RIO TINTO MINE SITE
ELKO COUNTY, NEVADA

Final

Remedy Construction Completion Certification Report

Prepared for:
Rio Tinto Working Group

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ACRONYMS

ADT	Articulated Dump Truck
AOC	Administrative Order on Consent
ARAR	Applicable or Relevant and Appropriate Requirement
BMPs	Best Management Practices
CD	Consent Decree
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
DCD	Design Criteria Document
EFOR	East Fork of the Owyhee River
EPA	United States Environmental Protection Agency
ET	Evapotranspiration
FWP	Fresh Water Pond
GCL	Geosynthetic Clay Liner
HCP	Hydraulic Control Pond
NCP	National Contingency Plan
NDEP	Nevada Division of Environmental Protection
NDOT	Nevada Department of Transportation
QA/QC	Quality Assurance/Quality Control
RD/RA	Remedial Design/Remedial Action
ROD	Record of Decision
RTWG	Rio Tinto Working Group
SOW	Statement of Work
SWPPP	Storm Water Pollution Prevention Plan
TDG	The Delaney Group
TDS	Total Dissolved Solids
USFS	United States Forest Service
WQCP	Water Quality Compliance Protocol

1.0 INTRODUCTION

1.1 Purpose

This Remedy Construction Completion Certification Report (RCCCR) is written to meet the requirements of the Consent Decree (CD) (USEPA 2013) for the Rio Tinto Mine Site Remediation Project in Elko County, Nevada. This RCCCR along with the attached Appendices is a part of the closure remedy requirements, as described in Section 8.6 of the Remedial Design/Remedial Action Work Plan.

In accordance with the CD, after concluding that the Remedy Construction has been fully performed, a pre-certification inspection will be organized by the Contractor. After satisfactory completion of this inspection, the Contractor will issue a Construction Completion Report, including as-built drawings, signed and stamped by a professional engineer, and request certification of completion of the Remedy Construction as provided under the CD. This Construction Completion Report will include language from a registered professional engineer and the Rio Tinto Working Group's (RTWG) Project Coordinator that states that the Remedy Construction has been completed in full satisfaction of the requirements of the CD. If NDEP, with EPA's concurrence, concludes, based on the RCCCR, that Remedy Construction has been performed in accordance with the CD, the Agencies will so certify to the Settling Defendants identified in the CD.

1.2 Organization

This RCCCR report is organized as follows:

- Section 1 contains the purpose, site description and site history.
- Section 2 summarizes the remedy selection, regulatory framework and environmental compliance.
- Section 3 provides a summary of the design.
- Section 4 provides an overview of the construction, remediation activities and stormwater controls and summarizes the project health and safety considerations.
- Section 5 details quality control (QC) activities for the site.
- Section 6 provides post-closure maintenance and monitoring recommendations for the site.
- Section 7 is the signed remedy certification statement.

The following appendices are included in this report:

- Appendix A, DCNs and Variances
- Appendix B, Repository Cover Modeling
- Appendix C, Pre-Certification Inspection Checklist
- Appendix D, Record (As-Built) Drawings
- Appendix E, Site Photographs

- Appendix F, QC Reports
- Appendix G, Certifications
- Appendix H, Stormwater Drainage BMP Inspection Data
- Appendix I, Monthly & Annual 3rd Party QA Inspection Reports
- Appendix J, Mill Creek Valley Excavation Completion Reports
- Appendix K, Surface Water Quality Analytical Results
- Appendix L, Heap Leach Pad Evaporation Pond Design
- Appendix M, Mill Creek Reconstruction Liner System Inspection Reports
- Appendix N, Geotechnical Test Results
- Appendix O, WTP Daily Reports
- Appendix P, Project Schedule
- Appendix Q, Lower Mill Creek Valley Seed Mixture and Revegetation Plans

1.3 Site Description and History

The Rio Tinto Mine is a former copper mine located approximately 2.5 miles south of Mountain City, in northern Elko County, Nevada. Underground mining occurred between 1932 and 1947. Starting in approximately 1965, there were a number of operations at the site that involved the re-working of the tailings material in the upper Mill Creek Valley, leaching stockpiles of ore, leaching the underground workings, and exploration for additional mineral deposits. No significant mining related activities have occurred at the site since the late 1970s. The upper Mill Creek Valley is defined as the area of Mill Creek Valley where mining and mineral processing activities took place, and is bound by Pond 1 on the west side and the Hydraulic Control Pond (HCP) on the east side. The lower Mill Creek Valley is the portion of the valley downstream from the HCP to the juncture with the East Fork Owyhee River.

Further description of the Rio Tinto Mine site features such as physiography, geology, surface water, groundwater, sediment, soils and mine-related materials can be found in the Remedial Design/Remedial Action Work Plan (TDG, 2011).

Site investigations, regulatory actions, and remedial construction activities have been ongoing for some time. In 1986, the Nevada Mining Association, on behalf of the Nevada Division of Environmental Protection (NDEP), developed several suggestions to reduce discharges from the former mine. Subsequently, the NDEP entered into an agreement with The Cleveland-Cliffs Iron Company, and E.I. du Pont de Nemours and Company, which are two of the member companies of the Rio Tinto Working Group (RTWG) (the other members are Atlantic Richfield Company and Teck Cominco American Incorporated), for the construction of the “S-curve” in the Mill Creek diversion along Pond 3 to reduce flow velocities, control erosion, minimize potential flow onto the tailings, and protect the stability of tailings located in the Mill Creek valley.

Under a 1996 Administrative Order on Consent (AOC) entered into between the RTWG and NDEP, the Heap Leach Pad and Hillside Tailings Piles 1 and 2, located on the slope south of the Mill Creek Diversion Channel, were regraded, covered with clean borrow soil and reseeded. Run-on structures and water bars were also constructed around the Waste Rock Pile, the Heap Leach Pad, and Hillside Tailings Piles 1 and 2, and run-off and intermittent seepage from the Heap Leach Pad were collected by an intercept ditch that conveyed flow towards Lower Dry Creek.

In 2004, the RTWG conducted a soil survey of the lower Mill Creek Valley between Pond 4 and historic Patsville to characterize soil chemistry and determine what reclamation strategies might be applicable to improve soil productivity for agricultural use.

In 2007, NDEP, after consultation with the EPA and RTWG companies, entered into an AOC to implement a final remedy for the hillside mining features. These cleanup actions were determined to be appropriate for implementation independent of the other decisions to be made for the final remedy in the Mill Creek Valley. Consistent with State of Nevada requirements for the reclamation of mine sites, the remedy for these features included:

- Added cover materials (18-inch minimum total thickness) and revegetated the covers of the Heap Leach Pad, Hillside Tailings Pile 1, and Hillside Tailings Pile 2;
- Regraded the Waste Rock Pile to a maximum slope of 2.5 horizontal to 1 vertical (2.5:1); installed an 18-inch thick cover and revegetated the cover; and
- Completed improvements to drainages around the Heap Leach Pad, and Hillside Tailings Piles 1 and 2. Installed new diversion drainages around the regraded Waste Rock Pile.

The NDEP approved the constructed remedy for the hillside features in January 2009.

2.0 REMEDIATION PROJECT BACKGROUND

2.1 Remedy Selection

In September 1996, the RTWG entered into an Administrative Order on Consent (1996 AOC) with the NDEP to address various environmental and safety concerns at the site. These concerns included surface water quality in Mill Creek and the Owyhee River, safety and environmental issues associated with the historic plant area and town site, and the stability of Ponds 3 and 4 embankments. To address continued Mill Creek and Owyhee River water quality concerns and to support final remedy selection by NDEP, the RTWG and NDEP entered into a second AOC in September 2001 (2001 AOC) that included a scope of work (2001 SOW). The 2001 SOW provided a general framework for the further characterization and evaluation of environmental concerns at the Rio Tinto Mine.

The 2001 SOW subdivided the Rio Tinto site into two work areas: Area A and Area B. Area A included the mine site proper including all areas of historic operation and mine-related materials placement. Area B included the Owyhee River upstream and downstream of the confluence with Mill Creek. No areas of concern requiring remediation were identified in the East Fork of the Owyhee River and Area B more generally.

The main purpose of the 2001 AOC was to collect data and conduct studies on remedial options for Area A in order to develop a Remedial Alternatives Study and to facilitate additional studies for Area B. This Remedial Alternatives Study (URS 2006) was prepared by the RTWG and submitted in January 2006. The Alternatives Study was updated in September 2006 in response to comments from governmental and tribal authorities and after consideration of additional data. The RTWG has completed additional data collection activities and evaluations in Area A since that time.

