (USEPA) Method 6010B (USEPA 1986). Sample identifications and the analyses requested are provided in tables included as 'Attachment 5' to this report.

Data validation was conducted in accordance with the USEPA Contract Laboratory Program using National Functional Guidelines for Inorganic Superfund Data Review (USEPA 2013), Golder Technical Procedure TP-2-2-12 "Analytical Data Management" (Golder 1995b), and applicable analytical methods. The data review process provides information on analytical limitations of the data based on specific quality control (QC) criteria outlined in the referenced documents. Attachments 1 through 5 provide the following information as indicated below:

- Attachment 1 Glossary of Data Reporting Qualifiers
- Attachment 2 Summary of Data Qualifications
- Attachment 3 Annotated Laboratory Reports
- Attachment 4 Laboratory Narrative and Chain of Custody Documentation
- Attachment 5 Supporting Documentation

2.0 SAMPLE – HANDLING AND CUSTODY REQUIREMENTS

2.1 Field Samples – Acceptable

Samples collected in the field were maintained in accordance with Work Plan (ARCADIS 2007). A running log was maintained of the field samples collected and tested at the field laboratory and on Chain of Custody records (Attachment 4) for the first sampling period (February to March 2014). The samples

collected during the second sampling period (September 2014) do not have a Chain of Custody recorded because the samples were kept in Golder's custody from field collection through XRF analysis, but field laboratory run logs recorded the sample list. A full list of samples subjected to XRF analysis is presented in the summary tables for XRF response (Attachment 5, Tables A5.1 to A5.4). Field samples were processed in accordance with consistent procedures from the XRF Standard Operating Procedure (SOP; Golder 1995a). This included microwave drying, a size 10-mesh sieve, and transfer to standardized cup for eventual XRF testing using an instrument-determined exposure period. Each sample from the February to March 2014 period was tested a minimum of three exposures, and an average value was recorded for the elements of concern (copper and iron). Samples from the September 2014 period were tested only once, but the same preparation procedures were employed.

2.2 Laboratory Confirmation Samples – Acceptable

Custody of samples being sent off site for analysis were controlled and documented in accordance with Technical Procedure TG-1.2-23 "Chain of Custody" (Golder 2009). Unique sample identification numbers were recorded on the Chain of Custody form along with sample location, matrix, and the other required information. The analyses required for each sample were limited to a targeted list of metal analytes (copper and iron) as noted on the Chain of Custody form (Attachment 4).

Sample custody was maintained throughout sample collection, transport, and laboratory receipt. Samples were received at ambient temperature in testing cups as prepared for previous XRF analysis. Requirements for soil cooling (4 degrees Celcius or better) during storage, transport and receipt do not apply to inorganic metals, according to USEPA guidance (1986; Chapter 3, Table 3-2).

3.0 HOLDING TIMES

3.1 Field Samples – Acceptable

Samples selected for XRF analysis were performed within an acceptable period of collection, preparation, and analysis according to Chain of Custody and field log records. Field records show that there was a range of five to seven days from the date of collection until the XRF analysis was recorded. No out-of-limit conditions are cited.

3.2 Laboratory Confirmation Samples – Not Acceptable, Qualification Applied

Analyses were performed within the recommended maximum holding time, with the exception of selected samples in this delivery group. Qualification of selected laboratory based copper and iron results was applied as a consequence of the data validation actions due to the issue of exceeded holding times for the laboratory based analyses. However, the estimated qualifiers applied for the selected samples are not a determining factor in data quality. This is because the comparison of laboratory based analyses with the field XRF analyses exhibits that nearly 50% of the samples of concern have a positive percent

difference of copper values, and the balance shows a negative percent difference of copper values (Table A5.3). This implies that exceeded holding times for this set of samples does not confirm a bias to the values for copper. Moreover, the percent difference of iron is consistently biased low for the laboratory based analysis, which is expected due to the difference in analyte quantitation between the two analytical methods. Therefore, the data validation review has applied the qualification of estimated for detected results ('J' qualifier) to both copper and iron results, which should be considered as an advisory condition to the data user, and not an analytical quality deficiency to the reported results.

Attachment 2 provides a summary of data quality deficiencies, the samples affected, and the qualification applied. Supporting documentation for the associated samples include Tables A2.1 and A5.2, which also provide summaries of sample holding times, and qualifications applied.

4.0 CALIBRATION/INSTRUMENT PERFORMANCE MONITORING

4.1 Field Samples – Acceptable

XRF analyses include daily procedures for instrument resolution checks and standard response checks. The resolution checks include exposure to a metal amalgam standard, where separation between the iron and manganese response peaks must meet specific limits. This check is performed once at the beginning of instrument use, and all dates were found to be within acceptance limits. Calibration checks included use site-specific calibration standards (SSCS) and National Institute of Standards Testing (NIST) materials. Known concentrations of copper and iron are recorded with the standards and compared to daily re-analyses of these standards. XRF records reflect that up to eight SSCS and two NIST were tested during the daily testing of field samples. Relative percent difference (RPD) measurements are recorded for each standard and each day, with the goal of staying within a maximum 35% RPD. All measurements complied with the acceptance value, with one exception on March 12, 2014, and the instrument was deemed to respond accurately. The outlier was noted for SSCS #23325 for iron (35.5%), however similar concentrations were within limits and all copper concentrations met limits. Therefore, the sample responses are presented without qualification and no further action was taken.

4.2 Laboratory Confirmation Samples – Not Assessed

Compliance requirements for satisfactory laboratory instrument calibration and performance monitoring were not evaluated since raw data was not provided with this data set, and due to the level of laboratory deliverable requested. Laboratory narrative for this data set did not indicate out of control conditions for calibration compliance, and no further action was taken.

5.0 BLANKS

5.1 Field Samples – Acceptable

Daily and more frequent checks were performed for the XRF to confirm background conditions were within control and not skewing copper or iron results. Sample blank materials consist of either a poly plastic block, or a prepared cup of silicon dioxide, known to show non-detect (ND) status for copper and iron. Field laboratory records show the daily checks are ND for all copper blanks, and iron typically showed ND or very low level response (11 to 15 parts per million [ppm] on March 06, 2014), and no further action was taken.

5.2 Laboratory Confirmation Samples – Acceptable

The assessment of blank analysis results is to determine the existence and magnitude of contamination resulting from laboratory activities. Both method blanks and calibration blanks are prepared with this sample set to determine effects on associated samples. However, the method blanks were target-analyte-free at the method reporting limits, and continuing calibration blanks were not evaluated since raw data was not provided. Field blanks and laboratory prepared trip blanks are often included to assess and monitor field related activities. There were no samples submitted in this sample delivery group identified as field or trip blanks and no further action is considered.

6.0 SYSTEM MONITORING

6.1 Field Samples – Acceptable

System monitoring for the XRF confirms consistent performance of the analytical method. However, XRF system monitoring was limited to the SSCS and NIST responses tracked with daily calibration protocols. Therefore, additional instrument checks are not included and no further action was taken. The calibration response checks confirmed appropriate daily operation.

6.2 Laboratory Confirmation Samples – Acceptable

System monitoring serves as a monitor for specific portions or the overall performance of the analytical method. System monitoring includes instrument checks, sample batch checks, and individual sample performance checks. Data for laboratory control samples (LCS) were provided in order to evaluate the accuracy and performance of the analytical method.

Laboratory Control Sample: Goals for LCS recovery were met and no qualifications are applied.

6.3 Field XRF Comparison to Laboratory Method 6010B Analyses – Advisory

Table A5.3 (Attachment 5) provides a summary comparison of field XRF results versus the fixed laboratory USEPA Method 6010B digestion and analysis results. Results compare the sample cup material used for XRF testing, which was subsequently digested and analyzed at SVL with USEPA

Method 6010B. Although the methods employed are fundamentally different, the results are often deemed comparable for environmental purposes. Table A5.3 demonstrates that copper results are highly comparable, with only 2 of the 22 samples exceeding an RPD of 35%, which is a range of acceptance for soil matrices according to data validation guidance (USEPA 2013).

Comparison for iron demonstrates that there is a lower correlation of methods, with only 5 of 22 samples meeting the acceptance limit of 35%. Since 21 of 22 iron results for the 6010B method are lower than the XRF method, it may be true that the digestion process for iron is incomplete for method 6010B, and less of the free iron is available for ICP wet chemistry detection. XRF shows more response to the detector (higher concentration) since digestion is not employed, but quantitation is predicated on the efficient response of iron signal through x-ray excitation and fluorescence. Iron was added to the suite of analytes reported by the XRF to ensure signal interference was not affecting the copper signal. Therefore, confirmation of the iron concentrations was not relevant to the Razorback Ridge remedial actions and qualification is not applied, but the difference in iron concentrations is only reported as an advisory condition.

7.0 MATRIX SPIKE AND DUPLICATE ANALYSES

7.1 Field Samples – Acceptable

Accuracy: Sample response for accuracy are measured through SSCS and NIST recovery metrics, and for precision by replicate analysis of prepared sample cups, or analysis of duplicate samples in separately prepared cups. Recovery of calibration check standards for SSCS closely represent the site soils and recoveries were generally met (Section 4.1).

Precision: XRF samples were tested in triplicate with the same prepared sample cup as replicate measurements and an average value reported. Individual measurements were compared to the average with a standard deviation and relative percent deviation (%RSD) to determine precision. If the values complied with a 40% maximum %RSD, the precision of the test was assured and the data average value was reported. Table A5.4 presents each sample included in the XRF analytical list, and the average copper and iron values reported. The Table includes a column for standard deviation of three replicate measurements (archived in field laboratory files) and a column for %RSD calculation. All values meet the compliance limit, with one exception (Sample RR-091 on March 06, 2014 at 52.4%). Replicate measurements can be variable due to the analyst practice of turning the sample cup 90 degrees for one of the three exposures. This resulted in an elevated reading of 686 ppm copper over previous readings near 300 ppm for sample RR-091. Despite the outlier for copper, the iron result was within limits (1.2% RSD), and results are accepted as reported. Therefore, precision of the instrument response was assured.

7.2 Laboratory Confirmation Samples – Acceptable

Precision and Accuracy: Matrix spikes (MS) analysis was performed on sample RR-204 and RR-242, based upon matching of sample results with the QC report pages, although the laboratory did not identify the sample on which the matrix spike was performed. Goals for precision and accuracy were met for samples where the sample amount was less than four times the spike level. A number of analytes were greater than four times the spike value and according to data validation guidelines (USEPA 2013), qualification does not apply.

8.0 FIELD QUALITY CONTROL SAMPLES

8.1 Field Samples – Not Assessed

Field QC samples are collected and processed to exhibit consistency in collection activities, sample handling, and analytical response. Field blanks are typical for water matrices to determine fugitive contaminants. Field blanks for soil collection and XRF analysis was deemed to not be necessary, and no data is provided. Field duplicates include the preparation of a duplicate cup on 'same location soils,' and are desirable to ensure complete and homogeneous processing is employed on the soil collected. However, field laboratory records do not list a field duplicate, and no further action was taken.

8.2 Laboratory Confirmation Analyses – Not Assessed

Field duplicate samples are collected to give an indication of overall field sampling precision and overall performance. There was not a field duplicate sample included with this sample delivery group and no further action was taken. A field blank is typically analyzed to determine the existence and magnitude of contamination resulting from field activities, however, there was not a field blank included with this data set.

9.0 OVERALL ASSESSMENT

Overall assessment was performed on the entire data packages. Review of the data results was performed in conjunction with the governing procedures for both field and commercial laboratory handling and analysis per the requests on the Chain of Custody or Work Plan (ARCADIS 2007).

9.1 Field Samples – Acceptable

Detection Limits: Detection limit goals were met for all results, although a strict XRF limit of detection was not established per the SOP (Golder 1995a). Rather, the XRF instrument response was accepted based upon the lowest SSCS provided for the project and the goal of meeting the action level for copper on the project properties.

Target Analyte Identification and Quantitation: All sample results were confirmed through proper response of the XRF software and peak recognition protocols. Raw data response to copper and iron

concentrations from SSCS and NIST runs, and with adequate result recoveries, were deemed to validate analyte identification and quantitation.

Completeness: The data package was complete for all requested analyses. A total of 209 samples were validated in this data package with a total of 418 determinations reported, all of which were deemed valid. This results in a completeness of 100%, which exceeds normal work plan objectives of 90%.

9.2 Laboratory Confirmation Samples – Acceptable

Detection Limits: Detection limit goals were met for all results.

Target Analyte Identification and Quantitation: All sample results in the laboratory hard copy report (SDG #W4J0298) were confirmed with results found in the electronic data format. Analyte quantitation could not be confirmed with raw data results since the raw data were not provided with this sample set.

Completeness: The data package was complete for all requested analyses. A total of 22 samples were validated in this data package with a total of 44 determinations reported, of which 44 were deemed valid. This results in a completeness of 100%, which exceeds normal work plan objectives of 90%.

10.0 DATA VALIDATION AND USABILITY

Data were validated by Golder personnel, based on the applicable elements of the USEPA Functional Guidelines for Inorganic Superfund Data Review (2013), USEPA Contract Laboratory Program, Golder Technical Procedure TP-2.2-12 “Analytical Data Management” (Golder 1995b), and applicable reference method requirements as appropriate.

Data generated in the field or by the subcontractor laboratory were reviewed. Original data is retained in the project file. Working copies were distributed to personnel designated by the Lead Analytical Chemist for validating/verifying analytical data or to the Data Management Specialist.

