Triumph Mine Tailings Piles Site

2019 Five-Year Review
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Triumph Mine Tailings Piles Site
Blaine County, Idaho
October 2019

Approved by:  
Date: 10/9/2019

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<table>
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<th>Description</th>
</tr>
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<tbody>
<tr>
<td>AWQC</td>
<td>Ambient Water Quality Criteria</td>
</tr>
<tr>
<td>bgs</td>
<td>below ground surface</td>
</tr>
<tr>
<td>BLM</td>
<td>Bureau of Land Management</td>
</tr>
<tr>
<td>CA</td>
<td>cost assessment</td>
</tr>
<tr>
<td>COCs</td>
<td>contaminant of concern</td>
</tr>
<tr>
<td>CPM</td>
<td>Community Protection Measures</td>
</tr>
<tr>
<td>CWA</td>
<td>Clean Water Act</td>
</tr>
<tr>
<td>d</td>
<td>day</td>
</tr>
<tr>
<td>DEQ</td>
<td>Idaho Department of Environmental Quality</td>
</tr>
<tr>
<td>EC</td>
<td>Environmental Covenant</td>
</tr>
<tr>
<td>EE</td>
<td>engineering evaluation</td>
</tr>
<tr>
<td>EPA</td>
<td>US Environmental Protection Agency</td>
</tr>
<tr>
<td>ft</td>
<td>feet</td>
</tr>
<tr>
<td>FYR</td>
<td>five-year review</td>
</tr>
<tr>
<td>gpm</td>
<td>gallons per minute</td>
</tr>
<tr>
<td>GWQS</td>
<td>ground water quality standard</td>
</tr>
<tr>
<td>HDPE</td>
<td>high-density polyethylene</td>
</tr>
<tr>
<td>IDL</td>
<td>Idaho Department of Lands</td>
</tr>
<tr>
<td>IRIS</td>
<td>Integrated Risk Information System</td>
</tr>
<tr>
<td>kg</td>
<td>kilogram</td>
</tr>
<tr>
<td>L</td>
<td>liter</td>
</tr>
<tr>
<td>LTP</td>
<td>lower tailings pile</td>
</tr>
<tr>
<td>mg</td>
<td>milligram</td>
</tr>
<tr>
<td>MOA</td>
<td>memorandum of agreement</td>
</tr>
<tr>
<td>NPL</td>
<td>National Priorities List</td>
</tr>
<tr>
<td>O&amp;M</td>
<td>operations and maintenance</td>
</tr>
<tr>
<td>OU</td>
<td>operable unit</td>
</tr>
<tr>
<td>PPRTV</td>
<td>provisional peer-reviewed toxicity value</td>
</tr>
<tr>
<td>psi</td>
<td>pounds per square inch</td>
</tr>
<tr>
<td>PWS</td>
<td>public water system</td>
</tr>
<tr>
<td>ROD</td>
<td>record of decision</td>
</tr>
<tr>
<td>TRBRG</td>
<td>Triumph risk-based remediation goal</td>
</tr>
<tr>
<td>UTP</td>
<td>upper tailings pile</td>
</tr>
</tbody>
</table>
1 Introduction

This review was completed according to the 1994 Triumph Mine Tailings Piles Site Memorandum of Agreement (MOA) between the US Environmental Protection Agency (EPA) and the Idaho Department of Environmental Quality (DEQ) (EPA and DEQ 1994). In the MOA, DEQ agreed to perform remediation work at the Triumph Mine Tailings Piles Site in a manner consistent with EPA’s Superfund process. DEQ’s Record of Decision (ROD) for the site included a requirement for a Five-Year Review (FYR) (DEQ 1998). Under Superfund, a FYR is required at sites where contaminants are left behind after remediation. The Triumph Mine ROD states “FYRs will be required at Triumph because contaminants will remain on-site and may pose potential risk. All caps will be subject to FYR as well as routine operation and maintenance (O&M). House dust metal concentrations may also be reviewed to determine the effectiveness of source control in reducing house dust metal loadings. Additionally, ground water quality in the area including downstream drinking water wells will be subject to review.”

During the FYR, the implementation and performance of a remedy is evaluated to determine if the remedy is and will continue to protect human health and the environment. Evaluation methods, findings, and conclusions are documented in FYRs. The FYR identifies issues found during the evaluation and documents recommendations to address them.