NDEP selected four remedial actions for evaluation based on the data collected pursuant to the 2001 Order, the 2006 Remedial Alternative Study, and subsequent data collection and analyses by the RTWG, various governmental agencies and the Tribes:

- Alternative 1 – No further action
- Alternative 2 – Improve existing source control and long-term water treatment
- Alternative 3 – Full removal of mine-related materials from upper Mill Creek Valley to on-site repository and long-term water treatment
- Alternative 3A (Preferred Alternative) – Partial removal of mine-related materials from upper Mill Creek Valley to on-site repository and seasonal water treatment or management during remedy construction

Each of these alternatives, other than Alternative 1, was intended to address the discharge of acidic, metal bearing waters from the mine waste materials deposited in the upper Mill Creek Valley. An evaluation of these alternatives was performed by the NDEP using two primary criteria and five secondary criteria (NDEP 2010). The U.S. Environmental Protection Agency (EPA) determined that the alternatives analysis was performed in a manner consistent with the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) and the National Contingency Plan (NCP). This evaluation determined that Alternative 3A was the preferred remedial alternative. The selected remedy met the two primary evaluation criteria and provided the best balance among the alternatives with respect to the secondary evaluation criteria.

The selected site remedy was set forth in NDEP's and EPA's February 2012 Record of Decision ("ROD").

2.2 Regulatory Framework

2.2.1 ROD Goals

The overall goal of the Remedy is to protect human health and the environment by minimizing exposure of human, terrestrial, and aquatic receptors to affected media through the development and implementation of a final site remedy. To accomplish this, the following two specific Remedial Action Objectives were established in the ROD (NDEP 2012):

- Minimize any significant loading of contaminants of concern from the Mill Creek Valley mining material impoundments to Mill Creek and the Owyhee River, and
- Minimize potential human, terrestrial biota, and aquatic biota exposures to low-pH, metal-bearing surface water at the Rio Tinto Mine Site, as well as in downstream receiving waters.

Achievement of Remedial Action Objectives will be evaluated by comparing surface water quality with the Performance Standards. The process established for doing this is set forth in the Water Quality Compliance Protocol, which was developed to monitor and evaluate water quality both during implementation of the Selected Remedy and after completion of construction.

Implementation of the selected remedy in accordance with the ROD and consistent with the NCP is required pursuant to the CD. As stated in the CD, EPA has deferred the lead agency role at the Site to the NDEP. The Site is not listed on the National Priorities List (NPL). EPA's "Superfund Alternative Approach," as described in the Revised Superfund Selection and Settlement Approach for Superfund Alternative Sites, OSWER 9208.0-18, issued June 17, 2004, addresses response actions at sites not on the NPL in a manner consistent with the NCP.

2.2.2 ARARs

A comprehensive listing of location-, chemical-, and action-specific ARARs that are pertinent to the selected remedy for the Rio Tinto Mine Site was developed and presented in the ROD (NDEP 2012). Compliance with ARARs is addressed in Section 2.8.3.2 of the ROD. The ARARs were considered in the development of the remedial design and construction methodologies and Quality Assurance/Quality Control (QA/QC) (which was addressed in technical specifications and the Construction Quality Assurance/Quality Control Plan.)

2.3 Environmental Compliance

The selected remedial alternative was intended to be protective of human health and the environment, and to comply with federal and state cleanup standards that are applicable or relevant and appropriate or "to be considered" for the Rio Tinto site.

Applicable or relevant and appropriate requirements ("ARARs") are used to develop and establish remediation goals. When ARARs are not identified, or are not sufficiently protective, other "to be considered" ("TBC") requirements, such as those found in state and federal guidance documents, may be used in developing cleanup goals. Collectively, the ARARs and TBCs are used to determine the appropriate remediation goals for a site. ARARs for this remedial action are identified in the ROD.

3.0 DESIGN SUMMARY

3.1 Design Criteria

Design criteria are given in the Design Criteria Document (DCD), Rev. 4 (TDG 2012a). The DCD details the project-specific design parameters, functional and technical requirements, design objectives, design assumptions, CADD requirements and applicable codes, standards and guidelines.

Project-specific design criteria were developed based on the project description of tasks and goals established in the Proposed Plan, the ROD, the RD/RA Work Plan, and client requirements.

3.2 Design Modifications

All modifications to the original, Revision 0, remedial design were recorded via Design Change Notices (DCN) in accordance with The Delaney Group (TDG) procedures. A complete collection of these DCNs and a corresponding log is included in Appendix A of this RCCCR. The DCN log gives a brief explanation of the changes involved with each DCN. The DCN process involved first an identification for a modification to the original design, then draft DCNs and appropriate changes to relevant design documents were issued for review, and once all reviewing parties were satisfied the approved DCN was issued. It is noted that prior to issuance of the Final Design Analysis Report (TDG 2013) that Agency and client comments were directly incorporated into the many versions of the Draft Design Analysis Report and other draft design documents.

3.3 Design of the Tailings Removal & Repository Construction

The following sections summarize the remedy design as presented originally in the Design Analysis Report (TDG 2013). All of the verb tenses are in present or future tense.

3.3.1 Tailings Extent and Removal

Mining materials and impacted alluvial materials at the HCP and in Ponds 3 and 4 are to be excavated to their full extent. Boring logs from previous geotechnical investigations were reviewed to estimate the extent of the mining materials and impacted alluvial materials in the upper Mill Creek Valley. The deepest mine-related waste soil at the site was determined to be located in Pond 4, and was approximately 45 feet deep. Excavation of mine-related waste material shall include all surface cover soils and embankments that compose these areas. The depth of excavation into the alluvium will depend on the extent of observable impacts. Alluvial materials that are visibly discolored or have a pH $\leq$ 4.5 will be removed. If impacted alluvium is identified beyond a depth of 2 feet, it could be excavated further after consultation with Mountain City Restoration LLC and the NDEP.

The expected volume of mining material (soil and rock), which includes the existing soil covers and embankment materials, from the HCP and Ponds 3 and 4 is 613,880 cy. An additional 39,300 cy of underlying alluvial soil is expected to be removed as estimated during the design phase. Approximately half of the volume of tailings in Ponds 3 and 4 is expected to be in a wet condition, and must be dried prior to transport to the on-site repository.

After the removal of mining-related materials and impacted alluvium, any seeps present along the north or south sides of the valley in the exposed slopes will be addressed. Post-excavation backfilling and contouring of the valley floor is intended to minimize the likelihood that lateral seeps will occur. If side slope seeps are observed, gravel filled infiltration trenches with drain pipes will be constructed to manage them and direct their flow back underground (Drawing D-8032-C-146).

3.3.2 On-Site Repository

The on-site repository will be located at the east end of the former town site, and will be excavated in native soil. Soil and rock will be excavated from the repository site to develop the site in accordance with the design documents (Drawing D-8032-C-120). The excavated material, in addition to soil excavated from other borrow areas, will be screened to produce the fine-grained soil required for the repository berm construction, repository interim berm construction, repository ET cover construction, upper Mill Creek liner system construction and other general uses. The fine-grained soil will be stockpiled near the repository site and possibly near the Tailings Ponds 3 and 4 sites. The coarse-grained soil from the screening operation will be used for construction of the upper Mill Creek liner system and be incorporated into the upper Mill Creek Valley backfill. The coarse-grained soil may be stockpiled near the Tailings Ponds 3 and 4 sites. Once a suitable amount of fine-grained and coarse-grained soil has been produced from the screening operation, any additional material excavated from the repository site will be stockpiled for future use. If needed, an alternative borrow area will be constructed to the southwest of the repository. Best Management Practices (BMPs), in accordance with the Storm Water and Erosion Control Plan, will be utilized for all stockpiles to prevent or minimize erosion and dust.

The repository will be of sufficient capacity to accommodate placement of all of the excavated materials from the upper Mill Creek Valley and other sources, and all treatment solids generated during water treatment operations. When a sufficient volume of material has been excavated from the repository site, the repository toe berm will be constructed, and the base of the repository will be prepared for materials placement. Approximately, 303,575 cy of material will be excavated within the footprint of the repository. This material is described as mudflow, colluvium and bedrock in the geotechnical report (URS 2008). The internal and outer slopes of the repository will be constructed at a maximum slope of 2:1 (horizontal:vertical), and the footprint of the repository will be approximately 15 acres. The expected capacity of the repository is approximately 791,380 cy if it is constructed to the final elevation of 6,084 ft.

The repository will be closed following the placement of all excavated upper Mill Creek Valley materials, haul road surface materials and treatment solids. Closure operations will include the construction of an ET cover, final grading, stormwater interceptor ditch construction and revegetation (Drawing D-8032-C-123). The ET cover is designed to minimize infiltration and to promote vegetation growth. An infiltration rate of 5% or less of the total average annual precipitation was the selected design basis. It will be constructed with the soil and rock previously excavated from the repository site to a 24-inch minimum thickness. The ET cover and adjacent soils disturbed by repository operations will be planted with a seed mixture similar to that used in previous site remedial activities. An interim cover will be placed over the deposited materials between construction seasons until the final cover is constructed.

A series of channels and berms will be constructed on the ET cover to direct storm drainage off of the cover and minimize surface erosion. In addition, run-on controls such as diversion channels, interceptor trenches or berms will be constructed to isolate the repository from upgradient stormwater flow. Diversion channels will be designed to safely convey the peak flow due to the 100-year, 24-hour storm event (approximately 2.8 inches of precipitation), and be armored, as necessary.