Validation/verification and data management activities were organized by analytical fraction (i.e., Ordnance, General Chemistry, Metals). All hard copy or electronic deliverable data were reviewed against Chain of Custody for verification of sample identification and analyses requested. Any incorrect data or discrepancies noted in the verification were resolved with project management and/or the data generator. After the completion of data validation/verification, any qualifiers or other comments noted in the validation/verification process assigned to the data were entered into this data quality report and the data validation checklist (Attachment 5). A glossary of data qualifiers is provided in Attachment 1.

The analytical data resulting from analysis of soil are acceptable for their intended use with the exception of those deficiencies noted. Limitations and sources of existing data are stated and clearly identified where applicable. Validated data are included in Attachment 3.

11.0 REFERENCES

ARCADIS US, Inc. (ARCADIS). 2007. Administrative Order on Consent, Interim Removal Action Work Plan, Smelter/Tailing Soil Investigation Units. Prepared for Chino Mines Company, November 2007.

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ATTACHMENT 1
GLOSSARY OF DATA REPORTING QUALIFIERS

INORGANIC:

U: The analyte was analyzed for, but was not detected above the level of the reported sample quantitation limit.

J: The result is an estimated quantity. The associated numerical value is the approximate concentration of the analyte in the sample.

J + : The result is an estimated quantity, but the result may be biased high.

J - : The result is an estimated quantity, but the result may be biased low.

UJ: The analyte was analyzed for, but was not detected. The reported quantitation limit is approximate and may be inaccurate or imprecise.

ATTACHMENT 2
SUMMARY OF DATA QUALIFICATIONS

Table A-2.1: Data Qualification Summary

SDG: W4J0298	Project: 140-0277	Date: December 1, 2014	Page 1 of 1	
Comments:				
Parameter	**Qualifier**	**Samples Affected**	**Reason**	**Value**
Copper, iron	J / UJ	RR-024, RR-037, RR-050, RR-063, RR-076, RR-089, RR-101, RR-111, RR-123, RR-134, and RR-147.	Inorganic Holding Time limit of 180 exceeded.	227 – 236 days

ATTACHMENT 3
ANNOTATED LABORATORY REPORTS

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PO Box 10
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Project Name: Razorback Ridge 2014
Work Order: **W4J0298**
Reported: 24-Oct-14 09:35

Client Sample ID: **RR-024**
SVL Sample ID: **W4J0298-01 (Soil)**

Sampled: 01-Mar-14 15:18
Received: 13-Oct-14
Sampled By: YM/EG

Method	Analyte	Result		Units	RL	MDL	Dilution	Batch	Analyst	Analyzed	Notes
Metals (Total) by EPA 6000/7000 Methods			Q								
EPA 6010B	**Copper**	1750	J	mg/kg	1.00	0.25		W443021	AS	10/23/14 17:05	H3,M3
EPA 6010B	**Iron**	15100	J	mg/kg	6.0	2.7		W443021	AS	10/23/14 17:05	H3,M3

This data has been reviewed for accuracy and has been authorized for release by the Laboratory Director or designee.

John Kern
Laboratory Director

12-1-2014

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Project Name: Razorback Ridge 2014
Work Order. **W4J0298**
Reported: 24-Oct-14 09:35

Client Sample ID: **RR-037**
SVL Sample ID: **W4J0298-02 (Soil)**

Sampled: 10-Mar-14 09:44
Received: 13-Oct-14
Sampled By: YM/EG

Method	Analyte	Result	Q	Units	RL	MDL	Dilution	Batch	Analyst	Analyzed	Notes
Metals (Total) by EPA 6000/7000 Methods											
EPA 6010B	**Copper**	771	J	mg/kg	1.00	0.25		W443021	AS	10/23/14 17:14	H3
EPA 6010B	**Iron**	12800	J	mg/kg	6.0	2.7		W443021	AS	10/23/14 17:14	H3

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Project Name: Razorback Ridge 2014
Work Order: **W4J0298**
Reported: 24-Oct-14 09:35

Client Sample ID: **RR-050**
SVL Sample ID: **W4J0298-03 (Soil)**

Sampled: 10-Mar-14 08:07
Received: 13-Oct-14
Sampled By: YM/EG

Method	Analyte	Result	Q	Units	RL	MDL	Dilution	Batch	Analyst	Analyzed	Notes
Metals (Total) by EPA 6000/7000 Methods											
EPA 6010B	**Copper**	863	J	mg/kg	1.00	0.25		W443021	AS	10/23/14 17:17	H3
EPA 6010B	**Iron**	14300	J	mg/kg	6.0	2.7		W443021	AS	10/23/14 17:17	H3

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Project Name: Razorback Ridge 2014
Work Order: **W4J0298**
Reported: 24-Oct-14 09:35

Client Sample ID: **RR-063**
SVL Sample ID: **W4J0298-04 (Soil)**

Sampled: 01-Mar-14 14:34
Received: 13-Oct-14
Sampled By: YM/EG

Method	Analyte	Result	Q	Units	RL	MDL	Dilution	Batch	Analyst	Analyzed	Notes
Metals (Total) by EPA 6000/7000 Methods											
EPA 6010B	**Copper**	747	J	mg/kg	1.00	0.25		W443021	AS	10/23/14 17:21	H3
EPA 6010B	**Iron**	14500	J	mg/kg	6.0	2.7		W443021	AS	10/23/14 17:21	H3

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Project Name: Razorback Ridge 2014
Work Order: **W4J0298**
Reported: 24-Oct-14 09:35

Client Sample ID: **RR-076**
SVL Sample ID: **W4J0298-05 (Soil)**

Sampled: 01-Mar-14 13:06
Received: 13-Oct-14
Sampled By: YM/EG

Method	Analyte	Result	Q	Units	RL	MDL	Dilution	Batch	Analyst	Analyzed	Notes
Metals (Total) by EPA 6000/7000 Methods											
EPA 6010B	**Copper**	773	J	mg/kg	1.00	0.25		W443021	AS	10/23/14 17:24	H3
EPA 6010B	**Iron**	12800	J	mg/kg	6.0	2.7		W443021	AS	10/23/14 17:24	H3

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Project Name: Razorback Ridge 2014
Work Order: **W4J0298**
Reported: 24-Oct-14 09:35

Client Sample ID: **RR-089**
SVL Sample ID: **W4J0298-06 (Soil)**

Sampled: 01-Mar-14 13:28
Received. 13-Oct-14
Sampled By: YM/EG

Method	Analyte	Result	Q	Units	RL	MDL	Dilution	Batch	Analyst	Analyzed	Notes
Metals (Total) by EPA 6000/7000 Methods											
EPA 6010B	**Copper**	275	J	mg/kg	1.00	0.25		W443021	AS	10/23/14 17:27	H3
EPA 6010B	**Iron**	13900	J	mg/kg	6.0	2.7		W443021	AS	10/23/14 17:27	H3

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Project Name: Razorback Ridge 2014
Work Order: **W4J0298**
Reported: 24-Oct-14 09:35

Client Sample ID: **RR-101**
SVL Sample ID: **W4J0298-07 (Soil)**

Sampled: 01-Mar-14 11:53
Received: 13-Oct-14
Sampled By: YM/EG

Method	Analyte	Result	Q	Units	RL	MDL	Dilution	Batch	Analyst	Analyzed	Notes
Metals (Total) by EPA 6000/7000 Methods											
EPA 6010B	Copper	152	J	mg/kg	1.00	0.25		W443021	AS	10/23/14 17:37	H3
EPA 6010B	Iron	10500	J	mg/kg	6.0	2.7		W443021	AS	10/23/14 17:37	H3

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Project Name: Razorback Ridge 2014
Work Order: **W4J0298**
Reported: 24-Oct-14 09:35

Client Sample ID: **RR-111**
SVL Sample ID: **W4J0298-08 (Soil)**

Sampled: 01-Mar-14 09:30
Received: 13-Oct-14
Sampled By: YM/EG

Method	Analyte	Result	Q	Units	RL	MDL	Dilution	Batch	Analyst	Analyzed	Notes
Metals (Total) by EPA 6000/7000 Methods											
EPA 6010B	**Copper**	523	J	mg/kg	1.00	0.25		W443021	AS	10/23/14 17 40	H3
EPA 6010B	**Iron**	14300	J	mg/kg	6.0	2.7		W443021	AS	10/23/14 17:40	H3

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Project Name: Razorback Ridge 2014
Work Order: **W4J0298**
Reported: 24-Oct-14 09:35

Client Sample ID: **RR-123**
SVL Sample ID: **W4J0298-09 (Soil)**

Sampled: 01-Mar-14 12:28
Received: 13-Oct-14
Sampled By: YM/EG

Method	Analyte	Result	Q	Units	RL	MDL	Dilution	Batch	Analyst	Analyzed	Notes
Metals (Total) by EPA 6000/7000 Methods											
EPA 6010B	**Copper**	523	J	mg/kg	1.00	0.25		W443021	AS	10/23/14 17:43	H3
EPA 6010B	**Iron**	17000	J	mg/kg	6.0	2.7		W443021	AS	10/23/14 17:43	H3

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Project Name: Razorback Ridge 2014
Work Order: **W4J0298**
Reported: 24-Oct-14 09:35

Client Sample ID: **RR-134**
SVL Sample ID: **W4J0298-10 (Soil)**

Sampled: 01-Mar-14 08:28
Received: 13-Oct-14
Sampled By: YM/EG

Method	Analyte	Result	Q	Units	RL	MDL	Dilution	Batch	Analyst	Analyzed	Notes
Metals (Total) by EPA 6000/7000 Methods											
EPA 6010B	Copper	351	J	mg/kg	1.00	0.25		W443021	AS	10/23/14 17:46	H3
EPA 6010B	Iron	18800	J	mg/kg	6.0	2.7		W443021	AS	10/23/14 17:46	H3

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Project Name: Razorback Ridge 2014
Work Order: **W4J0298**
Reported: 24-Oct-14 09:35

Client Sample ID: **RR-147**
SVL Sample ID: **W4J0298-11 (Soil)**

Sampled: 28-Feb-14 11:20
Received: 13-Oct-14
Sampled By: YM/EG

Method	Analyte	Result		Units	RL	MDL	Dilution	Batch	Analyst	Analyzed	Notes
Metals (Total) by EPA 6000/7000 Methods											
EPA 6010B	**Copper**	730	J	mg/kg	1.00	0.25		W443021	AS	10/23/14 17:49	H3
EPA 6010B	**Iron**	13900	J	mg/kg	6.0	2.7		W443021	AS	10/23/14 17:49	H3

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Project Name: Razorback Ridge 2014
Work Order: **W4J0298**
Reported: 24-Oct-14 09:35

Client Sample ID: **RR-162**
SVL Sample ID: **W4J0298-12 (Soil)**

Sampled: 25-Sep-14 08:58
Received: 13-Oct-14
Sampled By: YM/EG

Method	Analyte	Result	Units	RL	MDL	Dilution	Batch	Analyst	Analyzed	Notes
Metals (Total) by EPA 6000/7000 Methods										
EPA 6010B	**Copper**	987	mg/kg	1.00	0.25		W443021	AS	10/23/14 17:52	
EPA 6010B	**Iron**	21400	mg/kg	6.0	2.7		W443021	AS	10/23/14 17:52	

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Project Name: Razorback Ridge 2014
Work Order: **W4J0298**
Reported: 24-Oct-14 09:35

Client Sample ID: **RR-172**
SVL Sample ID: **W4J0298-13 (Soil)**

Sampled: 25-Sep-14 11:36
Received: 13-Oct-14
Sampled By: YM/EG

Method	Analyte	Result	Units	RL	MDL	Dilution	Batch	Analyst	Analyzed	Notes
Metals (Total) by EPA 6000/7000 Methods										
EPA 6010B	**Copper**	875	mg/kg	1.00	0.25		W443021	AS	10/23/14 17:56	
EPA 6010B	**Iron**	18200	mg/kg	6.0	2.7		W443021	AS	10/23/14 17:56	

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Project Name: Razorback Ridge 2014
Work Order: **W4J0298**
Reported: 24-Oct-14 09:35

Client Sample ID: **RR-182**
SVL Sample ID: **W4J0298-14 (Soil)**

Sampled: 24-Sep-14 11:50
Received: 13-Oct-14
Sampled By: YM/EG

Method	Analyte	Result	Units	RL	MDL	Dilution	Batch	Analyst	Analyzed	Notes
Metals (Total) by EPA 6000/7000 Methods										
EPA 6010B	**Copper**	216	mg/kg	1.00	0.25		W443021	AS	10/23/14 17:59	
EPA 6010B	**Iron**	25000	mg/kg	6.0	2.7		W443021	AS	10/23/14 17:59	

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Project Name: Razorback Ridge 2014
Work Order: **W4J0298**
Reported: 24-Oct-14 09:35

Client Sample ID: **RR-192**
SVL Sample ID: **W4J0298-15 (Soil)**

Sampled: 25-Sep-14 09:16
Received: 13-Oct-14
Sampled By: YM/EG

Method	Analyte	Result	Units	RL	MDL	Dilution	Batch	Analyst	Analyzed	Notes
Metals (Total) by EPA 6000/7000 Methods										
EPA 6010B	**Copper**	92.5	mg/kg	1.00	0.25		W443021	AS	10/23/14 18:02	
EPA 6010B	**Iron**	12900	mg/kg	6.0	2.7		W443021	AS	10/23/14 18:02	

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Project Name: Razorback Ridge 2014
Work Order: **W4J0298**
Reported: 24-Oct-14 09:35

Client Sample ID: **RR-202**
SVL Sample ID: **W4J0298-16 (Soil)**

Sampled: 24-Sep-14 11:59
Received: 13-Oct-14
Sampled By: YM/EG

Method	Analyte	Result	Units	RL	MDL	Dilution	Batch	Analyst	Analyzed	Notes
Metals (Total) by EPA 6000/7000 Methods										
EPA 6010B	**Copper**	78.1	mg/kg	1.00	0.25		W443021	AS	10/23/14 18:05	
EPA 6010B	**Iron**	16100	mg/kg	6.0	2.7		W443021	AS	10/23/14 18:05	