This 2019 FYR for the Triumph Mine Tailings Piles Site was prepared because hazardous substances, pollutants, or contaminants remain at the site above levels that allow unlimited use and unrestricted exposure. The site consists of two operable units (OU), which are addressed in this FYR. The soil OU addresses contaminated soils, sediments, and tailings at the site. The mine water OU addresses the discharge from the Triumph tunnel.

2 Site Background

This section provides background information on the Triumph Mine Tailings Piles Site.

2.1 Site Location, Description, and Characteristics

The Triumph Mine Tailings Piles Site is an inactive mining and milling complex adjacent to the community of Triumph, Blaine County, Idaho. The mining and milling complex and community of Triumph are accessed from Hailey, Idaho, by travelling north-northwest on Idaho State Highway 75 approximately 6 miles to East Fork Road and then travelling approximately 6 miles east on East Fork Road to the community of Triumph (Figure 1).

The main surface water body in the vicinity of the site is the East Fork Wood River, which runs south of the site along the southern margins of the valley floor. Surface water is also present in wetlands adjacent to the river, particularly in the area upstream (east) of the site.
The site and the East Fork Wood River Valley are part of the larger regional Wood River Valley aquifer system. Quaternary age valley fill sediments constitute the primary source of ground water for the East Fork and Wood River Valley aquifer systems. Valley fill sediments are estimated to be between 0 to 100 feet thick on the East Fork valley floor (Bartolino and Adkins 2012). Sediment thicknesses, near Triumph, range from 21 to greater than 80 feet, based on available well drillers logs (IDWR 2019). Bedrock that underlies the valley fill sediments also produces ground water; however, the degree of hydraulic connection between the bedrock and sediments is unknown. Bedrock is not considered a significant water source to the valley fill sediments (Bartolino 2009).
Ground water flow within the East Fork Wood River Valley fill sediments is believed to follow topography under unconfined conditions (Kennedy Jenks Consultants 1997, Bartolino and Adkins 2012, Fisher et al. 2014). Confined conditions may exist locally due to discontinuous clay layers deposited above coarser-grained sediments (Kennedy Jenks Consultants 1997). Estimates of hydraulic conductivity range from 1 foot per day (ft/d) to 1,900 ft/d with a mean of 250 ft/d and a geometric mean of 69 ft/d (Bartolino and Adkins 2012). Aquifer recharge is primarily from precipitation and streamflow infiltration. In a study conducted by Bartolino (2014), the East Fork Wood River was estimated to lose between 9.5 and 4.2 cubic feet of water per second (3,040 to 6,880 acre feet per year) to the valley fill aquifer, in September and October 2012, respectively, over the approximate 4.75 mile reach between Hyndman (near Triumph) and Gimlet. Aquifer discharge is through seeps, springs, and underflow to adjacent aquifers. Fisher et al. (2014) estimated inflow to the valley fill aquifer, near Triumph, to average 610 acre-feet per year. Bartolino (2009) estimated 12,000 to 14,000 acre-feet per year of the East Fork Wood River Valley fill ground water discharges to the Wood River Valley aquifer system.

The Triumph Mine Tailings Piles Site consists of the Triumph Mine and associated mine complex, waste rock pile, process areas, and two tailings piles associated with the former lead, zinc, and silver mining and milling operations (Figure 2). The two tailings piles are located on the valley floor immediately north of the East Fork Wood River and south of East Fork Road. The upper tailings pile (UTP) occupies approximately 6 acres and the lower tailings pile (LTP) occupies about 22 acres with an estimated total volume of 680,000 cubic yards. A spring emerges along the northern boundary of the UTP. Water from the spring flows through a drainage channel in the UTP and enters the wetlands south of the pile. The LTP contained two ponds. As a result of remediation, the southern pond was eliminated. The remaining permanent pond is located on private property on the eastern edge of the LTP. The Triumph Mine portal and tunnel is situated on the south-facing hillside above the tailings piles. The waste rock pile extends below the portal to the base of the valley floor.

Thirty residences are located adjacent to the mine complex, which make up the unincorporated town of Triumph. Approximately 65 people reside in the town of Triumph. Houses are located along the northwestern boundary of the UTP and along the eastern boundary of the LTP. Historical land use includes mining, ore processing, and residential. Anticipated future land use includes residential and recreational. Additional background information is found in the site ROD (DEQ 1998) and remedial investigation (Kennedy Jenks Consultants 1997).