Slope stability for the final configuration of the repository was analyzed, and found to be above the required factors of safety for both static and seismic loading (TDG 2013 – Appendix L).

3.4 Design of Mill Creek Reconstruction

The following sections summarize the Mill Creek reconstruction design as presented originally in the Design Analysis Report.

3.4.1 Upper Mill Creek Channel

A new Mill Creek channel will be constructed through the excavation area and realigned to the approximate center of upper Mill Creek Valley. The reconstructed channel will begin at a point just west of Pond 1 and connect to Mill Creek at a point downstream of the HCP. A sufficient amount of backfill material will be placed in the excavated channel to restore the alluvium to the proposed final grade as indicated on the project Drawings. Backfill material used to replace excavated alluvium will be screened and selected to have the appropriate physical properties necessary to allow adequate groundwater flow within the alluvial system through the reconstructed portion of the upper Mill Creek channel. The channel will be lined with a minimum one-foot thick soil layer to form a prepared subgrade for the geosynthetic clay liner (GCL). The GCL will be installed per manufacturer's recommendations through the entire length of the reconstructed channel east of Pond 1. The GCL will be covered with a minimum one-foot thick protective soil layer. Fine-grained soil will be used for construction of these subgrade soil and protective soil layers. A minimum two-foot thick layer of coarse-grained soil and rock riprap will be placed over the protective soil layer to form a rock armor layer, to control erosion damage to the protective soil layer and GCL. Additional thickness of rock armoring will be placed as needed at select locations along and beyond the lateral edges of the channel to increase the durability of the channel.

The rock armored channel will encompass the "low flow channel" width. This low flow channel will contain the 10-year flood event with one foot of freeboard. A "high flow channel" width will encompass this low flow channel. The high flow channel will contain the 100-year flood event. The width of the high flow channel will be minimized, as possible, and tie into the surrounding final grade. The high flow channel will not be rock armored, but will be vegetated to minimize erosion. The high flow channel banks will be soft armored. The low flow channel will be trapezoidal in cross section.

The Mill Creek diversion channel on the west end of the site will be directed through the FWP, around the north side of Pond 2 and through the realigned upper Mill Creek channel located roughly in the center of the valley (see Drawings D-8032-C-140 and C-141). A large span, low-profile arch culvert will be installed west of the Pond 1 to convey the realigned upper Mill Creek beneath the USFS road. The proposed arch culvert will provide a natural creek bottom, and will be composed of corrugated structural steel plates. An armored earthen berm will be constructed along the north side of Pond 2 to keep upper Mill Creek high flow events within the realigned channel. This armored berm will be extended around the west side of Pond 2 to prevent Pond 1 from overflowing onto the Pond 2 surface. Filling/grading will be performed in the area forming the transition between the east side of Pond 2 and the west end of the excavated/reconstructed upper Mill Creek channel to allow for the slope requirements for the channel bed.

Riparian vegetation along the banks of the reconstructed upper Mill Creek channel will be actively managed (controlled) during, and following, the completion of construction of the channel to prevent deep-rooting riparian vegetation from potentially impacting the buried GCL liner. Active riparian vegetation management will continue for a minimum of five years following the receipt of the Certification of Completion of Remedy construction. Following this five-year period, the decision to discontinue active riparian vegetation management will be made based on the water quality in Mill Creek. When active riparian vegetation management is discontinued, deep rooting vegetation will be allowed to voluntarily establish in, and on the banks of, the reconstructed channel.

3.4.2 Fish Passage

The reconstruction of the upper Mill Creek channel will include installation of features to facilitate opportunistic, seasonal passage of non-resident Redband trout through the reconstructed portion of Mill Creek during optimal flow conditions. A study of the existing Mill Creek and the conceptual design of the realigned channel was performed to determine enhancements that could aid in the passage of Redband trout (HabiTech, 2010). According to the study, boulder placements or small boulder groupings should be incorporated to create small resting pools within the realigned channel. The report also stated that, where feasible and appropriate, submerged structures, such as logs, could be incorporated to act as underwater baffles, which could provide additional benefit for fish passage. The upper Mill Creek channel design incorporates the majority of the recommendations made within the HabiTech report. Specific, key design components are described below.

The steepest-sloped portion of the realigned creek, with no greater than a 5.7% slope, will be located north and east of Pond 2. This portion of the realigned upper Mill Creek channel will be constructed using pool and riffle structures with elevation changes that do not exceed the Redband trout leaping ability (Drawing D-8032-C-145). Large riprap will also be used to create slack water resting pools and to prevent erosion.

The lower gradient portions of the realigned creek will have a <1% to 2.5% slope. Because of the seasonal flow characteristics of upper Mill Creek, the design focuses on more durable materials that serve a similar purpose (e.g. boulder groupings). This portion of the reconstructed creek will be constructed with isolated boulders, in groups of 1-2 boulders, spaced to provide eddies and small pools for resting places for Redband trout during their transition through the reach of reconstructed upper Mill Creek (Drawing D-8032-C-144).

Other portions of the reconstructed creek will have intermediate slopes of 2.6% to 4.5%. These portions will contain isolated boulders and boulder clusters at more frequent placements (i.e. spacing every 10’, as indicated on Drawing D-8032-C-144).

3.5 Design of Heap Leach Pad Evaporation Basin

Since the heap leach pad was previously remediated with an ET soil cover only minimal infiltration is expected into the mining material at this location. However, two seeps were identified along the north side of the facility (Drawing D-8032-C-114). At the time of the design phase it was unknown if these seeps would be persistent. These seeps will be located by the Contractor during remedial activities and a collection piping system will be constructed to convey this seepage to an evaporation basin. This evaporation basin will be lined with a sand/gravel mixture atop a geomembrane and sized to contain the expected seepage considering precipitation and evaporation at the site. The base beneath the basin will be constructed with fine grained material so as not to damage the geomembrane. The geomembrane will be designed for a minimum long-term UV exposure of 30 years.

After seasonal monitoring of the seeps in the field and a reevaluation of the expected flow, the design size and location of the evaporation basin changed from a site northwest of the heap leach pad to a new site to the east of the heap leach pad. Further design information on this evaporation basin can be found in Appendix L.

3.6 Design of Stormwater Controls

The storm water management approach for the project was designed to consider the following criteria:

- Guidelines presented in the *Storm Water Quality Manuals, Planning and Design Guide,* NDOT, January 2006; and the *Storm Water Quality Manuals, Construction Site Best Management Practices (BMPs)*, NDOT, January 2006.
- All water management structures/channels will be sized to convey the peak flow resulting from the 100-year, 24-hour precipitation event at the site (2.8 inches).
- Construction activities will be performed in a manner that will minimize transport of sediments and disturbance of surrounding areas using Best Management Practices (BMPs).
- Contain potentially contaminated storm water or waste drainage water within contaminated remediation area during the work.
- Treat potentially contaminated storm water and waste drainage water at the temporary water treatment plant. Collect contaminated water in sumps located within the remedial excavation area and within the repository.
- Allow uncontaminated storm water to evaporate, infiltrate, or discharge into existing drainage ways.
- Prevent storm water from the adjacent area from flooding trench excavation during remediation.

- Prevent contaminated sediment from spreading from remediation boundary.

The storm water and erosion control criteria were implemented via the Storm Water and Erosion Control Plan (TDG 2013- Appendix E).

The design storm event was selected based on construction duration and the potential risk and damage from exceeding the design storm event. Both permanent and temporary measures (BMPs) were designed for the 100-year, 24-hour storm event. These types of BMPs ensured that remedial construction activities had minimal impact to surface waters.

Stormwater controls were used to route non-contaminated stormwater runoff and runon away from contaminated areas and into the existing natural drainage system (e.g. ditches, channels and creeks). Erosion control measures were implemented to prevent soil loss from disturbed areas, excavations, haul roads, soil stockpiles, borrow areas, and any other areas where erosion developed as a result of remedial construction activities.

4.0 CONSTRUCTION SUMMARY

4.1 Summary of Activities

The selected remedy removed mine-related materials, cover material, and embankments from Ponds 3 and 4, as well as additional underlying alluvial soils and other associated impacted materials in the upper Mill Creek Valley including the HCP, and disposed these materials in the on-site repository. Pond 2 (Sludge Pond) remained in place, and Pond 1 (Fresh Water Pond [FWP]) was integrated into the reconstructed upper Mill Creek channel. The unlined repository is located on the hillside to the east of the former Rio Tinto townsite and includes an evapotranspirative (ET) cover. During construction activities a temporary water treatment system seasonally treated water associated with the removal/excavation work. Upon completion of the excavation, an average three foot-thick layer of clean, on-site soils was placed and graded within the footprint of the excavation. The reconstructed upper Mill Creek channel, which includes a geosynthetic clay liner, fine grained soil above and below the liner, and rock armoring, was realigned to the approximate center of the upper Mill Creek Valley from a point east of Pond 2 to a point downstream of the HCP (see Record Drawings D-8032-C-140 and C-141). Stream-bed features were incorporated into the entire reconstructed channel to facilitate certain fish movement through this area. The Record (As-Built) drawings are presented in Appendix D and construction progress photographs are included in Appendix E. An overall project schedule from design through construction is provided in Appendix P.