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Project Name: Razorback Ridge 2014
Work Order: **W4J0298**
Reported: 24-Oct-14 09:35

Client Sample ID: **RR-213**
SVL Sample ID: **W4J0298-17 (Soil)**

Sampled: 24-Sep-14 12:13
Received: 13-Oct-14
Sampled By: YM/EG

Method	Analyte	Result	Units	RL	MDL	Dilution	Batch	Analyst	Analyzed	Notes
Metals (Total) by EPA 6000/7000 Methods										
EPA 6010B	**Copper**	2010	mg/kg	1.00	0.25		W443021	AS	10/23/14 18:15	
EPA 6010B	**Iron**	27800	mg/kg	6.0	2.7		W443021	AS	10/23/14 18:15	

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Project Name: Razorback Ridge 2014
Work Order: **W4J0298**
Reported: 24-Oct-14 09:35

Client Sample ID: **RR-212**
SVL Sample ID: **W4J0298-18 (Soil)**

Sampled: 24-Sep-14 10:57
Received: 13-Oct-14
Sampled By: YM/EG

Method	Analyte	Result	Units	RL	MDL	Dilution	Batch	Analyst	Analyzed	Notes
Metals (Total) by EPA 6000/7000 Methods										
EPA 6010B	**Copper**	435	mg/kg	1.00	0.25		W443021	AS	10/23/14 18:18	
EPA 6010B	**Iron**	14600	mg/kg	6.0	2.7		W443021	AS	10/23/14 18:18	

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Project Name: Razorback Ridge 2014
Work Order: **W4J0298**
Reported: 24-Oct-14 09:35

Client Sample ID: **RR-222**
SVL Sample ID: **W4J0298-19 (Soil)**

Sampled: 24-Sep-14 10:15
Received: 13-Oct-14
Sampled By: YM/EG

Method	Analyte	Result	Units	RL	MDL	Dilution	Batch	Analyst	Analyzed	Notes
Metals (Total) by EPA 6000/7000 Methods										
EPA 6010B	**Copper**	128	mg/kg	1.00	0.25		W443021	AS	10/23/14 18:21	
EPA 6010B	**Iron**	10700	mg/kg	6.0	2.7		W443021	AS	10/23/14 18:21	

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Project Name: Razorback Ridge 2014
Work Order: **W4J0298**
Reported: 24-Oct-14 09:35

Client Sample ID: **RR-232**
SVL Sample ID: **W4J0298-20 (Soil)**

Sampled: 24-Sep-14 09:17
Received: 13-Oct-14
Sampled By: YM/EG

Method	Analyte	Result	Units	RL	MDL	Dilution	Batch	Analyst	Analyzed	Notes
Metals (Total) by EPA 6000/7000 Methods										
EPA 6010B	**Copper**	124	mg/kg	1.00	0.25		W443021	AS	10/23/14 18:24	
EPA 6010B	**Iron**	9180	mg/kg	6.0	2.7		W443021	AS	10/23/14 18:24	

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Project Name: Razorback Ridge 2014
Work Order: **W4J0298**
Reported: 24-Oct-14 09:35

Client Sample ID: **RR-242**
SVL Sample ID: **W4J0298-21 (Soil)**

Sampled: 24-Sep-14 13:31
Received: 13-Oct-14
Sampled By: YM/EG

Method	Analyte	Result	Units	RL	MDL	Dilution	Batch	Analyst	Analyzed	Notes
Metals (Total) by EPA 6000/7000 Methods										
EPA 6010B	**Copper**	96.6	mg/kg	1.00	0.25		W443023	AS	10/23/14 18:45	
EPA 6010B	**Iron**	19000	mg/kg	6.0	2.7		W443023	AS	10/23/14 18:45	M3

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Project Name: Razorback Ridge 2014
Work Order: **W4J0298**
Reported: 24-Oct-14 09:35

Client Sample ID: **RR-251**
SVL Sample ID: **W4J0298-22 (Soil)**

Sampled: 25-Sep-14 12:10
Received: 13-Oct-14
Sampled By: YM/EG

Method	Analyte	Result	Units	RL	MDL	Dilution	Batch	Analyst	Analyzed	Notes
Metals (Total) by EPA 6000/7000 Methods										
EPA 6010B	**Copper**	520	mg/kg	1.00	0.25		W443023	AS	10/23/14 18:54	
EPA 6010B	**Iron**	18700	mg/kg	6.0	2.7		W443023	AS	10/23/14 18:54	

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John Kern
Laboratory Director

www.svl.net One Government Gulch - PO Box 929 Kellogg ID 83837-0929 (208) 784-1258 Fax (208) 783-0891

Freeport McMoRan - Chino Mines
PO Box 10
Bayard, NM 88023

Project Name: Razorback Ridge 2014
Work Order: **W4J0298**
Reported: 24-Oct-14 09:35

Quality Control - BLANK Data

Method	Analyte	Units	Result	MDL	MRL	Batch ID	Analyzed	Notes
Metals (Total) by EPA 6000/7000 Methods								
EPA 6010B	Copper	mg/kg	<1.00	0.25	1.00	W443021	23-Oct-14	
EPA 6010B	Copper	mg/kg	<1.00	0.25	1.00	W443023	23-Oct-14	
EPA 6010B	Iron	mg/kg	<6.0	2.7	6.0	W443021	23-Oct-14	
EPA 6010B	Iron	mg/kg	<6.0	2.7	6.0	W443023	23-Oct-14	

Quality Control - LABORATORY CONTROL SAMPLE Data

Method	Analyte	Units	LCS Result	LCS True	% Rec.	Acceptance Limits	Batch ID	Analyzed	Notes
Metals (Total) by EPA 6000/7000 Methods									
EPA 6010B	Copper	mg/kg	101	100	101	80 - 120	W443021	23-Oct-14	
EPA 6010B	Copper	mg/kg	101	100	101	80 - 120	W443023	23-Oct-14	
EPA 6010B	Iron	mg/kg	978	1000	97.8	80 - 120	W443021	23-Oct-14	
EPA 6010B	Iron	mg/kg	965	1000	96.5	80 - 120	W443023	23-Oct-14	

Quality Control - MATRIX SPIKE Data

Method	Analyte	Units	Spike Result	Sample Result (R)	Spike Level (S)	% Rec.	Acceptance Limits	Batch ID	Analyzed	Notes
Metals (Total) by EPA 6000/7000 Methods										
EPA 6010B	Copper	mg/kg	1940	1750	100	R > 4S	75 - 125	W443021	23-Oct-14	H3 M3
EPA 6010B	Copper	mg/kg	209	96.6	100	112	75 - 125	W443023	23-Oct-14	
EPA 6010B	Iron	mg/kg	22200	15100	1000	R > 4S	75 - 125	W443021	23-Oct-14	H3 M3
EPA 6010B	Iron	mg/kg	18900	19000	1000	R > 4S	75 - 125	W443023	23-Oct-14	M3

Quality Control - MATRIX SPIKE DUPLICATE Data

Method	Analyte	Units	MSD Result	Spike Result	Spike Level	%R	RPD	RPD Limit	Batch ID	Analyzed	Notes
Metals (Total) by EPA 6000/7000 Methods											
EPA 6010B	Copper	mg/kg	1960	1940	100	R > 4S	1.0	20	W443021	23-Oct-14	H3,M3
EPA 6010B	Copper	mg/kg	204	209	100	108	2.2	20	W443023	23-Oct-14	
EPA 6010B	Iron	mg/kg	22300	22200	1000	R > 4S	0.7	20	W443021	23-Oct-14	H3 M3
EPA 6010B	Iron	mg/kg	19500	18900	1000	R > 4S	3.3	20	W443023	23-Oct-14	M3

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Freeport McMoRan - Chino Mines
PO Box 10
Bayard, NM 88023

Project Name: Razorback Ridge 2014
Work Order: **W4J0298**
Reported: 24-Oct-14 09:35

Notes and Definitions

H3	Sample was received and/or analysis requested past holding time.
M3	The spike recovery value is unusable since the analyte concentration in the sample is disproportionate to spike level. The LCS was acceptable.
LCS	Laboratory Control Sample (Blank Spike)
RPD	Relative Percent Difference
UDL	A result is less than the detection limit
R > 4S	% recovery not applicable, sample concentration more than four times greater than spike level
<RL	A result is less than the reporting limit
MRL	Method Reporting Limit
MDL	Method Detection Limit
N/A	Not Applicable

ATTACHMENT 4
LABORATORY NARRATIVE AND
CHAIN OF CUSTODY DOCUMENTATION

Chain of Custody Page 1 of 1

SVL Analytical, Inc One Government Gulch
PO Box 929
Kellogg, ID 83837-0929
Phone: 208-784-1258

W4J0298

Project Contact: Jen Pepe & Pam Pinson
Courier/Airbill:
Company: Chino Mines, Bayard, NM
Telephone/Email: jen_pepe@golder.co[m] Pamela_pinson@fmi.com
State of Sample Origin: NM USACE?
Sample Rejects: Dispose

PO #: ZN000003HT
Project: Razorback Ridge
Project Number:
COC #:

Sample ID	Sample Date	Sample Time	Matrix	Sampler	T / D	Analysis	Preservative / Container	Lab QC	Comments
RR-024	3/1/2014	15:18	Soil	YM/EG		Total Cu & Fe	XRF Cup		
RR-037	3/10/2014	9:44	Soil	YM/EG		Total Cu & Fe	XRF Cup		
RR-050	3/10/2014	08:07	Soil	YM/EG		Total Cu & Fe	XRF Cup		
RR-063	3/1/2014	14:34	Soil	YM/EG		Total Cu & Fe	XRF Cup		
RR-076	3/1/2014	13:06	Soil	YM/EG		Total Cu & Fe	XRF Cup		
RR-089	3/1/2014	13:28	Soil	YM/EG		Total Cu & Fe	XRF Cup		
~~RR-101~~	~~3/1/2014~~	~~11:53~~	~~Soil~~	~~YM/EG~~		~~Total Cu & Fe~~	~~XRF Cup~~		
RR-111	3/1/2014	9:30	Soil	YM/EG		Total Cu & Fe	XRF Cup		
RR-123	3/1/2014	12:28	Soil	YM/EG		Total Cu & Fe	XRF Cup		
RR-134	3/1/2014	8:28	Soil	YM/EG		Total Cu & Fe	XRF Cup		
RR-147	2/28/2014	11:20	Soil	YM/EG		Total Cu & Fe	XRF Cup		
RR-162	9/25/2014	8:58	Soil	YM/EG		Total Cu & Fe	XRF Cup		
RR-172	9/25/2014	11:36	Soil	YM/EG		Total Cu & Fe	XRF Cup		
RR-182	9/24/2014	11:50	Soil	YM/EG		Total Cu & Fe	XRF Cup		
RR-192	9/25/2014	9:16	Soil	YM/EG		Total Cu & Fe	XRF Cup		
RR-202	9/24/2014	11:59	Soil	YM/EG		Total Cu & Fe	XRF Cup		
RR-213	9/24/2014	12:13	Soil	YM/EG		Total Cu & Fe	XRF Cup		
RR-212	9/24/2014	10:57	Soil	YM/EG		Total Cu & Fe	XRF Cup		
RR-222	9/24/2014	10:15	Soil	YM/EG		Total Cu & Fe	XRF Cup		
RR-232	9/24/2014	9:17	Soil	YM/EG		Total Cu & Fe	XRF Cup		
RR-242	9/24/2014	13:31	Soil	YM/EG		Total Cu & Fe	XRF Cup		
RR-251	9/25/2014	12:10	Soil	YM/EG		Total Cu & Fe	XRF Cup		

Sampler Signature: Yoel Mora

Relinquished by	Date/Time	Received by	Date/Time
Yoel Mora	10-10-14/1430		10/13/14 15:00

LAB USE ONLY—Sample condition on Receipt

SVL Work No: W4J0298

Item	Description	V	VC	NV	NA	Comments
1	Client or project name	✓				Freeport Chino
2	Date and time of receipt at lab	✓				10/13/14 15:00
3	Received by	✓				M. Duce
4	Temperature blank or cooler temperature				✓	Temp. — °C. Soil only
5	Were the sample(s) received on ice				✓	no
6	Custody tape/bottle seals				✓	no
7	Condition of samples upon receipt (leaking; bubbles in VOA vials	✓				Good
8	Sample numbers/IDs agree with COC	✓				
9	Sample date & time agree with COC	✓				
10	Number of containers for each sample	✓				
11	The correct preservative for the analysis requested				✓	
12	Did an SVL employee preserve sample(s) upon receipt				✓	
13	Type of container for each sample / volume received	✓				
14	Analysis requested for each sample	✓				
15	Sample matrix description	✓				
16	COC properly completed & legible	✓				
17	Corrections properly made (initials & date)				✓	
18	Additional comments or records of sample condition or treatment (unlisted or missing samples at laboratory, aliquot taken, sample hold, samples subcontracted, communications between client and laboratory)				✓	
19	Shipper's air bill	✓				

V- Verified VC- Verified Corrections Made NV-Not Verified NA- Not Applicable

Additional Comments: _____

Golder Associates
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Fax: (575) 388-0120
www.golder.com

CHAIN OF CUSTODY RECORD

Project Number/Name:	Golder Contacts:
FMI/Razorback Ridge 1400277.103	Jen Pepe, York Morgan

Sampler: (print) Y. Morgan, E. Garcia (signature)