Contaminants of concern (COCs) for the site are antimony, arsenic, cadmium, copper, lead, manganese, mercury, nickel, selenium, silver, vanadium, and zinc. Indicator chemicals (chemicals that indicate the presence of others) for the residential soil investigation were arsenic and lead. The greatest risks from the site are contaminated soils, tailings, and waste rock materials. These sources were addressed in the soil portion of the remedy recommended in the ROD. Driven by human health risk, the remedy for contaminated soil sources was designed to also protect ground water and surface water. The remedy for mine water contamination was designed to reduce the load of arsenic and manganese moving from the mine into the wetlands and ground water. No unacceptable ecological risks that warranted remediation were identified.
2.2 Regulatory History

In the 1988 preliminary site assessment, DEQ found elevated, above background, concentrations of arsenic, manganese, and zinc in surface water in the Triumph tunnel drainage ditches near the LTP and the East Fork Wood River. EPA completed site inspections in September 1991, and conducted further assessments in 1992 and 1993. In May 1993, EPA proposed to add the Triumph Mine site to the federal National Priorities List (NPL), known as Superfund. General Notice letters were sent out in June 1993 to Triumph Minerals and ASARCO, and the Idaho Department of Lands (IDL), Snyder Mines, Inc., and the Bureau of Land Management (BLM) were also notified of potential liability.

Significant community opposition to the potential listing of the Triumph Mine site on the NPL resulted in an MOA between EPA and DEQ. This 1994 agreement defers remediation responsibility from EPA to DEQ’s regulatory authority. The MOA states that DEQ’s response activities will be conducted consistent with the Comprehensive Environmental Response, Compensation, and Liability Act as amended, the National Oil and Hazardous Substances Pollution Contingency Plan (i.e., National Contingency Plan), and the State of Idaho laws and regulations.
DEQ, as the oversight agency, entered into a consent order with ASARCO and IDL in January 1994 to perform a remedial investigation/feasibility study for the site. This remedial investigation was completed in January 1997. DEQ completed the baseline ecological risk assessment in May 1997 and the baseline human health risk assessment in August 1997. The final feasibility study was completed in March 1998, while the site’s ROD was issued on March 19, 1998. A second consent order was entered into with ASARCO and IDL for remedial design and remedial action in August 1999 (IDHW 1999). In this consent order, the site was broken into two OUs—soils and mine water.

On April 30, 2003, EPA withdrew the proposal to add the Triumph Mine site to the NPL. EPA de-proposed the site based on the MOA and DEQ fulfilling its obligations under the agreement.

During remediation, ASARCO was unable to meet remedial obligations at the Triumph Mine and other sites around the country due to financial constraints. Through a settlement with the federal government, in 2003 ASARCO used the funding to install the Triumph tunnel plug to control the mine water discharge.

ASARCO filed for bankruptcy in 2005, and DEQ became responsible for maintaining the mine water portion of the remedy and completing additional mine closure work to further reduce mine water flow. IDL remained responsible for the soils component of the cleanup. In 2009, ASARCO entered into a bankruptcy agreement with the federal government and several states. On June 11, 2009, the order approving DEQ and IDL’s receipt of settlement funds ($1,675,000 and $1,000,000, respectively) from ASARCO’s bankruptcy was entered. The State of Idaho received some property at site as part of this settlement (Figure 2).

On September 14, 2018, a citizen suit was filed by the Idaho Conservation League against DEQ and IDL, alleging violations of the federal Clean Water Act (CWA) for discharging pollutants from a point source without a National Pollutant Discharge Elimination System permit. On October 1, 2018, DEQ and IDL entered into an agreement to resolve the alleged violations through settlement.

### 2.3 Sources and Nature of Contamination before Remediation

Contamination resulting from mining, milling, and processing operations at the Triumph Mine site was largely confined to the immediate area of these operations (i.e., residential areas, tailings piles, process areas, waste rock pile, mine tunnel, and adjacent soils and wetlands). Maximum concentrations of arsenic, lead, and manganese in soils at the site are shown in Table 1.