4.2 Repository Construction

4.2.1 Source Soil Materials

From previous geotechnical investigations (URS 2008) the surface soils in the vicinity of the repository were identified as topsoil (gravelly, lean clay), colluvium (silty sand) and mudflow (sandy lean clay and dense clayey gravel). The results of the testing of materials found in the repository area indicated that they could be used in the construction of the repository embankments and as cover material.

The on-site repository is located at the east end of the former town site, and was excavated in native soil, as described above. The excavated material was screened to produce the fine-grained soil required for the repository berm construction, repository interim berm construction, repository ET cover construction, upper Mill Creek liner system construction and other general uses. The fine-grained soil was stockpiled near the repository site and near Ponds 3 and 4. The coarse-grained soil from the screening operation was used for construction of the upper Mill Creek liner system and was incorporated into the upper Mill Creek Valley backfill. The coarse-grained soil was stockpiled near Ponds 3 and 4. In addition, suitable fine-grained and coarse-grained soil was produced from the screening of material removed from areas adjacent to the repository construction and within the site boundary. Best Management Practices (BMPs), in accordance with the Storm Water and Erosion Control Plan, were utilized for all stockpiles to prevent or minimize erosion and dust.

4.2.2 Site Preparation

The area of the repository was first cleared of any existing vegetation and excavation areas were surveyed and staked out. Once excavation had reached the designed bottom elevation of the repository footprint, the repository toe berm was constructed, and the base of the repository was prepared for materials placement. Preparation of the base included confirmation of proper bottom elevations and proof rolling of the ground surface prior to waste placement. Approximately, 303,570 bcy of material was excavated within the footprint of the repository. The internal and outer slopes of the repository were constructed at a maximum slope of 2:1 (horizontal:vertical), and the footprint of the repository was 14.6 acres. The actual capacity of the completed repository was approximately 824,950 cy due to the additional excavation into the west slope of the footprint.

In 2014, TDG evaluated the quantity of material being excavated from Ponds 3 and 4 and assessed that the amount of contingent disposal volume available in the Repository was inadequate. TDG took the opportunity to expand the design capacity of the Repository to accommodate the expected increase in volume of mining material predicted for disposal. An excavation into the western bottom slope of the Repository expanded the available capacity by approximately 51,060 cy. Agency and client approval of this repository volume change was obtained through the DCN process. This is documented in DCN-009, as provided in Appendix A.

Early in August 2013, the Subcontractor's excavation crew at the Repository encountered a void in the SE portion near the base of the repository excavation. The portion of the void first exposed contained water and was reported to be about 4 ft wide and high. Upon further excavation that same day, the full extent of the void was uncovered. It was about 80 ft long, was essentially linear except for the west end where it circled back to the east in a U-shaped fashion and was relatively uniform in width and height. The height after further excavation was approximately 6 ft rather than 4 ft as originally observed. From field observations it was determined that this was a man-made void, probably an exploratory adit or shaft.

The key findings relative to the repository were that the limits of the opening were contained well within the repository and that the opening did not appear to have a hydraulic connection to any other feature including the Silverado adit. To confirm this, a ground-penetrating radar (GPR) survey was conducted following repository excavation and no additional near-surface voids were identified. The excavation Subcontractor then excavated the full extent of the void to verify that no hydraulic connection existed and subsequently backfilled the former opening with compacted clayey material from the Repository excavation. The TDG project engineer then determined that the remainder of the repository may be constructed and filled with tailings as shown on the approved design documents.

4.2.3 Intermediate Cover Placement

Between construction seasons, a temporary soil cover was constructed over the waste surface. This temporary soil cover was composed of 12 inches of clean soil, compacted and sloped to drain stormwater off the repository surface.

4.2.4 Final Cover Placement

The repository was closed following the placement of all excavated upper Mill Creek Valley materials, haul road surface materials and treatment solids. Closure operations included the construction of an ET cover, final grading, stormwater interceptor ditch construction and revegetation. It was constructed with the soil previously excavated from the repository site, screened to remove 3-inch plus material, and built to a minimum five foot thickness. It is noted that the original design included a minimum 24 inch thick ET cover, but this was increased to a thickness of five feet in lieu of performing post-construction infiltration monitoring on the cover during operation, as requested by the NDEP. TDG conducted cover performance modeling, after the appropriate site cover soil was available for testing, to verify that the actual cover infiltration rate would meet the design criteria requirement of less than 5% of annual precipitation infiltration. Based on the results of this performance modeling TDG requested that a design change be allowed to increase the cover thickness from 2 to 5 feet in lieu of requiring post-construction infiltration testing. The results of this performance modeling (see Appendix B) definitively proved that the thicker soil cover would meet the design infiltration requirement. The NDEP agreed with this assessment and allowed the 5 foot ET cover thickness to be built instead of requiring post-construction infiltration modeling on the cover surface. This thicker soil cover will also provide the advantage of improved cover performance and protectiveness versus a thinner soil cover. The ET cover and adjacent soils disturbed by repository operations were planted with a seed mixture similar to that used in previous site remedial activities (see Table 4-1).

It is noted that the final elevation of the repository was approximately 6,058 ft msl which was not as high as the design final elevation. This was due to the fact that there was less volume of mining material actually present and removed from the upper Mill Creek Valley than what was anticipated. This elevation difference will not adversely affect drainage off the repository. Long-term inspections, maintenance and repair activities for the Repository are described in the Operations and Maintenance Plan (TDG 2013, Appendix I).

4.2.5 Armored Perimeter Channels

A series of channels and berms were constructed on the ET cover to direct storm drainage off of the cover and minimize surface erosion. In addition, run-on controls such as diversion channels, and berms were constructed to isolate the repository from upgradient stormwater flow during construction. Diversion channels were designed to safely convey the peak flow due to the 100-year, 24-hour storm event (approximately 2.8 inches of precipitation).

Armored perimeter channels were constructed on the north, south and west sides of the repository. These perimeter channels are armored with either riprap or articulated concrete blocks and convey water from the repository surface terrace channels to the local drainage features (e.g. dry bed streams).

4.3 Stormwater, Erosion and Sediment Control Structures

Stormwater controls were used to route non-contaminated stormwater runoff and runon away from contaminated areas and into the existing natural drainage system (e.g. ditches, channels and creeks). Erosion control measures were implemented to prevent soil loss from disturbed areas, excavations, haul roads, soil stockpiles, borrow areas, and any other areas where erosion develops as a result of remedial construction activities. The primary control structures used on site were berms, riprap, rock check dams, silt fence and waddles.

4.3.1 Drainage Structures

The repository perimeter channels act as storm water controls to prevent storm water run-on from entering the repository area. Drainage terrace channels were designed for the repository cover to intercept flow down the side slopes and minimize rill and gully erosion. These terrace channels were designed to limit velocities below 5 feet per second to eliminate the need for hard armor erosion protection and to limit sedimentation from the sites.

All storm water control berms were constructed from uncontaminated borrow soil. Corrugated metal pipe culverts were placed in ditches to convey surface water flows beneath the site access roads and haul roads.

4.3.2 Retention Areas

The upper Mill Creek valley excavation area contained a retention area (sump) to collect the storm water that fell in the immediate vicinity of the excavation and any waste material drainage from drying procedures. The perimeter embankments around Ponds 3 and 4 were excavated last to act as runon control berms. A similar sump area was constructed within the confines of the repository during waste placement to collect potentially contaminated storm water runoff and/or waste soil seepage. Excess water collected in these sump areas was pumped to the WTP for treatment prior to discharge into Mill Creek. A temporary retention area was built to the northeast of the WTP to capture runoff from the WTP construction area and allow sedimentation to occur prior to storm water exiting this site. This was constructed during the site mobilization in the fall of 2012 and was removed once the WTP was built and the ground surface stabilized.

4.3.3 Erosion Protection

Erosion protection included hay mulch on disturbed areas, as necessary, and channel protection to minimize sediment discharge. The repository site contained steep grades, so erosion within diversion ditches was a concern. Sediment control features were limited to silt fence or sediment logs (waddles) for the relatively flat areas, and hay bales or rock check dams for the terrace channels. The diversion/perimeter ditches were either riprapped or lined with articulated concrete block. The reconstructed portion of Mill Creek was armored with rock and rip rap to withstand high velocity flows within the channel (Drawing D-8032-C-143).

In April 2014, significant erosion of the southeast corner of the Repository soil cover occurred and included the interim berm, but no mining materials. The interim berm was properly reconstructed and cover soil replaced and compacted in accordance with the project specifications.