DATE/TIME	SAMPLE ID	SAMPLE TYPE	Number of Cups	ANALYSIS REQUESTED: Total Cu & Fe (XRF)						COMMENTS
3-10-14/09:45	RR-012	Soil	1	x						
3-10-14/08:52	RR-013	Soil	1	x						
3-10-14/08:47	RR-014	Soil	1	x						
3-10-14/09:55	RR-019	Soil	1	x						
3-10-14/09:41	RR-020	Soil	1	x						
3-10-14/08:57	RR-021	Soil	1	x						
3-10-14/09:38	RR-026	Soil	1	x						
3-10-14/09:01	RR-027	Soil	1	x						
3-10-14/10:04	RR-030	Soil	1	x						
3-10-14/09:33	RR-031	Soil	1	x						
3-10-14/09:08	RR-032	Soil	1	x						
3-10-14/08:37	RR-033	Soil	1	x						
3-10-14/10:10	RR-036	Soil	1	x						

RELINQUISHED BY:	DATE & TIME	RECEIVED BY:	RELINQUISHED BY:	DATE & TIME	RECEIVED BY:
York Morgan	3-10-14 1430	Jamie Bailey 1000 3/11/14			
RELINQUISHED BY:	DATE & TIME	RECEIVED BY:	RELINQUISHED BY:	DATE & TIME	RECEIVED BY
RELINQUISHED BY:	DATE & TIME	RECEIVED BY:	REMARKS: Page 1 of 2; Bag 1 w/ 13 samples		

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CHAIN OF CUSTODY RECORD

Project Number/Name:
FMI/Razorback Ridge
1400277.103

Golder Contacts:
Jen Pepe, York Morgan

Sampler: (print) Y. Morgan, E. Garcia (signature) York Morgan

DATE/TIME	SAMPLE ID	SAMPLE TYPE	Number of Cups	ANALYSIS REQUESTED: Total Cu & Fe (XRF)						COMMENTS
3-10-14/09:44	RR-037	Soil	1	x						
3-10-14/09:12	RR-038	Soil	1	x						
3-10-14/10:18	RR-042	Soil	1	x						
3-10-14/09:22	RR-043	Soil	1	x						
3-10-14/09:17	RR-044	Soil	1	x						
3-10-14/08:20	RR-045	Soil	1	x						
3-10-14/08:07	RR-050	Soil	1	x						
3-10-14/08:14	RR-051	Soil	1	x						

RELINQUISHED BY:	DATE & TIME	RECEIVED BY:	RELINQUISHED BY:	DATE & TIME	RECEIVED BY:
York Morgan	3-10-14 1430	James Bailey 3/11/14 @ 1000			
RELINQUISHED BY:	DATE & TIME	RECEIVED BY:	RELINQUISHED BY:	DATE & TIME	RECEIVED BY
RELINQUISHED BY:	DATE & TIME	RECEIVED BY:	REMARKS: Page 2 of 2; Bag 2 w/ 8 samples		

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CHAIN OF CUSTODY RECORD

Project Number/Name:
FMI/Razorback Ridge
1400277.103

Golder Contacts:
Jen Pepe, York Morgan

Sampler: (print) Y. Morgan, E. Garcia (signature) York Morgan

DATE/TIME	SAMPLE ID	SAMPLE TYPE	Number of Cups	ANALYSIS REQUESTED: Total Cu & Fe (XRF)						COMMENTS
3-1-14/12:12	RR-119	Soil	1	x						
3-1-14/09:21	RR-120	Soil	1	x						
3-1-14/10:14	RR-121	Soil	1	x						
3-1-14/12:28	RR-123	Soil	1	x						
3-1-14/12:16	RR-124	Soil	1	x						
3-1-14/09:14	RR-125	Soil	1	x						
3-1-14/08:08	RR-126	Soil	1	x						
3-1-14/12:26	RR-128	Soil	1	x						
3-1-14/12:21	RR-129	Soil	1	x						
3-1-14/08:22	RR-130	Soil	1	x						
3-1-14/08:16	RR-131	Soil	1	x						
3-1-14/07:58	RR-132	Soil	1	x						
3-1-14/08:53	RR-133	Soil	1	x						

RELINQUISHED BY:	DATE & TIME	RECEIVED BY:	RELINQUISHED BY:	DATE & TIME	RECEIVED BY:
York Morgan	3-3-14 15:00	3/4/14 @ 1030			
RELINQUISHED BY:	DATE & TIME	RECEIVED BY:	RELINQUISHED BY:	DATE & TIME	RECEIVED BY
RELINQUISHED BY:	DATE & TIME	RECEIVED BY:	REMARKS: Page 6 of 8; Bag 6 w/ 13 samples.		

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Project Number/Name:
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1400277.103

Golder Contacts:
Jen Pepe, York Morgan

Sampler: (print) Y. Morgan, E. Garcia (signature) York Morgan

DATE/TIME	SAMPLE ID	SAMPLE TYPE	Number of Cups	ANALYSIS REQUESTED: Total Cu & Fe (XRF)	COMMENTS
3-1-14/08:28	RR-134	Soil	1	x	
2-28-14/11:55	RR-135	Soil	1	x	
3-1-14/07:51	RR-136	Soil	1	x	
3-1-14/08:48	RR-137	Soil	1	x	
3-1-14/08:33	RR-138	Soil	1	x	
2-28-14/11:52	RR-139	Soil	1	x	
3-1-14/07:45	RR-140	Soil	1	x	
3-1-14/08:42	RR-142	Soil	1	x	
2-28-14/11:48	RR-143	Soil	1	x	
3-1-14/07:29	RR-144	Soil	1	x	
2-28-14/11:20	RR-147	Soil	1	x	
2-28-14/11:42	RR-148	Soil	1	x	
2-28-14/11:35	RR-149	Soil	1	x	

RELINQUISHED BY:	DATE & TIME	RECEIVED BY:	RELINQUISHED BY:	DATE & TIME	RECEIVED BY:
York Morgan	3-3-14 15:00	[illegible] 3/4/14 @1030			
RELINQUISHED BY:	DATE & TIME	RECEIVED BY:	RELINQUISHED BY:	DATE & TIME	RECEIVED BY
RELINQUISHED BY:	DATE & TIME	RECEIVED BY:	REMARKS: Page 7 of 8; Bag 7 w/ 14 samples		

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CHAIN OF CUSTODY RECORD

Project Number/Name: FMI/Razorback Ridge 1400277.103

Golder Contacts: Jen Pepe, York Morgan

Sampler: (print) Y. Morgan, E. Garcia (signature)

ANALYSIS REQUESTED

DATE/TIME	SAMPLE ID	SAMPLE TYPE	Number of Cups	Total Cu & Fe (XRF)	COMMENTS
3-1-14/07:22	RR-152	Soil	1	x	

RELINQUISHED BY:	DATE & TIME	RECEIVED BY:	RELINQUISHED BY:	DATE & TIME	RECEIVED BY:
	3/3/14 15:05	3/4/14 @1030			
RELINQUISHED BY:	DATE & TIME	RECEIVED BY:	RELINQUISHED BY:	DATE & TIME	RECEIVED BY
RELINQUISHED BY:	DATE & TIME	RECEIVED BY:	REMARKS: Page 8 of 8; Bag 7 w/ 14 samples		

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Project Number/Name:
FMI/Razorback Ridge
1400277.103

Golder Contacts:
Jen Pepe, York Morgan

Sampler: (print) Y. Morgan, E. Garcia (signature) [signature]

DATE/TIME	SAMPLE ID	SAMPLE TYPE	Number of Cups	ANALYSIS REQUESTED: Total Cu & Fe (XRF)						COMMENTS
3-1-14/14:26	RR-056	Soil	1	x						
3-1-14/14:39	RR-058	Soil	1	x						
3-1-14/14:11	RR-059	Soil	1	x						
3-1-14/14:15	RR-060	Soil	1	x						
3-1-14/11:23	RR-061	Soil	1	x						
3-1-14/14:34	RR-063	Soil	1	x						
3-1-14/16:01	RR-064	Soil	1	x						
3-1-14/16:10	RR-065	Soil	1	x						
3-1-14/11:27	RR-066	Soil	1	x						
3-1-14/16:05	RR-069	Soil	1	x						
3-1-14/16:15	RR-070	Soil	1	x						
3-1-14/11:31	RR-071	Soil	1	x						
3-1-14/11:10	RR-072	Soil	1	x						

RELINQUISHED BY:	DATE & TIME	RECEIVED BY:	RELINQUISHED BY:	DATE & TIME	RECEIVED BY:
[signature]	3/5 15:30	[signature] 5/4/14 @1030			
RELINQUISHED BY:	DATE & TIME	RECEIVED BY:	RELINQUISHED BY:	DATE & TIME	RECEIVED BY
RELINQUISHED BY:	DATE & TIME	RECEIVED BY:	REMARKS: Page 2 of 8; Bag 2 w/ 13 samples		

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CHAIN OF CUSTODY RECORD

Project Number/Name:
FMI/Razorback Ridge
1400277.103

Golder Contacts:
Jen Pepe, York Morgan

Sampler: (print) Y. Morgan, E. Garcia (signature) York Morgan

DATE/TIME	SAMPLE ID	SAMPLE TYPE	Number of Cups	ANALYSIS REQUESTED: Total Cu & Fe (XRF)						COMMENTS
3-1-14/13:41	RR-074	Soil	1	x						
3-1-14/16:23	RR-075	Soil	1	x						
3-1-14/13:06	RR-076	Soil	1	x						
3-1-14/11:04	RR-077	Soil	1	x						
3-1-14/13:35	RR-079	Soil	1	x						
3-1-14/16:26	RR-080	Soil	1	x						
3-1-14/13:02	RR-081	Soil	1	x						
3-1-14/10:58	RR-082	Soil	1	x						
3-1-14/13:31	RR-084	Soil	1	x						
3-1-14/16:29	RR-085	Soil	1	x						
3-1-14/12:58	RR-086	Soil	1	x						
3-1-14/11:42	RR-087	Soil	1	x						
3-1-14/13:28	RR-089	Soil	1	x						

RELINQUISHED BY:	DATE & TIME	RECEIVED BY:	RELINQUISHED BY:	DATE & TIME	RECEIVED BY:
York Morgan	3-3-14 15:00	3/4/14 @1030			
RELINQUISHED BY	DATE & TIME	RECEIVED BY:	RELINQUISHED BY:	DATE & TIME	RECEIVED BY
RELINQUISHED BY:	DATE & TIME	RECEIVED BY:	REMARKS: Page 3 of 8; Bag 3 w/ 13 samples		

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CHAIN OF CUSTODY RECORD

Project Number/Name: FMI/Razorback Ridge 1400277.103

Golder Contacts: Jen Pepe, York Morgan

Sampler: (print) Y. Morgan, E. Garcia (signature)

DATE/TIME	SAMPLE ID	SAMPLE TYPE	Number of Cups	Total Cu & Fe (XRF)						COMMENTS
				ANALYSIS REQUESTED						
3-1-14/12:55	RR-090	Soil	1	x						
3-1-14/11:45	RR-091	Soil	1	x						
3-1-14/10:43	RR-092	Soil	1	x						
3-1-14/13:22	RR-094	Soil	1	x						
3-1-14/12:51	RR-095	Soil	1	x						
3-1-14/11:49	RR-096	Soil	1	x						
3-1-14/09:47	RR-097	Soil	1	x						
3-1-14/13:18	RR-099	Soil	1	x						
3-1-14/12:46	RR-100	Soil	1	x						
3-1-14/11:53	RR-101	Soil	1	x						
3-1-14/09:40	RR-102	Soil	1	x						
3-1-14/09:54	RR-103	Soil	1	x						
3-1-14/13:13	RR-104	Soil	1	x						

RELINQUISHED BY:	DATE & TIME	RECEIVED BY:	RELINQUISHED BY:	DATE & TIME	RECEIVED BY:
	3/4 15:00	3/4/14 @1030			
RELINQUISHED BY:	DATE & TIME	RECEIVED BY:	RELINQUISHED BY:	DATE & TIME	RECEIVED BY
RELINQUISHED BY:	DATE & TIME	RECEIVED BY:	REMARKS: Page 4 of 8; Bag 4 w/ 13 samples		

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CHAIN OF CUSTODY RECORD

Project Number/Name:
FMI/Razorback Ridge
1400277.103

Golder Contacts:
Jen Pepe, York Morgan

Sampler:(print) Y. Morgan, E. Garcia (signature) York Morgan

DATE/TIME	SAMPLE ID	SAMPLE TYPE	Number of Cups	ANALYSIS REQUESTED: Total Cu & Fe (XRF)						COMMENTS
3-1-14/12:42	RR-105	Soil	1	x						
3-1-14/11:57	RR-106	Soil	1	x						
3-1-14/09:35	RR-107	Soil	1	x						
3-1-14/10:00	RR-108	Soil	1	x						
3-1-14/12:38	RR-109	Soil	1	x						
3-1-14/12:03	RR-110	Soil	1	x						
3-1-14/09:30	RR-111	Soil	1	x						
3-1-14/10:05	RR-112	Soil	1	x						
3-1-14/12:36	RR-113	Soil	1	x						
3-1-14/12:06	RR-114	Soil	1	x						
3-1-14/09:25	RR-115	Soil	1	x						
3-1-14/10:10	RR-116	Soil	1	x						
3-1-14/12:32	RR-118	Soil	1	x						

RELINQUISHED BY:	DATE & TIME	RECEIVED BY:	RELINQUISHED BY:	DATE & TIME	RECEIVED BY:
York Morgan	3-3-14 15:30	[signature] 3/4/14 @1030			
RELINQUISHED BY:	DATE & TIME	RECEIVED BY:	RELINQUISHED BY:	DATE & TIME	RECEIVED BY
RELINQUISHED BY:	DATE & TIME	RECEIVED BY:	REMARKS: Page 5 of 8; Bag 5 w/ 13 samples		