Historically, prior to remediation, ground water in the valley fill sediments, hydraulically downgradient of the tailings piles, has shown evidence of site-related impacts. Total arsenic, cadmium, lead, and manganese were detected in ground water samples from site monitoring wells that were above federal drinking water standards and Idaho’s ground water quality standards (IDAPA 58.01.11) (Kennedy Jenks Consultants 1997, Golder 2014a, Golder 2014b). Ground water samples from wells completed in bedrock, both hydraulically up- and downgradient of the site, have not detected site-related COC concentrations above actionable levels that can be directly associated with the site. The public water system (PWS) wells currently used by the Triumph community did not show signs of contamination above actionable levels.
Before remediation, surface water in ponds and seeps associated with the mine portal water, tailings and waste rock pile were also impacted. During the remedial investigation, it was determined the East Fork Wood River was largely unaffected by historic contamination at the site (Kennedy Jenks Consultants 1997).

### Table 1. Maximum selected metals concentrations in Triumph Mine site soil before remediation.

<table>
<thead>
<tr>
<th>Location</th>
<th>Arsenic</th>
<th>Lead</th>
<th>Manganese</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Milligram per kilogram</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tailings piles</td>
<td>18,900</td>
<td>17,060</td>
<td>33,370</td>
</tr>
<tr>
<td>Waste rock</td>
<td>5,287</td>
<td>7,378</td>
<td>7,693</td>
</tr>
<tr>
<td>Process areas</td>
<td>22,860</td>
<td>52,410</td>
<td>4,792</td>
</tr>
<tr>
<td>Residential areas</td>
<td>1,085</td>
<td>22,790</td>
<td>27,840</td>
</tr>
<tr>
<td>Wetland areas</td>
<td>1,500</td>
<td>28,740</td>
<td>105,700</td>
</tr>
<tr>
<td>Tunnel discharge ditch</td>
<td>38,560</td>
<td>20,480</td>
<td>221,000</td>
</tr>
<tr>
<td>River sediments</td>
<td>184</td>
<td>177</td>
<td>Not analyzed</td>
</tr>
<tr>
<td>ROD remediation goal</td>
<td>300</td>
<td>400</td>
<td>Not applicable</td>
</tr>
</tbody>
</table>

Source: DEQ 1998

Before site remediation began, the tailings piles were a source of contaminant migration via airborne transport, overland flow, conveyance channels, seeps, and leaching into the ground water. Contaminants carried by surface water and fugitive dust were the primary sources of contamination to the adjacent soils and wetlands. Overland flow, channels, and seeps carried water from the tailings piles to the wetlands adjacent to the river. Data collected during the remedial investigation show the metals in the tailings were not leaching to a large extent (Kennedy Jenks Consultants 1997). This lack of leaching was attributed to the clay layer underlying much of the tailings piles and the presence of carbonates in the host geological formation that inhibits acidification and metal solubility.

The waste rock pile and process areas were also a source of contaminant migration from fugitive dust and surface water runoff and infiltration. The Triumph tunnel water ponded near the mine entrance before conveyance to the wetlands located west of the LTP. The ponded water near the tunnel resulted in seeps of contaminated water at the base of the waste rock pile. The conveyance system used for the water discharging from the Triumph tunnel was not maintained and at times would run uncontrolled down the waste rock pile. Contaminants exceeding Ambient Water Quality Criteria (AWQC) included arsenic, zinc, cadmium, and selenium.

Before the concrete plug was installed by ASARCO in 2003, the Triumph tunnel discharged water at 90 to 190 gallons per minute (gpm). Arsenic concentrations ranged from 2.6 to 5.2 milligrams per liter (mg/L) (same as parts per million). Manganese levels ranged from 4.3 to 10.3 mg/L. Zinc concentrations ranged from 2.8 to 10.9 mg/L. Water emerged from the mine portal and entered into holding ponds before being piped downhill through plastic drainage pipes. At times, this water was not contained in the pipes and ran down the road or seeped into the waste rock pile. Water discharged from the drainage pipes into a ditch, then entered a culvert and crossed the East Fork Road, where it entered an unlined ditch. The water flowed in a southerly direction along the western edge of the LTP, where the ditch was not well defined.
Ultimately, the water dispersed in the wetlands and toward a small pond west of the tailings piles.

### 2.3.1 Contamination Affecting Primarily Human Health

People were being exposed to COCs by ingesting soil, breathing dust, drinking water, eating homegrown vegetables, or through dermal exposure. The primary media of concern for human health at the site were as follows.