4.4 Water Treatment Plants

4.4.1 Temporary Water Treatment Plant

A temporary water treatment plant (WTP) was set up on the hillside southeast of Pond 4 and Mill Creek (Drawing D-8032-C-103) to treat drained or collected water from the tailings dewatering and the upper Mill Creek excavation area. The temporary WTP operated seasonally for the duration of the excavation activities in Mill Creek. This temporary water treatment system consisted of a metal precipitation/aeration plant that used hydrated lime, aeration and settling ponds. Two lined holding ponds were constructed to the northwest of the WTP to receive and store water prior to treatment (Drawing D-8032-C-160).

The area where the water treatment plant was located was cleared and graded prior to equipment installation. The majority of the treatment plant site was constructed as a gravel pad for equipment support with a cast in place concrete foundation for the lime silo. Prepackaged used and new water treatment equipment was utilized. Two lined settling ponds were constructed north of the WTP to accept treated water prior to discharge into Mill Creek. Sludge generated as a part of the treatment process was removed and disposed in the on-site repository. Sludge was mixed with the tailings at the repository to create a uniform waste mix that facilitated compaction. Operations of the WTP are detailed in the daily reports, see Appendix O.

Road access to the temporary water treatment plant was developed and connected to the haul road between Ponds 3 and 4 and the on-site repository. Electrical power to the site was initially provided by an auxiliary generator, but in 2014 the existing overhead power line was activated to provide the required power. The treated water from the settling ponds was piped to Mill Creek east of the water treatment plant.

Upon completion of the upper Mill Creek Valley excavation activities the temporary WTP was dismantled, equipment shipped off site, electric power lines removed and the gravel pad was removed. The holding ponds were refilled in with soil after the liners were removed and disposed in the on-site repository. The entire area was then reseeded with native plant species (see Table 4-1), in accordance with the remedial design.

4.4.2 Former Water Treatment Pilot Plant

At the request of the NDEP, all features associated with the former pilot studies for remedial water treatment located east of the HCP (Drawing D-8032-C-116) were disposed in the repository. The solid wastes associated with this pilot treatment area included: structures, tanks, piping, liners and sludge. All waste was properly sized and disposed in the on-site repository. The bio-treatment cell/pond was left in place and the existing rocks covered with soil. The existing geomembrane liner within the bio-treatment cell was perforated with a backhoe prior to backfilling operations.

4.5 Tailings Removal

4.5.1 Excavation Limits and Quantities

4.5.1.1 Pond 3

Mining materials and impacted alluvial materials in Pond 3 were excavated to their full depth. The volume of mining material (soil and rock), which included the existing soil covers and embankment materials, from Pond 3 was approximately 282,100 cy. This volume included the underlying alluvial soil that was also removed due to staining or pH levels below 4.5. TDG staff observed all excavation events, inspected completed excavations and documented staining and pH testing of the alluvium. Excavation proceeded from west to east in the Mill Creek Valley and the western end of Pond 3 required deeper excavation than anticipated to remove all affected mining material. Once the tailings excavation was complete, any stained alluvium or alluvium with a pH equal to or less than 4.5 was also removed. In cases where the alluvium excavation operation encountered competent bedrock the over excavation was terminated. Approximately a fourth of the volume of tailings in Pond 3 was in a wet condition, and was either dried prior to transport to the on-site repository or spread and tilled in the repository until dry enough for compaction. Paint filter testing was used to determine if mining material was too wet to be transported to the Repository for blending and disposal.

4.5.1.2 Pond 4

Mining materials and impacted alluvial materials in Pond 4 were excavated to their full depth. The volume of mining material (soil and rock), which included the existing soil covers and embankment materials, from Pond 4 was approximately 523,900 cy. Approximately a third of the volume of tailings in Pond 4 was in a wet condition, and was either dried prior to transport to the on-site repository or spread and tilled in the repository until dry enough for compaction. Paint filter testing was used to determine if mining material was too wet to be transported to the Repository for blending and disposal.

The existing Pond 4 embankment was left in place during excavation to provide run-on control. Additional run-on control was provided by a berm on the west side of Pond 2 and supplementary berms were constructed on the north sides of Ponds 3 and 4. The embankments for Ponds 3 and 4 were excavated last and transported to the repository. Once the tailings excavation was complete, any stained alluvium or alluvium with a pH equal to or less than 4.5 was also removed. In cases where the alluvium excavation operation encountered competent bedrock the over excavation was terminated.

After the removal of mining-related materials and impacted alluvium, four seeps were present along the north side of the valley and one on the south side of the valley in the exposed slopes (Drawings D-8032-C-140 & C-141). These seeps were addressed by the installation of gravel filled infiltration trenches with drain pipes to manage them and direct their flow back underground towards the center of the valley. These trenches were typically one foot wide, contained a 4-inch perforated PVC pipe and were backfilled with 3 feet of gravel (Drawing D-8032-C-146).

4.5.1.3 Hydraulic Control Pond

The extent of the Hydraulic Control Pond (HCP) was delineated by the rock filled basin that composed it. Prior to rock and gravel removal, the water within the HCP was pumped out and treated at the WTP. There was no tailing material located within the HCP. The HCP was removed down to a depth of 3 feet beyond the horizontal and vertical limits of the HCP and all material placed in the repository (approximately 5,700 cy) (Drawings D-8032-C-112 & 113).

4.5.2 Transport & Placement of Excavated Material

In some cases, excavated materials from Ponds 3 and 4 needed to be dried to a sufficient extent to minimize accumulation of drained water in the repository and to allow for structural placement of materials within the repository. Drying procedures for the tailings consisted primarily of spreading the wet tailings over a portion of Ponds 3 and 4 to allow air-drying. Tailings transported to the repository that were too moist for compaction were spread out and tilled to increase the rate of drying.

Excavated materials that had dried sufficiently to allow transport to the repository were loaded into articulated dump trucks (ADT) using a trackhoe or front-end loader, for transport to the repository. Materials were dumped in the repository and spread in approximately one foot thick lifts, and compacted with a pad-foot roller to a minimum of 90 percent of maximum dry density in accordance with ASTM D698. Additional drying, via discing, was occasionally conducted in the repository, as required. The compacted materials were sloped away from the berm to prevent storm water from flowing out of the repository during filling operations. All storm water accumulated within the repository and drained liquids was either pumped or transported to the temporary water treatment plant or allowed to infiltrate.

As the placement of excavated materials neared the top of the repository toe berm and each successive interim berm, another interim berm was constructed, to improve slope stability and contain the waste material. The interim berms were three feet high, with 2.5H:1V exterior slopes and 2H:1V interior slopes. The top of the interim berms were 9.5 feet wide. Berm construction incorporated storm water interceptor ditches (terrace channels) into the exterior slope of the repository at 30 foot vertical intervals (Drawing D-8032-C-124).

Between construction seasons (May-November), a one-foot thick interim soil cover was placed over the excavated materials top surface in the repository. Fine-grained clean soil was used to construct this interim soil cover to a minimum compacted depth of 12 inches. The interim soil cover was sloped at approximately 1 to 2 percent away from the repository high wall so that any precipitation would drain off the repository. During the following construction season, the interim soil cover was left in-place and tailings placement resumed. At the completion of the excavation, the upper 6 inches of the haul roads used to transport excavated material was removed and placed in the repository. These areas were then graded to facilitate proper drainage.

4.5.3 Backfill of Upper Mill Creek Valley

After the over excavation of the ponds area was completed, and the final contours of the post-excavation upper Mill Creek Valley were determined, an alignment consistent with the CD for the reconstructed upper Mill Creek channel was selected and the remainder of the tailings ponds area was backfilled to an average depth of 3 feet to accommodate the selected design (Drawings D-8032-C-140 and C-141). Stockpiled general borrow from the initial repository excavation was used for backfill. General borrow from other borrow areas was also used (Drawing D-8032-C-150). Other borrow areas were chosen due to their proximity to the working area. Soil from these borrow areas was initially sampled and was classified to make sure that it met the specification requirements for use as general backfill, soil cushion layer or rock for armor layer of the reconstructed Mill Creek. All soil geotechnical testing results are included in Appendix N. Coarse-grained soil from the borrow areas screening operations was incorporated into the backfill to assist in erosion control. The final layer of backfill soil was amended with rock, up to 5 inches in size, to minimize erosion during extreme precipitation events. The backfilled area was graded to gently direct drainage towards the reconstructed upper Mill Creek channel.

4.6 Heap Leach Pad Evaporation Basin

The existing seeps along the north side of the HLP were monitored on a routine basis over the course of a year to gage the amount of water seeping from the leach pad on a seasonal basis.

Based on the annual monitoring and modeling of these seeps it was determined that a large evaporation basin would be required on site to accommodate the potential volume of seeping water. Analysis of the expected annual flow for this basin and the calculations for sizing this basin are included in Appendix L. A collection piping system was constructed to convey this seepage to an evaporation basin located to the northeast of the heap leach pad (Drawing D-8032-C-114). This collection piping system was tied into the existing cover drainage system for the heap leach pad. This evaporation basin is lined with coarse sand atop a nonwoven geotextile and textured geomembrane, and was sized to contain the expected seepage considering precipitation and evaporation at the site on an annual basis. The base beneath the basin was constructed with fine grained material so as not to damage the geomembrane. The geomembrane will be designed for a minimum long-term UV exposure of 30 years. In cases of high water levels in the basin, an overflow pipe was constructed in the upper portion of the west containment berm. This overflow pipe leads to an infiltration/ neutralization trench (Drawing D-8032-C-114). A security fence was installed around this basin to limit access to wildlife.