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CHAIN OF CUSTODY RECORD

Project Number/Name:
FMI/Razorback Ridge
1400277.103

Golder Contacts:
Jen Pepe, York Morgan

Sampler:(print) Y. Morgan, E. Garcia (signature)

DATE/TIME	SAMPLE ID	SAMPLE TYPE	Number of Cups	ANALYSIS REQUESTED: Total Cu & Fe (XRF)	COMMENTS
3-1-14/15:42	RR-015	Soil	1	x	
3-1-14/15:35	RR-016	Soil	1	x	
3-1-14/15:50	RR-023	Soil	1	x	
3-1-14/15:18	RR-024	Soil	1	x	
3-1-14/15:13	RR-029	Soil	1	x	
3-1-14/15:08	RR-035	Soil	1	x	
3-1-14/15:03	RR-041	Soil	1	x	
3-1-14/14:58	RR-047	Soil	1	x	
3-1-14/14:54	RR-048	Soil	1	x	
3-1-14/14:02	RR-049	Soil	1	x	
3-1-14/14:47	RR-053	Soil	1	x	
3-1-14/14:06	RR-054	Soil	1	x	
3-1-14/14:22	RR-055	Soil	1	x	

RELINQUISHED BY:	DATE & TIME	RECEIVED BY:	RELINQUISHED BY:	DATE & TIME	RECEIVED BY:
York Morgan	3-3-14 15:50	J Bailey 3/4/14 @1030			
RELINQUISHED BY:	DATE & TIME	RECEIVED BY:	RELINQUISHED BY:	DATE & TIME	RECEIVED BY
RELINQUISHED BY:	DATE & TIME	RECEIVED BY:	REMARKS: Page 1 of 8; Bag 1 w/ 13 samples		

ATTACHMENT 5
SUPPORTING DOCUMENTATION

INORGANIC ANALYTE - Tier II & III Data Validation Summary Checklist

SVL, ID	RazorBack Ridge, NM
	#W4J0298

RR-024	3/1/2014	RR-162	9/25/2014	Soil
RR-037	3/10/2014	RR-172	9/25/2014	Soil
RR-050	3/10/2014	RR-182	9/24/2014	Soil
RR-063	3/1/2014	RR-192	9/25/2014	Soil
RR-076	3/1/2014	RR-202	9/24/2014	Soil
RR-089	3/1/2014	RR-212	9/24/2014	Soil
RR-101	3/1/2014	RR-213	9/24/2014	Soil
RR-111	3/1/2014	RR-222	9/24/2014	Soil
RR-123	3/1/2014	RR-232	9/24/2014	Soil
RR-134	3/1/2014	RR-242	9/24/2014	Soil
RR-147	2/28/2014	RR-251	9/25/2014	Soil

DATA ASSESSMENT SUMMARY

REVIEW ITEM	VOA EPA 8260C	PAHs EPA 8270D	Metals EPA 6010	NWTPH-HCID	Gen. Chemistry Anions	NO2/NO3-N	OTHER
1. Data Completeness			O				
2. Holding Times (1)			X				
3. Calibration, Tune			-				
4. Field, Trip Blanks			-				
5. Laboratory Blanks			O				
6. Surrogates			-				
7. Lab Duplicate, Field Duplicate			O				
8. LCS, Blank Spike			O				
9. Matrix Spike /MS Duplicate			O				
10. Result Verify, Detection Limits			O				
11. Overall Summary			O				

O = Data had no problems Θ = Problems, but do not affect data

X = Data qualified due to minor problems [typically estimated data (J or UJ)].

M = Data qualified due to major problems [typically more than 50% qualified (J/UJ).

Z = Data unacceptable [typically data rejected (R).

Comments/Qualified Results: (1) Holding Time limit exceeded for selected samples for Cu & Fe results. SEE H:TIME SUMM. TABLE 1.

Validated by: [signature] **Date:** Dec. 1, 2014

Reviewed by: **Date:**

INORGANIC ANALYTE - Tier II & III Data Validation Summary Checklist

Acceptable: YES / NO

1. Date Package Completeness (Check if present)..... ☑ ☐

- ✓ Case narrative
- ✓ Chain of Custody
- ✓ Sample Results
- ✓ Detection Limits
- O GC/MS Tuning
- ✓ Initial Calibration
- ✓ Continuing Calib.
- ✓ Blank Results
- O Surrogate Results
- O Internal Standards
- ✓ MS/MSD, LCS Results
- O Preparation Logs
- ✓ Analysis Run Logs
- ✓ Raw Data
- ✓ Other_____

/ Acceptable
x Absent
o Not required for data package requested.

Comments/Qualified Results: The samples arrived in good condition as individual soils in XRF cups. The temperature at receipt time was ambient and no qualification is warranted. This is a Tier II data deliverable package from SVL Laboratory, Some QC criteria will not be available for review.

2. Holding Times (Check all that apply)..... ☐ ☒

- O Preserved VOA analyzed 14 days from collection; Unpreserved in 7 days from collection; All Water Smpls <6 degC;
- ✓ BNA samples extracted within 7 days (14 day soil) of collection; All Water Smpls <6 degC
- ✓ BNA extracts analyzed within 40 days of collection
- ✓ Pest/PCBs samples extracted within 7 days (14 day soil) of collection; All Water Smpls <6 degC
- ✓ Pest/PCBs extracts analyzed within 40 days of collection
- ✓ Qualify as estimated (J) all detects and ~~Reject (R) all non-detect results~~ analyzed past hold time limits. UJ Non-detects
- O Soil & Encore Smpls stored at -7 deg C.

Comments/Qualified Results: See Holding Time summary page calculations; Table 1 ⊗ Sample handling requirements exceeded for selected samples: **Cu, Fe** – Selected samples qualified as estimated (J/UJ) due to out of limit HT.

3. Calibration, Tuning Criteria (Check all that apply)..... ☐ NA ☐

***ICP*/MS:**	**PCBs**
__BFB for GC/MS: BFB/ICV/M.Blank/CCV; Beginning and each 12 hour period,	__5 pt. Calib for A-1016 & A1260; Single point for other Aroclors; Performed in sequence
__BFB Ion abundance criteria meets Table guidelines.	__Retention Times @+/-0.7 min.from ICAL means.
__ICV on 5 levels; RRF & %RSD calc for all Cmpnds. must meet Table 16 guidelines	__Calculate CalibFactor (CF) for each of 5 peaks; %RSD for each peak <20%; Same for Surrogates.
__CCV @ midpoint conc.; Must meet Table 16 guidelines	__CCV @ midpoint each 12 hours; %D 20% max between ICAL and CCV
__For outliers,qualify detects as estimated (J+) and NDs as unusable (R)	

Examples:

Comments/Qualified Results: ICV&CCV data not provided. **Metals**: No issues noted with Calibration by Lab – No Qualification applied

Acceptable: Yes NO

4. Field Blanks, Storage Blanks (VOA only) (Check all that apply)..... ☐ NA ☐

GC/MS	PCBs
__Storage Blanks; prepared upon receipt of sample set,	__Storage Blanks; prepared upon receipt of sample set,
__ Storage Blanks; Target Cmpnds <RL, MeCl2, Acetone, 2-butanone (<2X RLs)	__ Storage Blanks; Target Cmpnds <RL, MeCl2, Acetone, 2-butanone (<2X RLs)
__All blanks; Non-Target Cmpnds must be < 2.0 ug/L	__All blanks; Non-Target Cmpnds must be < 2.0 ug/L
__ Field Blanks, Trip Blanks; Qualification is advisory, but should be called out in Report Text.	__ Field Blanks, Trip Blanks; Qualification is advisory, but should be called out in Report Text.

Examples:

Comments/Qualified Results: **Samples** identified as Trip Blank, or Field Blank were not included on Chain of Custody documents. No further action taken, and no qualification applied.

5. Laboratory Blanks (Check all that apply)..... ☑ ☐

GC/MS:	PCBs:
__Method Blanks, Prep.Blanks analyzed after Cal Stnds and every 12 hours	__Method Blanks &All other Blanks analyzed after Cal Stnds and every 12 hours;
__ Method Blanks; Target Cmpnds <RL, MeCl2, Acetone, 2-butanone (<2X RLs); Chart	__ Detects Cmpnds >RL qualif assoc results U @ detect level, or J+ @ <10X detect; Chart
__other Contaminants: Qualif. Results <5X RLs according to Chart	
__Instrument blanks after all high level samples, All cmpnds must be <RL	
__All blanks; Non-Target Cmpnds must be < 2.0 ug/L	
Detects List:	

Comments/Qualified Results: **Metals:** All blank data ND @ MRL. No Qualific applies.

6. Surrogates (Check all that apply)..... ☐ NA ☐

GC/MS:	PCBs:
__Surrogates analyzed	TCX and DCB w/in 0.05 & 0.1 RT minutes of ICAL
__Recoveries within Method Control (lab) limits (VOA, SVOA: Lab Established, PEST: 30-150%)	__Recovery within 30-150% for All: MS, Blnk, Smpls.
__Recoveries above Method Control limits (J detects only)	__Recoveries above 150% (J+ detects only)
__Recoveries below Method Control limits but>20% (J/UJ)	__Recoveries below 30% but>10% (J-/UJ)
__Recoveries below 20%, 10% for PEST (J/UR for VOA, J/ UJ or UR for SVOA, J/UR for PEST)	__Recoveries below 10%, (J-/R for Non-dilute, J-/ UJ for diluted extract)

Comments/Qualified Results **Not applicable;**

Acceptable: Yes NO

7. Duplicate, Field Duplicates (Check all that apply)..... ☑ ☐

__Duplicate RPD ≤20% for waters (≤35% for soils) for results >5X CRDL
__Duplicate range is within ±CRDL (± 2X CRDL for soils) for results <5X CRDL
__Field duplicate RPD ≤20% (≤35% for soils)

Comments/Qualified Results: Samples do not include a field duplicate per the deliverable documents in review; MS/MSD data for RPD of spike values are within acceptance range (<35%). No qualifications applied.

Acceptable: **Yes** **NO**

8. Lab Control Samples, Blank Spikes (Check all that apply)..... ☑ ☐

__LCS %R 70-130% 504.1 Analysis; Prescribed by FGuidelines for EPA 8260
__LCS %R 50-79% or >120%, results >IDL estimated (J)
__LCS %R 50-79% and results <IDL estimated (UJ)
__LCS %R <50% and all results rejected (R/UR)

Comments/Qualified Results: **Metals:** all meet recovery 80-120%. No qualification applies;

9. MS / MSD Recovery on samples for associated Data Package... ☑ ☐

MS/MSD Recovery data required in Functional Guidelines for select analytes; following limits will be advisory.Professional judgement is applied.

VOA-Trace & Low Level	***SVOA-***
__ MS or MSD %R 20-[61 to 76]% for Water, [59 to 172%] for Soil; Qualify J/UJ; Reference Table 11&23 NFG;	__ MS/MSD %R [10 to 127]% for Water, [11 to 142%] for Soil; Qualify J/UJ; Reference Table 38 NFG;
__ MS or MSD %R <20%, estimated (J/R)	__ MS/MSD %R <10%, Qualify J/R;
__ MS or MSD %R >120%, results >IDL estimated (J)	__ MS/MSD %R >120%, results >IDL estimated (J)
PCB-	
__ MS/MSD %R [29 to 135]% for Water & Soil; Qualify J/UJ; Reference Table 70 NFG;	__ MS/MSD %R >135%, results >IDL estimated (J)
__ MS/MSD %R <20%, Qualify J/R;	***Metals- 75-125%***

Comments/Qualified Results: **Metals: Samples RR-024 and RR-242 used for spike (assumed);** all meet recovery 75-125% or sample result is >4 times the spike amount and qualification does not apply, according to DV guidelines.

10. Result Verification, Detection Limits ..... ☑ ☐

__All results supported in raw data
__Detection Limits appropriate to meet project needs (Review Work Plan, QAPP)

Comments/Qualified Results: Raw data files not included, however the Tier II deliverable is complete for the QC items reviewed.

Cu MDL 0.25 mg/kg; MRL 1.00 mg/kg;

Fe MDL 2.7 mg/kg; MRL 6.0 mg/kg;

11. Overall Assessment..... ☑ ☐

Comments/Qualified Results: Sample results accepted as reported with qualifications as noted on report pages.