The infiltration trench was designed to neutralize any acidic overflow from the evaporation basin when it was at capacity volume. The trench is located on the west side of the evaporation basin and is 50 feet in length, 5.5 feet deep and 1.5 feet wide, as shown on Drawing D-8032-C-114. A 6-inch HDPE drain pipe conveys the water to this trench and is perforated within the trench to allow drainage. The bottom portion of the trench is filled with high calcium limestone fines for neutralization of acidic water. A Sparling flangeless electromagnetic flowmeter was installed on the piping at the east end of the infiltration trench to monitor the flow entering the trench. The piping in the vicinity of the flowmeter was necked down to 1-inch diameter to facilitate monitoring under full-pipe flow conditions for more accurate measurements. The flowmeter is housed in a valvebox with an adjacent digital readout and a pole-mounted solar panel with battery for a power supply. Also, a 2-inch PVC pipe, perforated along the bottom 18 inches, was installed vertically to monitor water level within the trench. This design was reviewed and approved by the agencies via DCN-029 in September 2016.

4.7 Relocation and Reconstruction of Mill Creek

4.7.1 Mill Creek Channel Construction

A new Mill Creek channel was constructed through the excavated upper Mill Creek Valley and realigned to the approximate center of the valley. The reconstructed channel begins at a point just east of Pond 2 and connects to Mill Creek at a point downstream of the HCP. Backfill material was placed in the excavated channel to restore the alluvium to the proposed final grade. This backfill material used to replace excavated alluvium was screened and selected to have the appropriate physical properties for the reconstructed portion of the upper Mill Creek channel (e.g. soil cushion layer and rock-amended vegetative soil layer). The channel was lined with a minimum one-foot thick soil layer to form a prepared subgrade for the geosynthetic clay liner (GCL). The GCL was installed per manufacturer's recommendations along the entire length of the reconstructed channel east of Pond 1. The GCL was covered with a minimum one-foot thick protective soil layer. Fine-grained soil was used for construction of these subgrade soil and protective soil layers. A minimum two-foot thick layer of coarse-grained soil and rock riprap was placed over the protective soil layer to form a rock armor layer, to control erosion damage to the protective soil layer and GCL. Additional thickness of rock armoring was placed as needed at select locations along and beyond the lateral edges of the channel to increase the durability of the channel.

The rock armored channel encompasses the “low flow channel” width. This low flow channel is designed to contain the 10-year flood event with one foot of freeboard. A “high flow channel” width encompasses this low flow channel. The high flow channel is designed to contain the 100-year flood event. The width of the high flow channel was minimized, where possible, and tied into the surrounding final grade. The high flow channel is not rock armored, but is vegetated to minimize erosion. The need for soft armoring of the high flow channel banks was determined during the draft design stage. The low flow channel is roughly trapezoidal in cross section.

The Mill Creek channel on the west end of the site was directed through the FWP, around the north side of Pond 2 and through the realigned upper Mill Creek channel located roughly in the center of the valley. A large diameter arch culvert was installed west of the FWP to convey the realigned upper Mill Creek beneath the USFS road. An armored earthen berm was constructed along the north side of Pond 2 to keep upper Mill Creek high flow events within the realigned channel. This berm was composed of general fill and was constructed immediately atop the north edge of Pond 2 along the Mill Creek channel. The dimensions and layout of this berm are shown on Drawing D-8032-C-143A. A granitic outcrop was discovered on the north side of Pond 2 while constructing the Mill Creek channel around STA 11+00. As a result, the north side of the channel at this spot was steepened to a 2:1 (H:V) side slope and the channel was deeper at this location.

Filling/grading was performed in the area forming the transition between the east side of Pond 2 and the west end of the excavated/reconstructed upper Mill Creek channel to allow for appropriately sized drop structures and pools, and to achieve the slope requirements for the channel bed. Since the Pond 3 excavation was deeper than expected at the west end, abutting Pond 2, the steepest section of Mill Creek at 5.6% slope was extended an additional 80 feet to the east. This was the slope that ran from the north side of Pond 2 into Pond 3 (Drawing D-8032-C-140).

4.7.2 Arch Culvert Construction

As stated previously, a large span, low-profile type arch culvert was installed over Mill Creek to allow a crossing for the USFS road just west of the FWP. The arch culvert was installed at a relatively flat slope with its flow line armored to prevent erosion. The channel bed beneath the arch culvert was constructed to provide a natural creek bottom much like the rest of the realigned Mill Creek channel. The arch culvert is composed of corrugated structural steel plates bolted together and is anchored with a concrete footing along each side of the creek. This culvert has a span of 26 feet, interior height of 8 feet 7 inches and is 30 feet long (Drawing D-8032-C-148). The culvert and armored portion of Mill Creek beneath the culvert were designed to accommodate the 100-year flood event. It was designed in accordance with the most current version of AASHTO LRFD Bridge Design Specifications and has a minimum soil cover of 3 feet 3 inches. A corrugated steel headwall abuts the ends of the arch culvert and is backfilled with clean, well-graded granular material in accordance with the manufacturer's recommendations.

4.8 Site Completion

4.8.1 Fencing

Perimeter fencing and signs were installed where needed to control site access. Fencing consists of steel or wood posts and 4 strand barbed wire, and was installed around the private property boundaries at the beginning of site remedial activities (Drawings D-8032-C-150 and C-170). The fencing will prevent unauthorized livestock grazing, which will reduce the potential for erosion of new and existing vegetated covers. Cattle guards were installed, as needed, to allow continued public use of the Forest Service road. Additionally, a wildlife fence and gate was constructed around the Heap Leach Pad Evaporation Basin to prevent wildlife from entering this area.

4.8.2 Site Revegetation

The on-site repository ET cover and adjacent soils disturbed by repository operations was planted with a seed mixture similar to that used in previous site remedial activities (Table 4-1). The seed mixture was also deemed to be metals-tolerant and suitable for this climate. All revegetation was performed in accordance with Specification Section 329000.

TABLE 4-1

DESIGN SEED MIXTURE

Species	Pounds of Pure Live Seed (PLS) per acre
Sandberg bluegrass (*Poa secunda*)	2.9
Bottlebrush squirreltail (*Elymus elymoides*)	5.0
Goose-berry leaf globemallow (*Sphaeralcea grossulariifolia*)	1.0
Lewis flax (*Linum lewisii*, specifically the Maple Grove cultivar)	1.9
Sulfur buckwheat (*Eriogonum umbellatum*)	1.1
Great Basin wildrye (*Leymus cinereus*)	5.9
Sagebrush (*Artemesia tridentata*)	0.2
Bitterbrush (*Purshia tridentata*)	1.0
Idaho Fescue (*Festuca idahoensis*)	1.0
Bluebunch wheatgrass (*Elymus spicatum*)	1.0

Upon completion of all earthwork within the valley, the area outside of the upper Mill Creek channel was scarified and revegetated using the test plot seed mix (Table 4-1). An organic fertilizer amendment (Sustane 18-1-8 organic fertilizer) was applied based on agronomic testing of samples of borrow material collected during construction activities. The organic fertilizer was uniformly spread over these areas at a rate of 500 lbs/acre. Revegetated areas will be evaluated during subsequent field seasons and re-seeded or otherwise managed as necessary until vegetative cover has been established.

Select areas, as identified in the ROD, of barren soil or very sparse vegetation were reclaimed to establish vegetation in the lower Mill Creek Valley, between the Pond 4 embankment and the Owyhee River confluence. A lime amendment, PLS Formulation, was thoroughly incorporated into the upper six inches of soil at a rate of 32 tons/acre in required areas (see Drawing D-8032-C-151). The former pilot treatment plant area was also included in this reclamation effort. The quality of vegetation established in these select areas, was comparable to the sparse vegetation in the immediately adjacent unreclaimed areas. The seed mix and lime and fertilizer application rates used are based, on reestablishing vegetation that would be deemed robust enough to survive in the lower Mill Creek Valley, see Appendix Q and DCN 15.

4.8.3 Site Restoration and Demobilization

Site restoration entailed the removal of all construction site support facilities, temporary access roads, and the temporary water treatment plant. Stormwater and erosion control devices were removed or repaired as applicable, and an interim checklists from site inspections were generated for the Contractor to complete. The site was revegetated and existing perimeter fence was repaired or replaced, as required, as an institutional control. Additional institutional controls included the installation of locked access road gates, repair or replacement of cattle guards, wildlife fence barrier around the evaporation pond and signage.