Table A5.1: Comprehensive Sample Analysis Summary

Razorback Ridge: XRF vs Certified Lab Results						
Sample ID	**Sample Date**	**Sample Time**	**Longitude**	**Latitude**	**XRF Sample Collection & Analysis**	**Certified Laboratory Preparation & Analysis**
RR-012	3/10/2014	9:45	770912	3622008	X	
RR-013	3/10/2014	8:52	770949	3622009	X	
RR-014	3/10/2014	8:47	770985	3622010	X	
RR-015	3/1/2014	15:42	770730	3621966	X	
RR-016	3/1/2014	15:35	770767	3621967	X	
RR-019	3/10/2014	9:55	770877	3621970	X	
RR-020	3/10/2014	9:41	770913	3621971	X	
RR-021	3/10/2014	8:57	770950	3621972	X	
RR-023	3/1/2014	15:50	770805	3621931	X	
RR-024	3/1/2014	15:18	770841	3621932	X	X
RR-026	3/10/2014	9:38	770914	3621935	X	
RR-027	3/10/2014	9:01	770951	3621936	X	
RR-029	3/1/2014	15:13	770842	3621896	X	
RR-030	3/10/2014	10:04	770879	3621897	X	
RR-031	3/10/2014	9:33	770916	3621898	X	
RR-032	3/10/2014	9:08	770952	3621899	X	
RR-033	3/10/2014	8:37	770989	3621900	X	
RR-035	3/1/2014	15:08	770843	3621859	X	
RR-036	3/10/2014	10:10	770880	3621860	X	
RR-037	3/10/2014	9:44	770917	3621861	X	X
RR-038	3/10/2014	9:12	770953	3621862	X	
RR-041	3/1/2014	15:03	770845	3621823	X	
RR-042	3/10/2014	10:18	770881	3621824	X	
RR-043	3/10/2014	9:22	770918	3621825	X	
RR-044	3/10/2014	9:17	770954	3621826	X	
RR-045	3/10/2014	8:20	770991	3621827	X	
RR-047	3/1/2014	14:58	770846	3621786	X	
RR-048	3/1/2014	14:54	770882	3621787	X	
RR-049	3/1/2014	14:02	770919	3621788	X	
RR-050	3/10/2014	8:07	770955	3621789	X	X
RR-051	3/10/2014	8:14	770992	3621790	X	
RR-053	3/1/2014	14:47	770883	3621751	X	
RR-054	3/1/2014	14:06	770920	3621752	X	
RR-055	3/1/2014	14:22	770956	3621753	X	
RR-056	3/1/2014	14:26	770993	3621754	X	
RR-058	3/1/2014	14:39	770884	3621714	X	
RR-059	3/1/2014	14:11	770921	3621715	X	
RR-060	3/1/2014	14:15	770958	3621716	X	
RR-061	3/1/2014	11:23	770994	3621717	X	
RR-063	3/1/2014	14:34	770885	3621677	X	X
RR-064	3/1/2014	16:01	770922	3621678	X	
RR-065	3/1/2014	16:10	770959	3621680	X	
RR-066	3/1/2014	11:27	770995	3621681	X	
RR-069	3/1/2014	16:05	770923	3621642	X	
RR-070	3/1/2014	16:15	770960	3621643	X	
RR-071	3/1/2014	11:31	770996	3621644	X	

Table A5.1: Comprehensive Sample Analysis Summary

Razorback Ridge: XRF vs Certified Lab Results						
Sample ID	**Sample Date**	**Sample Time**	**Longitude**	**Latitude**	**XRF Sample Collection & Analysis**	**Certified Laboratory Preparation & Analysis**
RR-072	3/1/2014	11:10	771033	3621645	X	
RR-074	3/1/2014	13:41	770924	3621605	X	
RR-075	3/1/2014	16:23	770961	3621606	X	
RR-076	3/1/2014	13:06	770997	3621607	X	X
RR-077	3/1/2014	11:04	771034	3621609	X	
RR-079	3/1/2014	13:35	770925	3621569	X	
RR-080	3/1/2014	16:26	770962	3621570	X	
RR-081	3/1/2014	13:02	770999	3621571	X	
RR-082	3/1/2014	10:58	771035	3621572	X	
RR-084	3/1/2014	13:31	770926	3621532	X	
RR-085	3/1/2014	16:29	770963	3621533	X	
RR-086	3/1/2014	12:58	771000	3621534	X	
RR-087	3/1/2014	11:42	771036	3621535	X	
RR-089	3/1/2014	13:28	770964	3621497	X	X
RR-090	3/1/2014	12:55	771001	3621498	X	
RR-091	3/1/2014	11:45	771037	3621499	X	
RR-092	3/1/2014	10:43	771074	3621500	X	
RR-094	3/1/2014	13:22	770965	3621460	X	
RR-095	3/1/2014	12:51	771002	3621461	X	
RR-096	3/1/2014	11:49	771038	3621462	X	
RR-097	3/1/2014	9:47	771075	3621463	X	
RR-099	3/1/2014	13:18	770966	3621423	X	
RR-100	3/1/2014	12:46	771003	3621425	X	
RR-101	3/1/2014	11:53	771039	3621426	X	X
RR-102	3/1/2014	9:40	771076	3621427	X	
RR-103	3/1/2014	9:54	771113	3621428	X	
RR-104	3/1/2014	13:13	770967	3621387	X	
RR-105	3/1/2014	12:42	771004	3621388	X	
RR-106	3/1/2014	11:57	771041	3621389	X	
RR-107	3/1/2014	9:35	771077	3621390	X	
RR-108	3/1/2014	10:00	771114	3621391	X	
RR-109	3/1/2014	12:38	771005	3621351	X	
RR-110	3/1/2014	12:03	771042	3621353	X	
RR-111	3/1/2014	9:30	771078	3621354	X	X
RR-112	3/1/2014	10:05	771115	3621355	X	
RR-113	3/1/2014	12:36	771006	3621315	X	
RR-114	3/1/2014	12:06	771043	3621316	X	
RR-115	3/1/2014	9:25	771079	3621317	X	
RR-116	3/1/2014	10:10	771116	3621318	X	
RR-118	3/1/2014	12:32	771007	3621278	X	
RR-119	3/1/2014	12:12	771044	3621279	X	
RR-120	3/1/2014	9:21	771080	3621280	X	
RR-121	3/1/2014	10:14	771117	3621282	X	
RR-123	3/1/2014	12:28	771008	3621242	X	X
RR-124	3/1/2014	12:16	771045	3621243	X	
RR-125	3/1/2014	9:14	771082	3621244	X	

Table A5.1: Comprehensive Sample Analysis Summary

Razorback Ridge: XRF vs Certified Lab Results						
Sample ID	**Sample Date**	**Sample Time**	**Longitude**	**Latitude**	**XRF Sample Collection & Analysis**	**Certified Laboratory Preparation & Analysis**
RR-126	3/1/2014	8:08	771118	3621245	X	
RR-128	3/1/2014	12:26	771009	3621205	X	
RR-129	3/1/2014	12:21	771046	3621206	X	
RR-130	3/1/2014	8:22	771083	3621207	X	
RR-131	3/1/2014	8:16	771119	3621208	X	
RR-132	3/1/2014	7:58	771156	3621209	X	
RR-133	3/1/2014	8:53	771047	3621170	X	
RR-134	3/1/2014	8:28	771084	3621171	X	X
RR-135	2/28/2014	11:55	771120	3621172	X	
RR-136	3/1/2014	7:51	771157	3621173	X	
RR-137	3/1/2014	8:48	771048	3621133	X	
RR-138	3/1/2014	8:33	771085	3621134	X	
RR-139	2/28/2014	11:52	771121	3621135	X	
RR-140	3/1/2014	7:45	771158	3621136	X	
RR-142	3/1/2014	8:42	771086	3621098	X	
RR-143	2/28/2014	11:48	771122	3621099	X	
RR-144	3/1/2014	7:29	771159	3621100	X	
RR-147	2/28/2014	11:20	771087	3621061	X	X
RR-148	2/28/2014	11:42	771124	3621062	X	
RR-149	2/28/2014	11:35	771160	3621063	X	
RR-152	3/1/2014	7:22	771161	3621027	X	
RR-156	9/24/2014	11:24	-108.11244	32.69960	X	
RR-157	9/25/2014	10:22	-108.11205	32.69960	X	
RR-158	9/25/2014	10:46	-108.11322	32.69926	X	
RR-159	9/25/2014	11:17	-108.11283	32.69927	X	
RR-160	9/25/2014	11:27	-108.11244	32.69927	X	
RR-161	9/25/2014	10:18	-108.11205	32.69927	X	
RR-162	9/25/2014	8:58	-108.11166	32.69927	X	X
RR-163	9/24/2014	11:30	-108.11400	32.69893	X	
RR-164	9/25/2014	10:52	-108.11322	32.69893	X	
RR-165	9/25/2014	11:14	-108.11283	32.69894	X	
RR-166	9/25/2014	11:31	-108.11244	32.69894	X	
RR-167	9/25/2014	10:15	-108.11205	32.69894	X	
RR-168	9/25/2014	9:01	-108.11166	32.69894	X	
RR-169	9/24/2014	11:28	-108.11399	32.69860	X	
RR-170	9/25/2014	10:56	-108.11321	32.69860	X	
RR-171	9/25/2014	11:11	-108.11282	32.69861	X	
RR-172	9/25/2014	11:36	-108.11243	32.69861	X	X
RR-173	9/25/2014	10:11	-108.11204	32.69861	X	
RR-174	9/25/2014	9:05	-108.11165	32.69861	X	
RR-175	9/24/2014	11:40	-108.11438	32.69827	X	
RR-176	9/24/2014	11:23	-108.11399	32.69827	X	
RR-177	9/25/2014	11:00	-108.11321	32.69827	X	
RR-178	9/25/2014	11:07	-108.11282	32.69828	X	
RR-179	9/25/2014	11:40	-108.11243	32.69828	X	
RR-180	9/25/2014	10:07	-108.11204	32.69828	X	

Table A5.1: Comprehensive Sample Analysis Summary

Razorback Ridge: XRF vs Certified Lab Results						
Sample ID	**Sample Date**	**Sample Time**	**Longitude**	**Latitude**	**XRF Sample Collection & Analysis**	**Certified Laboratory Preparation & Analysis**
RR-181	9/25/2014	9:08	-108.11165	32.69828	X	
RR-182	9/24/2014	11:50	-108.11438	32.69794	X	X
RR-183	9/24/2014	11:20	-108.11399	32.69794	X	
RR-184	9/25/2014	11:04	-108.11282	32.69795	X	
RR-185	9/24/2014	11:43	-108.11243	32.69795	X	
RR-186	9/25/2014	10:03	-108.11204	32.69795	X	
RR-187	9/25/2014	9:12	-108.11165	32.69795	X	
RR-188	9/24/2014	12:45	-108.11516	32.69761	X	
RR-189	9/24/2014	12:43	-108.11477	32.69761	X	
RR-190	9/24/2014	11:52	-108.11438	32.69761	X	
RR-191	9/24/2014	11:18	-108.11399	32.69761	X	
RR-192	9/25/2014	9:16	-108.11165	32.69762	X	X
RR-193	9/24/2014	12:39	-108.11477	32.69728	X	
RR-194	9/24/2014	11:54	-108.11438	32.69728	X	
RR-195	9/24/2014	11:15	-108.11399	32.69728	X	
RR-196	9/25/2014	9:14	-108.11165	32.69729	X	
RR-197	9/24/2014	12:24	-108.11477	32.69695	X	
RR-198	9/24/2014	11:51	-108.11438	32.69695	X	
RR-199	9/24/2014	11:11	-108.11399	32.69695	X	
RR-200	9/25/2014	9:24	-108.11126	32.69696	X	
RR-201	9/24/2014	12:32	-108.11477	32.69662	X	
RR-202	9/24/2014	11:59	-108.11438	32.69662	X	X
RR-203	9/24/2014	11:06	-108.11399	32.69662	X	
RR-204	9/25/2014	9:34	-108.11126	32.69663	X	
RR-205	9/24/2014	12:27	-108.11477	32.69629	X	
RR-206	9/24/2014	12:03	-108.11438	32.69629	X	
RR-207	9/24/2014	11:03	-108.11399	32.69629	X	
RR-208	9/25/2014	9:40	-108.11126	32.69630	X	
RR-209	9/24/2014	12:06	-108.11438	32.69596	X	
RR-210	9/24/2014	11:00	-108.11399	32.69596	X	
RR-211	9/24/2014	12:10	-108.11438	32.69563	X	
RR-212	9/24/2014	10:57	-108.11399	32.69563	X	X
RR-213	9/24/2014	12:13	-108.11437	32.69530	X	X
RR-214	9/24/2014	10:55	-108.11398	32.69530	X	
RR-215	9/24/2014	10:52	-108.11398	32.69497	X	
RR-216	9/24/2014	10:05	-108.11359	32.69498	X	
RR-217	9/24/2014	10:50	-108.11398	32.69464	X	
RR-218	9/24/2014	10:03	-108.11359	32.69465	X	
RR-219	9/24/2014	13:50	-108.11086	32.69465	X	
RR-220	9/24/2014	10:45	-108.11398	32.69431	X	
RR-221	9/24/2014	10:00	-108.11359	32.69432	X	
RR-222	9/24/2014	10:15	-108.11398	32.69399	X	X
RR-223	9/24/2014	9:56	-108.11359	32.69399	X	
RR-224	9/24/2014	9:53	-108.11359	32.69366	X	
RR-225	9/24/2014	9:36	-108.11320	32.69366	X	
RR-226	9/24/2014	9:47	-108.11359	32.69333	X	

Table A5.1: Comprehensive Sample Analysis Summary

Razorback Ridge: XRF vs Certified Lab Results						
Sample ID	**Sample Date**	**Sample Time**	**Longitude**	**Latitude**	**XRF Sample Collection & Analysis**	**Certified Laboratory Preparation & Analysis**
RR-227	9/24/2014	9:33	-108.11320	32.69333	X	
RR-228	9/24/2014	9:41	-108.11359	32.69300	X	
RR-229	9/24/2014	9:28	-108.11320	32.69300	X	
RR-230	9/24/2014	13:43	-108.11047	32.69300	X	
RR-231	9/24/2014	9:24	-108.11320	32.69267	X	
RR-232	9/24/2014	9:17	-108.11281	32.69267	X	X
RR-233	9/24/2014	13:41	-108.11047	32.69267	X	
RR-234	9/24/2014	9:10	-108.11319	32.69234	X	
RR-235	9/24/2014	9:15	-108.11280	32.69234	X	
RR-236	9/24/2014	13:35	-108.11085	32.69234	X	
RR-237	9/24/2014	13:38	-108.11046	32.69234	X	
RR-238	9/24/2014	9:04	-108.11319	32.69201	X	
RR-239	9/24/2014	9:00	-108.11280	32.69201	X	
RR-240	9/24/2014	8:53	-108.11241	32.69201	X	
RR-241	9/24/2014	13:33	-108.11085	32.69201	X	
RR-242	9/24/2014	13:31	-108.11046	32.69201	X	X
RR-243	9/25/2014	8:23	-108.11308	32.70075	X	
RR-244	9/25/2014	8:18	-108.11244	32.70024	X	
RR-245	9/25/2014	8:33	-108.11330	32.70012	X	
RR-246	9/24/2014	16:10	-108.11258	32.69649	X	
RR-247	9/24/2014	16:03	-108.11312	32.69458	X	
RR-248	9/24/2014	15:55	-108.11218	32.69328	X	
RR-249	9/24/2014	8:30	-108.11161	32.69142	X	
RR-250	9/24/2014	8:46	-108.11241	32.69134	X	
RR-251	9/25/2014	12:10	-108.11375	32.70162	X	X

Notes:

All samples collected at 0- to 1-inch sampling depth. Sampling by EG, SK, and YM - Golder Associates Inc. (Golder).