As a part of demobilization a pre-certification inspection was conducted and attended by representatives from TDG, Mountain City Remediation, NDEP and the USEPA. Any work items that were not completed at the time of this inspection were photographed upon completion for final review, see Appendix E. In addition, as-built drawings have been completed and a written report requesting certification of completion of the Remedy Construction will be submitted to NDEP and EPA in accordance with the CD and the precertification checklist (Appendix C). The Contractor will not proceed with complete demobilization until written certification is received from NDEP confirming that the remedy construction has been performed in accordance with the CD.

4.8.4 Erosion Control Channel Repairs and Maintenance

As a result of routine BMP inspections, maintenance and repairs were made to exposed drainage channels as appropriate. This included the removal of accumulated silt within the channel, repair of rock check dams, repair of channel linings, and replacement or repair of silt fence, as required. The final version of all channels was designed to be armored or vegetated to minimize erosion of the channels for the expected rainfall or runoff events encountered at the site. However, as a part of the site operations and maintenance routine inspections of these channels will be performed to check for any necessary repairs.

4.8.5 Interim Implementation Inspections

Representatives from the NDEP and the USEPA conducted periodic inspections of the remedial construction activities over the course of the project duration at the Rio Tinto mine site.

4.9 Summary of Construction Health and Safety

All site work was performed in accordance with the task-specific Health and Safety Plan (TDG 2012b).

There was only one Occupational Safety and Health Administration recordable for the project. This was an injury on August 14 of 2013. Other significant incidents that occurred at the site involving property damage or injury are listed below:

- September 13, 2012—(Property damage) Small brush fire occurred during road construction.
- August 14, 2013—(Injury) Subcontractor mechanic changing out ripper teeth on D-9 Dozer. Piece of metal broke off and splinter struck his leg.
- October 2, 2013—(Property damage) D-6 dozer came in contact with a haul truck.
- December 3, 2013—(Property damage) An excavator moving along the haul road came in contact with and broke an overhead power line. No resulting injuries.
- May 8, 2014—(Injury) Subcontractor employee not directly supervised cut his left hand ring finger while crossing barbed wire fence.
- July 16, 2014—(Property damage) Hydraulic oil spill from on-site equipment.
- August 15, 2014—(Motor vehicle) TDG employee hit deer with truck.
- December 7, 2015—(Motor vehicle) Subcontractor operating equipment backed into parked vehicle.

There were no lost time accidents recorded during the project.

4.10 Community Relations

TDG, Mountain City Remediation and the Regulatory Agencies (USEPA and NDEP) prepared and distributed a project Fact Sheet in January 2014. TDG, Mountain City Remediation and the agencies also conducted two public meetings at the Shoshone-Paiute Tribes of the Duck Valley Reservation and the Mountain City, NV Community Center on August 6, 2014.

5.0 QUALITY CONTROL TESTING

This section discusses the approach for quality control testing for the Rio Tinto Mine Site Remediation Project.

5.1 Quality Control Summary

Quality assurance and quality control were addressed in the Construction Quality Assurance/ Quality Control (QA/QC) Plan of the Design Analysis Report (TDG 2013 - Appendix F). This plan outlined the Contractor and Subcontractor requirements needed to implement quality assurance/quality control inspection, documentation and testing activities. Oversight of the Rio Tinto Mine site remedy construction ensured that the final work product met the requirements stated within the technical specifications, drawings, plans and procedures. The TDG acted in the primary role as QC inspector over the Subcontractor's work. In accordance with the CD, independent (third party) QA inspections were conducted on a monthly basis to inspect the field work and review project records to verify compliance with the construction documents. QA Inspections from 2012 through August 2013 were conducted by representatives from Tierra Group International, LTD and from October 2013 through project completion in 2016 by Kevin Lutes with New Fields Mining Design & Technical Services. Both of these companies were located in Elko, NV. The Construction QA/QC Plan was prepared in compliance with the ROD and CD.

The Subcontractor (High Mark Construction) proceeded with Remedy Construction in accordance with the approved design, project schedule and Construction QA/QC Plan. The Construction QA/QC Plan included an explanation of the construction authorities and inspection activities listed below:

- Responsibilities and authorities of all Contractor and Subcontractor key personnel involved in the design and construction of the remedy;
- The qualifications of the quality assurance personnel;
- The observations and tests that shall be used, as appropriate, to monitor construction and the frequency of performance of these activities;
- Any necessary QA/QC sampling activities, sample locations, frequency of testing, acceptance and rejection criteria, and plans for implementing corrective measures as addressed in the plans and specifications;
- Description of the documentation requirements for quality assurance/quality control activities.

5.1.1 Repository Construction

Construction of the on-site repository required quality control checks for several field tasks:

- Construction surveying – to confirm grades and elevations of all components associated with the repository and soil placement thicknesses, establishment of control points, and for record surveys;

- Earthwork and Grading – visual inspections of general fill to ensure placement of proper material, subgrade preparation, general fill placement and compaction, placement and compaction of excavated mine-related waste material, in-place soil density checks, and soil moisture density (Proctor) tests.

- Revegetation – review of seed mixture certifications and soil amendments, observation of seeding methodology.

Documentation of the quality control checks can be found in Appendices F, G and N.

5.1.2 Stormwater Drainage Structures

The TDG field engineering staff observed the installation of stormwater drainage control structures to ensure that proper materials were supplied and installed in accordance with the approved project specifications. Inspections of stormwater drainage control structures and erosion control devices were performed on a routine basis and after every rain event to ensure they were properly functioning and to check for needed repairs.

The corresponding quality control inspection checklists can be found in Appendix H.

5.1.3 Tailings Removal from Mill Creek

In order to verify that all mining-related waste material was removed from the upper Mill Creek valley, a survey grid was set up on a 50-foot grid spacing over the Pond 3 and 4 areas and elevations were taken at the ground (alluvium) surface when excavation was completed. If the underlying alluvium was found to be stained or contained a pH $\leq$ 4.5, additional excavation was performed to a maximum depth two feet or to bedrock. The mining-related material associated with the Hydraulic Control Pond was completely removed to a minimum depth of 3 feet beyond its known boundaries.

Fifteen of 418 Excavation Completion Reports for the Pond #3 and #4 areas indicate alluvium with a pH of 4.5 was left in-place and not excavated for placement in the Repository in strict conformance with the Project Design. This alluvium is not expected to have a significant influence on the effectiveness of the remedy for the following reasons:

- All mine tailings were removed from Ponds #3 and #4, plus discolored soil and alluvium with a pH<4.5, therefore the source material for metals-contaminated groundwater has been removed. There is probably residual metals-contaminated groundwater in the pores of the remaining alluvium but it is a finite amount and not a source of long-term, continued leaching of metals into groundwater.
- The groundwater that seeps into the backfilled excavation has near neutral pH and will mitigate transport of the presumed residual metals-contaminated groundwater from the Ponds #3 and #4 area.
- The soil used to backfill the area of the pH=4.5 alluvium is slightly alkaline and will buffer the groundwater in the area of the pH=4.5 alluvium and attenuate transport of the metals-contaminated groundwater.

- The exact amount of alluvium with a pH=4.5 is unknown but is substantially less than the 800,000+ cubic yards of mine tailings and discolored alluvium removed during remedy construction.

The corresponding quality control survey and excavation completion inspection forms can be found in Appendix J.

5.1.4 Mill Creek Reconstruction

The reconstruction of Mill Creek through the upper Mill Creek valley included the installation of geosynthetics, compacted and screened soil layers and a rock armor layer. Laboratory or manufacturer QA/QC testing and certificates were required for all geosynthetics used on the project. Gradation testing was required on the rock armor layer to ensure it met the project requirements. Field supervision of the installation of these materials was performed by TDG staff to ensure that the installations met all project specification requirements.

The corresponding certificates, testing results and quality control checklists can be found in Appendices G, M and N.

5.1.5 Heap Leach Pad Evaporation Basin

The construction of the Heap Leach Pad evaporation basin involved the excavation and placement of soil, installation of a geomembrane liner, nonwoven cushion liner, and piping for the conveyance of seepage water and construction of an infiltration gallery. Laboratory or manufacturer QA/QC testing and certificates were required for all geosynthetics and other materials used on the project. Field supervision of the installation of these materials was performed to ensure that the installations met all project specification requirements.

The corresponding certificates, testing results and quality control inspection checklists can be found in Appendices G and N.

5.1.6 Surface Water Sampling and Analysis

Surface Water sampling was conducted during the remedy implementation as required under the Water Quality Compliance Protocol (WQCP) included in the ROD for remedy implementation at the Site. The WQCP established Performance Standards and a protocol for monitoring water quality at the Rio Tinto Mine Site to demonstrate achievement of the Performance Standards in the East Fork of the Owyhee River (EFOR) and Mill Creek. The WQCP established sampling and analysis protocols that met the requirements of Paragraph 35 of the CD. The WQCP contains provisions that apply during and after certification of completion of Remedy Construction. During Remedy Construction, WQCP monitoring occurred on a biweekly basis while construction activities took place on site. The WQCP requires the monitoring of surface water at selected locations along Mill Creek and the EFOR. After Performance Standards are demonstrated as having been met at Station SW-4, the post-construction monitoring will begin.