X-Ray Fluorescence (XRF) analyses by Golder: B. Ireson for RR-001 - RR-155 and S. Keller for the remainder.

Certified Laboratory preparation and analysis at SVL Analytical Inc., Kellog, Idaho.

XRF analyses by United States Environmental Protection Agency (USEPA) Method 6200; Certified laboratory analysis by USEPA SW-846 Method 6010B.

Sample locations by GPS measurement in the field.

Table A5.2: Holding Time Summary / Laboratory Analysis

SVL Laboratory Analysis Date-Days									
Sample ID	Sample Date	Sample Time	Cu 6010B	Collect Date	Fe 6010B	Collect Date	Regulatory Days	Status Days	Qualifier Applied
			Days		Days				
RR-024	3/1/2014	15:18	236	10/23/2014	236	10/23/2014	180	>180	J/UJ
RR-037	3/10/2014	9:44	227	10/23/2014	227	10/23/2014	180	>180	J/UJ
RR-050	3/10/2014	8:07	227	10/23/2014	227	10/23/2014	180	>180	J/UJ
RR-063	3/1/2014	14:34	236	10/23/2014	236	10/23/2014	180	>180	J/UJ
RR-076	3/1/2014	13:06	236	10/23/2014	236	10/23/2014	180	>180	J/UJ
RR-089	3/1/2014	13:28	236	10/23/2014	236	10/23/2014	180	>180	J/UJ
RR-101	3/1/2014	11:53	236	10/23/2014	236	10/23/2014	180	>180	J/UJ
RR-111	3/1/2014	9:30	236	10/23/2014	236	10/23/2014	180	>180	J/UJ
RR-123	3/1/2014	12:28	236	10/23/2014	236	10/23/2014	180	>180	J/UJ
RR-134	3/1/2014	8:28	236	10/23/2014	236	10/23/2014	180	>180	J/UJ
RR-147	2/28/2014	11:20	237	10/23/2014	237	10/23/2014	180	>180	J/UJ
RR-162	9/25/2014	8:58	28	10/23/2014	28	10/23/2014	180	OK	OK
RR-172	9/25/2014	11:36	28	10/23/2014	28	10/23/2014	180	OK	OK
RR-182	9/24/2014	11:50	29	10/23/2014	29	10/23/2014	180	OK	OK
RR-192	9/25/2014	9:16	28	10/23/2014	28	10/23/2014	180	OK	OK
RR-202	9/24/2014	11:59	29	10/23/2014	29	10/23/2014	180	OK	OK
RR-212	9/24/2014	10:57	29	10/23/2014	29	10/23/2014	180	OK	OK
RR-213	9/24/2014	12:13	29	10/23/2014	29	10/23/2014	180	OK	OK
RR-222	9/24/2014	10:15	29	10/23/2014	29	10/23/2014	180	OK	OK
RR-232	9/24/2014	9:17	29	10/23/2014	29	10/23/2014	180	OK	OK
RR-242	9/24/2014	13:31	29	10/23/2014	29	10/23/2014	180	OK	OK
RR-251	9/25/2014	12:10	28	10/23/2014	28	10/23/2014	180	OK	OK

Note: N/A - Not analyzed

Table A5.3: Laboratory Confirmation Results and Accuracy Status

Sample ID	Date Sampled	Time	XRF Cu (ppm)[1]	Cu QA (mg/kg)[2]	RPD[3]	Status	XRF Fe (ppm)	Fe QA[4] (mg/kg)	RPD	Status
RR-024	3/1/2014	15:18	**1578**	1750	10	Accept	31579	15100	71	FAIL
RR-037	3/10/2014	9:44	**851**	771	10	Accept	24046	12800	61	FAIL
RR-050	3/10/2014	8:07	**955**	863	10	Accept	25894	14300	58	FAIL
RR-063	3/1/2014	14:34	**597**	747	22	Accept	24453	14500	51	FAIL
RR-076	3/1/2014	13:06	**1008**	773	26	Accept	21742	12800	52	FAIL
RR-089	3/1/2014	13:28	**273**	275	1	Accept	29310	13900	71	FAIL
RR-101	3/1/2014	11:53	**183**	152	19	Accept	20714	10500	65	FAIL
RR-111	3/1/2014	9:30	**538**	523	3	Accept	24511	14300	53	FAIL
RR-123	3/1/2014	12:28	**375**	523	33	Accept	31726	17000	60	FAIL
RR-134	3/1/2014	8:28	**334**	351	5	Accept	34112	18800	58	FAIL
RR-147	2/28/2014	11:20	**661**	730	10	Accept	25398	13900	59	FAIL
RR-162	9/25/2014	8:58	**958**	987	3	Accept	31851	21400	39	FAIL
RR-172	9/25/2014	11:36	**909**	875	4	Accept	24634	18200	30	Accept
RR-182	9/24/2014	11:50	**261**	216	19	Accept	33320	25000	29	Accept
RR-192	9/25/2014	9:16	**186**	93	67	FAIL	15756	12900	20	Accept
RR-202	9/24/2014	11:59	**116**	78	40	FAIL	28274	16100	55	FAIL
RR-212	9/24/2014	10:57	**544**	435	22	Accept	23475	14600	47	FAIL
RR-213	9/24/2014	12:13	**2371**	2010	16	Accept	49760	27800	57	FAIL
RR-222	9/24/2014	10:15	**158**	128	21	Accept	23236	10700	74	FAIL
RR-232	9/24/2014	9:17	**135**	124	8	Accept	15622	9180	52	FAIL
RR-242	9/24/2014	13:31	**126**	97	26	Accept	18733	19000	1	Accept
RR-251	9/25/2014	12:10	**457**	520	13	Accept	25259	18700	30	Accept

Notes:

[1] ppm = parts per million

[2] mg/kg = milligram per kilogram

[3] RPD = Relative percent difference calculation for precision

[4] Quality Assurance analyses are performed at a certified laboratory using United States Environmental Protection Agency (USEPA) SW-846 Method 6010B.

Table A5.4: Field XRF Precision Summary

Date	Time	Sample ID	Mode	Unit	Cu	Cu +/-	Cu StnDev	%SD	Fe	Fe +/-	Fe StnDev	%SD
3/12/2014	14:17:05	RR-012	AVERAGE	PPM	176	4.0	28.6	16.2	22048	102	780.6	3.5
3/12/2014	14:23:42	RR-013	AVERAGE	PPM	50	3.0	2.1	4.2	20291	96	750.5	3.7
3/12/2014	14:30:31	RR-014	AVERAGE	PPM	1235	9.7	44.5	3.6	18599	86	1003.4	5.4
3/12/2014	14:37:17	RR-019	AVERAGE	PPM	390	6.0	25.6	6.6	24995	115	795.1	3.2
3/12/2014	14:47:13	RR-020	AVERAGE	PPM	989	8.7	194.9	19.7	23152	107	351.5	1.5
3/12/2014	14:53:51	RR-021	AVERAGE	PPM	61	3.0	11.6	19.1	19461	90	458.3	2.4
3/12/2014	15:01:00	RR-026	AVERAGE	PPM	1265	10.0	81.7	7.0	21508	99	291.4	1.4
3/12/2014	15:07:55	RR-027	AVERAGE	PPM	465	6.0	34.2	7.4	21985	103	182.0	0.8
3/12/2014	15:14:42	RR-030	AVERAGE	PPM	573	7.0	34.2	6.0	21863	104	805.2	3.7
3/12/2014	15:21:26	RR-031	AVERAGE	PPM	16	3.0	3.5	21.7	15021	78	915.3	6.1
3/12/2014	15:28:20	RR-032	AVERAGE	PPM	284	4.7	95.6	33.6	22010	103	2034.4	9.2
3/12/2014	15:35:02	RR-033	AVERAGE	PPM	1312	10.3	309.0	23.5	16477	81	284.3	1.7
3/12/2014	15:41:49	RR-036	AVERAGE	PPM	108	4.0	14.5	13.4	27734	129	606.3	2.2
3/12/2014	15:56:46	RR-037	AVERAGE	PPM	851	8.0	59.2	7.0	24046	110	238.7	1.0
3/12/2014	16:04:11	RR-038	AVERAGE	PPM	590	6.7	103.1	17.5	21810	102	598.2	2.7
3/12/2014	16:11:22	RR-042	AVERAGE	PPM	79	3.0	4.0	5.1	23908	111	513.3	2.1
3/12/2014	16:18:34	RR-043	AVERAGE	PPM	780	8.0	22.4	2.9	22804	106	69.3	0.3
3/12/2014	16:25:15	RR-044	AVERAGE	PPM	660	7.0	53.7	8.1	22504	106	306.7	1.4
3/12/2014	16:31:54	RR-045	AVERAGE	PPM	40	3.0	11.0	27.8	23761	111	858.9	3.6
3/12/2014	16:38:41	RR-050	AVERAGE	PPM	955	9.0	8.2	0.9	25894	120	310.5	1.2
3/12/2014	16:52:32	RR-051	AVERAGE	PPM	761	7.7	64.3	8.4	23406	108	914.6	3.9
3/7/2014	9:24:08	RR-119	AVERAGE	PPM	146	4.0	4.2	2.9	24625	114	1262.9	5.1
3/7/2014	9:35:32	RR-120	AVERAGE	PPM	577	7.0	37.2	6.5	25517	117	2365.3	9.3
3/7/2014	9:42:52	RR-121	AVERAGE	PPM	277	5.0	6.1	2.2	19334	89	414.5	2.1
3/7/2014	9:50:25	RR-123	AVERAGE	PPM	375	6.0	15.9	4.2	31726	148	1614.4	5.1
3/7/2014	10:01:56	RR-124	AVERAGE	PPM	187	4.3	9.7	5.2	36153	167	1453.3	4.0
3/7/2014	10:08:38	RR-125	AVERAGE	PPM	426	6.3	38.4	9.0	27591	133	284.4	1.0
3/7/2014	10:16:37	RR-126	AVERAGE	PPM	53	3.0	2.0	3.8	20002	92	418.4	2.1
3/7/2014	10:24:18	RR-128	AVERAGE	PPM	227	4.3	14.8	6.5	23117	106	329.1	1.4
3/7/2014	10:34:37	RR-129	AVERAGE	PPM	460	6.0	18.6	4.0	28502	132	1157.3	4.1
3/7/2014	10:53:17	RR-130	AVERAGE	PPM	497	6.3	28.1	5.7	30466	140	935.3	3.1
3/7/2014	11:00:20	RR-131	AVERAGE	PPM	134	4.0	28.9	21.5	23950	111	393.1	1.6
3/7/2014	11:07:13	RR-132	AVERAGE	PPM	539	6.3	102.4	19.0	17339	81	74.5	0.4
3/7/2014	11:14:18	RR-133	AVERAGE	PPM	38	3.0	7.1	18.8	13392	73	592.0	4.4
3/7/2014	11:26:11	RR-134	AVERAGE	PPM	334	5.3	43.7	13.1	34112	156	36.3	0.1
3/7/2014	11:33:30	RR-135	AVERAGE	PPM	558	6.7	33.2	6.0	23481	110	1242.3	5.3

Table A5.4: Field XRF Precision Summary

Date	Time	Sample ID	Mode	Unit	Cu	Cu +/-	Cu StnDev	%SD	Fe	Fe +/-	Fe StnDev	%SD
3/7/2014	11:40:45	RR-136	AVERAGE	PPM	479	6.0	16.3	3.4	19355	90	301.5	1.6
3/7/2014	12:49:48	RR-137	AVERAGE	PPM	313	5.0	9.1	2.9	27619	129	399.3	1.4
3/7/2014	12:58:38	RR-138	AVERAGE	PPM	478	6.3	91.0	19.0	25936	119	866.9	3.3
3/7/2014	13:06:47	RR-139	AVERAGE	PPM	25	3.0	1.2	4.6	17305	85	63.8	0.4
3/7/2014	13:14:18	RR-140	AVERAGE	PPM	178	4.0	15.9	9.0	24491	112	783.8	3.2
3/7/2014	13:22:26	RR-142	AVERAGE	PPM	407	6.0	12.7	3.1	27228	127	1120.1	4.1
3/7/2014	13:30:20	RR-143	AVERAGE	PPM	83	3.3	18.8	22.6	24382	113	930.7	3.8
3/7/2014	13:38:56	RR-144	AVERAGE	PPM	207	4.3	15.6	7.5	17919	88	1244.0	6.9
3/7/2014	13:52:08	RR-147	AVERAGE	PPM	661	7.7	38.1	5.8	25398	122	48.4	0.2
3/7/2014	14:20:28	RR-148	AVERAGE	PPM	292	5.0	27.0	9.2	18058	87	1274.0	7.1
3/7/2014	14:27:52	RR-149	AVERAGE	PPM	74	3.3	6.4	8.5	22235	109	666.4	3.0
3/7/2014	14:41:24	RR-152	AVERAGE	PPM	228	4.7	13.1	5.7	22118	105	1592.1	7.2
3/6/2014	10:47:39	RR-056	AVERAGE	PPM	982	9.0	16.6	1.7	17625	87	260.1	1.5
3/6/2014	10:55:15	RR-058	AVERAGE	PPM	496	6.7	31.2	6.3	34396	159	1044.2	3.0
3/6/2014	11:02:30	RR-059	AVERAGE	PPM	842	8.0	14.5	1.7	25147	117	214.6	0.9
3/6/2014	11:09:37	RR-060	AVERAGE	PPM	820	8.0	5.6	0.7	21774	105	338.0	1.6
3/6/2014	11:39:34	RR-061	AVERAGE	PPM	707	7.7	190.0	26.9	23780	111	492.3	2.1
3/6/2014	11:46:32	RR-063	AVERAGE	PPM	597	7.0	70.6	11.8	24453	114	48.3	0.2
3/6/2014	11:53:45	RR-064	AVERAGE	PPM	1006	9.0	16.7	1.7	30013	137	796.7	2.7
3/6/2014	12:01:04	RR-065	AVERAGE	PPM	1154	10.0	14.9	1.3	24527	115	383.3	1.6
3/6/2014	12:07:54	RR-066	AVERAGE	PPM	1479	11.3	64.0	4.3	29826	136	117.3	0.4
3/6/2014	12:14:42	RR-069	AVERAGE	PPM	369	5.7	25.9	7.0	25376	119	858.8	3.4
3/6/2014	12:34:56	RR-070	AVERAGE	PPM	585	7.0	31.8	5.4	22158	108	553.1	2.5
3/6/2014	12:42:36	RR-071	AVERAGE	PPM	97	3.3	11.8	12.2	24287	111	129.9	0.5
3/6/2014	12:54:39	RR-072	AVERAGE	PPM	93	3.0	5.9	6.3	21737	101	196.5	0.9
3/6/2014	13:21:43	RR-074	AVERAGE	PPM	363	6.0	9.8	2.7	32221	146	319.7	1.0
3/6/2014	13:28:19	RR-075	AVERAGE	PPM	615	7.0	25.0	4.1	24064	112	80.8	0.3
3/6/2014	13:35:13	RR-076	AVERAGE	PPM	1008	9.3	88.5	8.8	21742	103	345.9	1.6
3/6/2014	13:41:55	RR-077	AVERAGE	PPM	63	3.0	11.6	18.3	17556	83	114.5	0.7
3/6/2014	13:49:41	RR-079	AVERAGE	PPM	673	7.3	27.5	4.1	23661	110	448.8	1.9
3/6/2014	13:56:28	RR-080	AVERAGE	PPM	473	6.0	16.5	3.5	24234	114	303.8	1.3
3/6/2014	14:03:17	RR-081	AVERAGE	PPM	1330	10.7	28.7	2.2	24108	112	516.8	2.1
3/6/2014	14:10:31	RR-082	AVERAGE	PPM	416	6.0	10.1	2.4	19720	93	411.2	2.1
3/6/2014	14:27:08	RR-084	AVERAGE	PPM	79	3.0	3.8	4.8	21419	101	292.0	1.4
3/6/2014	14:33:47	RR-085	AVERAGE	PPM	1319	11.0	67.9	5.1	26218	123	67.2	0.3
3/6/2014	14:40:39	RR-086	AVERAGE	PPM	89	3.7	16.5	18.5	35122	160	527.2	1.5

Table A5.4: Field XRF Precision Summary

Date	Time	Sample ID	Mode	Unit	Cu	Cu +/-	Cu StnDev	%SD	Fe	Fe +/-	Fe StnDev	%SD
3/6/2014	14:47:40	RR-087	AVERAGE	PPM	822	8.0	17.6	2.1	22458	104	176.2	0.8
3/6/2014	14:58:52	RR-089	AVERAGE	PPM	273	5.0	13.0	4.8	29310	134	516.6	1.8
3/6/2014	15:07:24	RR-090	AVERAGE	PPM	475	6.0	9.5	2.0	21352	101	50.2	0.2
3/6/2014	15:14:48	RR-091	AVERAGE	PPM	427	5.7	224.0	52.4	24638	113	285.1	1.2
3/6/2014	15:21:29	RR-092	AVERAGE	PPM	38	3.0	2.5	6.7	20519	95	219.2	1.1
3/6/2014	15:31:57	RR-094	AVERAGE	PPM	298	5.0	16.4	5.5	24705	115	300.1	1.2
3/6/2014	15:39:11	RR-095	AVERAGE	PPM	461	6.0	27.1	5.9	23763	109	280.4	1.2
3/6/2014	15:52:49	RR-096	AVERAGE	PPM	558	6.7	76.2	13.7	23213	109	1124.1	4.8
3/6/2014	16:00:14	RR-097	AVERAGE	PPM	187	4.0	3.0	1.6	17405	82	85.8	0.5
3/6/2014	16:07:17	RR-099	AVERAGE	PPM	366	6.0	15.5	4.2	29655	137	125.0	0.4
3/6/2014	16:15:07	RR-100	AVERAGE	PPM	720	7.3	174.1	24.2	25675	118	89.8	0.3
3/6/2014	16:22:01	RR-101	AVERAGE	PPM	183	4.0	34.2	18.7	20714	99	225.1	1.1
3/6/2014	16:29:06	RR-102	AVERAGE	PPM	24	3.0	1.0	4.2	23552	109	96.2	0.4
3/6/2014	16:39:28	RR-103	AVERAGE	PPM	527	6.7	27.3	5.2	22965	108	757.0	3.3
3/6/2014	16:46:25	RR-104	AVERAGE	PPM	372	6.0	14.2	3.8	29577	139	247.2	0.8
3/6/2014	16:54:24	RR-105	AVERAGE	PPM	374	6.0	3.5	0.9	30593	143	3791.0	12.4
3/6/2014	17:01:49	RR-106	AVERAGE	PPM	237	5.0	5.9	2.5	31236	140	825.4	2.6
3/6/2014	17:08:45	RR-107	AVERAGE	PPM	514	6.3	64.1	12.5	27607	123	814.1	2.9
3/6/2014	17:15:32	RR-108	AVERAGE	PPM	346	5.0	12.4	3.6	24479	112	315.7	1.3
3/6/2014	17:22:18	RR-109	AVERAGE	PPM	302	5.0	10.8	3.6	32528	150	675.0	2.1
3/6/2014	17:29:18	RR-110	AVERAGE	PPM	311	5.0	36.7	11.8	24194	114	337.4	1.4
3/6/2014	17:36:56	RR-111	AVERAGE	PPM	538	7.0	9.8	1.8	24511	114	697.3	2.8
3/6/2014	17:53:42	RR-112	AVERAGE	PPM	49	3.0	1.0	2.0	24394	113	236.5	1.0
3/6/2014	18:00:34	RR-113	AVERAGE	PPM	222	5.0	2.5	1.1	33379	153	641.7	1.9
3/6/2014	18:07:25	RR-114	AVERAGE	PPM	504	6.3	19.1	3.8	25092	117	357.3	1.4
3/6/2014	10:47:39	RR-115	AVERAGE	PPM	986	9.0	39.8	4.0	20431	100	114.3	0.6
3/6/2014	18:21:02	RR-116	AVERAGE	PPM	36	3.0	6.0	16.6	19426	92	317.5	1.6
3/6/2014	18:27:39	RR-118	AVERAGE	PPM	219	5.0	1.2	0.5	34827	160	1847.1	5.3
3/5/2014	14:48:35	RR-015	AVERAGE	PPM	123	4.0	9.5	7.8	20549	100	361.0	1.8
3/5/2014	14:55:48	RR-016	AVERAGE	PPM	141	4.0	3.6	2.6	22743	112	288.8	1.3
3/5/2014	15:03:13	RR-023	AVERAGE	PPM	303	5.0	11.5	3.8	38436	176	919.9	2.4
3/5/2014	15:19:44	RR-024	AVERAGE	PPM	1578	12.0	29.6	1.9	31579	144	622.8	2.0
3/5/2014	15:30:43	RR-029	AVERAGE	PPM	23	3.0	1.5	6.7	20388	99	256.5	1.3
3/5/2014	15:38:43	RR-035	AVERAGE	PPM	697	7.7	39.4	5.6	30808	144	1979.9	6.4
3/5/2014	15:46:07	RR-041	AVERAGE	PPM	484	6.7	39.8	8.2	28628	133	953.6	3.3
3/5/2014	15:53:47	RR-047	AVERAGE	PPM	50	3.0	4.0	8.0	27804	130	74.8	0.3

Table A5.4: Field XRF Precision Summary

Date	Time	Sample ID	Mode	Unit	Cu	Cu +/-	Cu StnDev	%SD	Fe	Fe +/-	Fe StnDev	%SD
3/5/2014	16:01:03	RR-048	AVERAGE	PPM	271	5.0	8.0	3.0	31154	144	923.5	3.0
3/5/2014	16:08:10	RR-049	AVERAGE	PPM	39	3.0	2.6	6.8	27225	124	395.0	1.5
3/5/2014	16:16:04	RR-053	AVERAGE	PPM	165	4.0	8.1	4.9	36202	165	433.7	1.2
3/5/2014	16:23:55	RR-054	AVERAGE	PPM	367	6.0	19.3	5.3	32682	152	874.5	2.7
3/5/2014	16:32:01	RR-055	AVERAGE	PPM	54	3.0	11.2	20.8	34135	156	85.9	0.3

Note: Percent Standard Deviation should not exceed 40% per guidance through the "X-Ray Fluorescence On-Site Measurement SOP" (Tech 1995).

APPENDIX C
EAST REMOVAL BORROW AREA BMPS

-13200 -13000 -12800 -12600 -12400 -12200 -12000 -11800 -11600 -11400 -11200 -11000

-34800 -35000 -35200 -35400 -35600 -35800 -36000 -36200 -36400 -36600 -36800 -37000 -37200 -37400 -37600 -37800 -38000 -38200

LEGEND

- Removal Area
- BMP (berm)
- Gradient Break
- Water Bar
- Native Channel
- Rock Armor
- Elevation Contour (5')

Coordinate System: Chinolocalmine
Projection: Hotine Oblique Mercator Azimuth Center
Datum: North American 1983
False Easting: -5,794.2264
False Northing: 18,252.3373
Scale Factor: 1.0000
Azimuth: 0.0670
Longitude Of Center: -108.0884
Latitude Of Center: 32.8488
Units: Foot US

FREEPORT-MCMORAN COPPER & GOLD

Reclamation and Closure Planning

East Removal Area
Post Removal Surface Water Control Locations

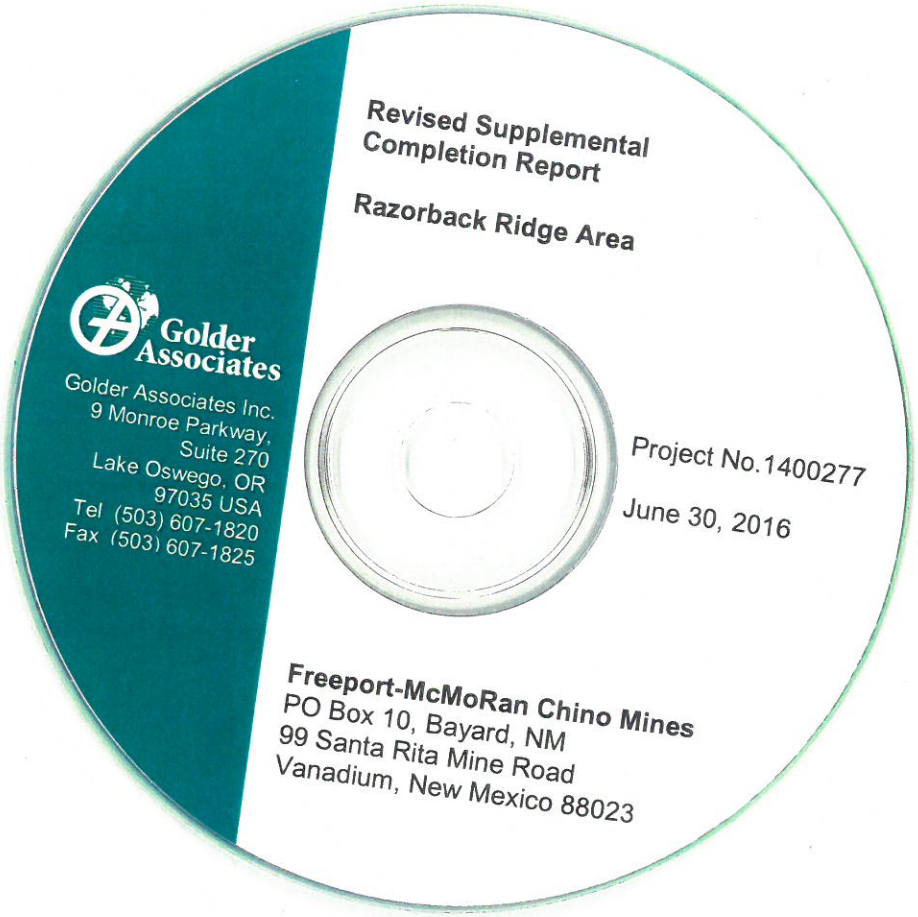
N

0 250 500 Feet

1 inch = 250 feet 1:3,000

Travis Smith April 2014

*Data is based on estimates and is therefore approximate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