Biweekly sampling was conducted during Remedy Construction activities from May or July through August or December depending on the year (2013- 2016). Samples were collected at four surface water stations on Mill Creek and the EFOR as described below and presented in the map provided in Appendix K:

- Station SW-1 – Mill Creek upstream location
- Station SW-2 – Downstream from SW-1 immediately upstream of the confluence of Mill Creek and the EFOR
- Station SW-3 – EFOR located upstream of the confluence with Mill Creek
- Station SW-4 – EFOR located downstream of the confluence with Mill Creek

Samples were collected at each station location when there was enough flowing water present to collect a sample and measure field parameters. Surface water samples were analyzed and measured for the following:

- Performance Analytes – Dissolved cadmium, copper, zinc
- Supplemental Analytes – Total iron and aluminum, hardness, total dissolved solids (TDS), and total suspended solids
- Field Parameters – pH, temperature, specific conductance, dissolved oxygen, turbidity, and stream discharge (flow rate)

A summary of analytical results were provided in monthly progress reports accompanied by an evaluation of the results documenting whether performance standards were met for dissolved cadmium, copper, and zinc. Table 5-1 presents a summary of the Performance Standard exceedances at EFOR surface water Station SW-4 that occurred during the four-year Remedy Construction period. Appendix K provides the analytical results for surface water samples collected 2013 through 2016 during Remedy construction.

Table 5-1. Summary of Surface Water Exceedances at Station SW-4 During Remedy Construction

	Performance Analyte Concentrations (mg/L)		
Year	**Dissolved Cadmium (Standard – 0.00024 mg/L)**	**Dissolved Copper (Standard – 0.028 mg/L)**	**Dissolved Zinc (Standard – 0.030 mg/L)**
2013	No exceedances in 2013	No exceedances in 2013	No exceedances in 2013
2014	No exceedances in 2014	No exceedances in 2014	No exceedances in 2014
2015	09/01/2015 – 0.0003 J	No exceedances in 2015	No exceedances in 2015
2016	No exceedances in 2016	No exceedances in 2016	No exceedances in 2016

B – Analyte was detected in the sample and the corresponding laboratory method blank.
J – Analyte detected at an estimated concentration less than the reporting limit.
mg/L – milligrams per liter

In 2013, 2014, and 2016, there were no exceedances of Performance Analytes in any surface water samples collected at Station SW-4 during Remedy Construction activities. Only in 2015, did the concentration of a Performance Analyte exceed the standard at Station SW-4. The exceedance of cadmium in September 2015 at this location was potentially the result of lower flow in the EFOR at that time when a higher volume of solids accounts for the concentration of cadmium at 0.0003 mg/L, which slightly exceeds the Performance Standard of 0.00024 mg/L. Lower flow rates on Mill Creek and the Owyhee River in late summer were likely due to drought conditions, low precipitation, and decreased runoff on Mill Creek and upstream of SW-3.

5.2 Site Inspections and QA/QC Reporting

Representatives from the Nevada Division of Environmental Protection and the USEPA conducted periodic inspections of the remedial construction activities over the course of the project duration at the Rio Tinto mine site.

TDG field staff QC reporting of the remedial construction activities was performed on a routine basis and is contained in the attached Appendices.

In addition to the field QC reporting for the remedial construction work an independent third party, professional engineer, was contracted to perform QA reporting on a monthly and annual basis. These monthly and annual QA reports were submitted to the NDEP and USEPA on-time for each reporting period to meet the requirements of the CD. The third party QA inspection reports are included in Appendix I.

5.3 Earthwork Quality Control Field Density Testing Anomalies

TDG conducted field density testing for selected remedy features during remedy construction. The results of the field density testing program are presented in Appendix N. There are several field density testing results in Appendix N which did not meet the required density and are reported as Failed status. The Failed field density test locations were reworked and retested. In most instances, the re-test results are identified as re-tests and achieved a Pass status. Four locations of Failed field density tests were not adequately documented as being re-tested and achieving Pass status. Three of the four subject locations are located in backfill soil areas in Ponds 3 and 4. The other location of a Failed field density test is in mine tailings placed in Repository Tailings Lift #60.

The backfilled soil in Ponds 3 and 4 was not used as structural fill and the lack of documented re-testing of the placed soil backfill does not significantly affect the function and integrity of the Repository. In a similar manner, the lack of documented re-testing for a single field density test in the Repository does not significantly affect the stability and function of the completed Repository.

6.0 POST-CLOSURE MAINTENANCE AND MONITORING

Monitoring & Maintenance and Operation and Maintenance, as defined in the CD, will commence after certification of completion of the Remedy Construction. Activities will include monitoring and maintenance of the reclaimed mining material areas, ET covers, reconstructed Mill Creek Valley, the HLP Evaporation Basin and the repository. This will consist primarily of monitoring and maintenance of the vegetated ET covers and water quality monitoring. Periodic inspections will be performed by TDG field personnel to assess vegetative performance, any erosion on ET covers or damage to channels. Diversion channels will be inspected when covers are monitored. Maintenance activities will include performing necessary repairs to covers and diversion channels.

Additional Monitoring & Maintenance and Operation and Maintenance activities will include:

- Maintenance of the Heap Leach Pad Evaporation Basin.
- Monitoring for any erosion of the reconstructed upper Mill Creek Channel and subsequent repairs.
- Inspection and maintenance of the perimeter fencing and signage.
- Maintenance of the upper Mill Creek GCL, Rock Armor Layer and Protective Soil Layer.
- Management of deep rooting vegetation in the Upper Mill Creek Valley.
- Maintenance of the Pond 2 berm and soil cover.

6.1 Surface Water Monitoring

Surface water quality will be monitored in accordance with the Water Quality Compliance Protocol as included in the ROD (NDEP 2012).

Based on the results of sampling conducted under the WQCP in 2013 through 2016, water quality in Mill Creek and EFOR met the applicable Performance Standards during Remedy Construction. The general trend in the concentrations of cadmium, copper, and zinc decreased over time, as reflected in the annual summary tables for Years 2013 through 2016. Data for 2016 indicated that there were no exceedances of Performance Standards during remedy the construction phase of the project. These data support certification of the Remedy Construction as being complete, and “Long Term Monitoring” in Mill Creek and the EFOR under the WQCP can proceed.

7.0 CERTIFICATION

Based upon the information presented in this RCCCR, I certify that the Remedy Construction has been completed in full satisfaction of the requirements of the subject Consent Decree and request Certification of Completion of Remedy Construction under Paragraph 63 of the CD from NDEP, with concurrence from USEPA, stating that Remedy Construction has been fully performed.

To the best of my knowledge, after thorough investigation, I certify that the information contained in or accompanying this submission is true, accurate and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

April 4, 2017

Mountain City Remediation, LLC
Administrator

Date

Ronald E Versaw

APRIL 7, 2017

TDG Project Engineer

Date

Prepared under the supervision of:
Ronald E. Versaw, PE

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VERSAW
MINING
No. 6054
Ronald E Versaw
4/7/2017

EXPIRES 6/30/2018
Professional Engineering Seal

8.0 REFERENCES

HabiTech (HabiTech, Inc.)

2010 (April) *Redband trout status and Mill Creek conceptual channel design for fish passage, Rio Tinto Mine remediation.* Memo.

NDEP (Nevada Division of Environmental Protection)

2010 (Oct.) *Proposed Plan for Rio Tinto Mine Site.* Final.

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2011 (Apr. 28) *Rio Tinto Mine Site – Elko County, Nevada, Remedial Design/Remedial Action Work Plan.* Revision 0.

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URS (URS Corporation)

2006 (Sept.) *Area A Alternatives Study – Final Draft.* Rio Tinto Mine Remediation Project, Elko County, Nevada.

2008 (Aug.) *On-Site Repository Geotechnical Investigation - Final.* Rio Tinto Project, Elko County, Nevada.

USEPA (U.S. Environmental Protection Agency)

2013 (May) *Consent Decree for the Rio Tinto Mine Site.* Final. Case 3:12-cv-00524-RCJ-WGC, United States District Court, District of Nevada (entered May 20, 2013).

APPENDICES

(Available electronically on separate flash drive)

Appendix A

DCNs and Variances

Appendix B

Repository Cover Modeling

Appendix C

Precertification Checklist

Appendix D

Record (As-Built) Drawings

Appendix E

Site Photographs

Appendix F

Quality Control Reports

Appendix G

Certifications

Appendix H

Stormwater Drainage BMP Inspection Data

Appendix I

Monthly & Annual 3rd Party QA Inspection Reports

Appendix J

Mill Creek Valley Excavation Completion Reports

Appendix K

Surface Water Quality Analytical Results

Appendix L

Heap Leach Pad Evaporation Pond Design

Appendix M

Mill Creek Reconstruction Liner System Inspection Reports

Appendix N

Geotechnical Test Results

Appendix O

WTP Daily Reports

Appendix P

Project Schedule

Appendix Q

Lower Mill Creek Valley Seed Mixture and Revegetation Plans