- Contaminated soils in residential yards, gardens, right-of-ways, commercial and undeveloped properties, and common areas. Airborne dust generated at these locations is also a human health concern.
- Contaminated house dust, originating from contaminated soil.
- Drinking water from local wells.
- Contaminated wetland soil and sediments

The COCs evaluated in the site’s risk assessment are antimony, arsenic, cadmium, copper, lead, manganese, mercury, nickel, selenium, silver, vanadium, and zinc (Tetra Tech 1997b). The baseline human health risk assessment for the Triumph Mine site identified arsenic as the primary COC in soils because it has the highest carcinogenic and noncarcinogenic risks at the site. Arsenic, lead, and antimony concentrations in soil were above acceptable risk levels for the soil ingestion exposure route. Cadmium and manganese were above acceptable risk levels for the garden produce ingestion exposure route. Arsenic concentrations in soil were above acceptable risk levels for the dermal exposure route.

At the time the ROD was issued in 1998, DEQ concluded no unacceptable risks were associated with the ground water consumed by site residents. Unacceptable noncarcinogenic risks were identified for ingestion of total manganese in ground water under future residential scenarios downgradient (west) from the LTP.

### 2.3.2 Contamination Affecting Primarily Ecological Receptors

The site’s ecological risk assessment addressed the East Fork Wood River and wetlands and found no unacceptable risks to ecological receptors that would warrant remedial action (Tetra Tech 1997a).

### 2.4 Cleanup Goals and Objectives

The objective of remedial action at the Triumph Mine site is to provide effective response actions that protect human health and the environment from contaminated soil, tailings, surface water, and ground water. Remediation goals for cleanup were established based on the results of the human health risk assessment (Table 2). A remediation goal of 300 milligrams per kilogram (mg/kg) (same as parts per million) was established for arsenic in soils. Although implementation of the arsenic remediation goal was anticipated to provide response actions protective of human health, the EPA lead screening level of 400 mg/kg is also used to identify potential risks (EPA 1996). A cleanup goal was not established for lead but the screening criteria are useful for evaluating remedial action effectiveness.
The federal drinking water standards are the acceptable risk levels for contaminants found in ground water used as drinking water. At the time the Triumph Mine ROD was issued, no federal standard was established for manganese. Based on elevated concentrations of manganese measured in ground water, the Triumph Mine risk-based remediation goal of 0.84 mg/L was established for manganese during the human health risk assessment phase of developing the ROD. Since ROD issuance, a secondary federal drinking water standard of 0.05 mg/L was established for manganese. The secondary drinking water standards are nonmandatory standards established as guidelines to assist public water systems in managing their drinking water for aesthetic considerations. The secondary drinking water standards are not enforceable, but exceeding these levels may cause the water to appear cloudy or colored, or to taste or smell bad. The state established a secondary ground water quality standard of 0.05 mg/L for manganese in ground water based on aesthetic qualities.

To address the potential risks from the site, the following cleanup objectives were developed:

- **Soils**: Prevent human ingestion and/or inhalation of and direct contact with contaminated soil and dust above acceptable risk level under current and future residential scenarios. The soils cleanup objective included soils in yards, gardens, road shoulders, roads within and adjacent to residential properties and the waste rock area.
- **Tailings piles**: Prevent human ingestion and inhalation of, and direct contact with, tailings and fugitive dust above acceptable risk levels. Prevent human ingestion of surface water on the tailings ponds. Prevent contaminant migration and exposures to ponds on the tailings piles that would result in unacceptable risk to human health and the environment.
- **Process Area**: Prevent human ingestion and inhalation of, and direct contact with, contaminated soil and dust above acceptable risk levels. Prevent contaminant migration that would result in unacceptable risk to human health and the environment.
- **Wetlands**: Prevent human consumption of garden produce grown in soils above risk levels for future residential scenarios.
- **Mine Portal Ditch**: Prevent human ingestion and direct contact with ditch sediments above acceptable risk levels.
- **Ground Water**: Prevent human ingestion of ground water at levels above acceptable risk level for future residential scenarios.
- **Mine Portal Water**: Prevent human ingestion of mine portal water and prevent contaminant migration through mine water discharges that would result in unacceptable risk to human health and the environment.

### Table 2. Remediation goals for Triumph Mine cleanup.

<table>
<thead>
<tr>
<th>Media</th>
<th>Analyte</th>
<th>Remediation Goal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Soils</td>
<td>Arsenic</td>
<td>300 mg/kg</td>
</tr>
<tr>
<td>Ground Water</td>
<td>Manganese</td>
<td>0.84 mg/L</td>
</tr>
<tr>
<td>Ground Water</td>
<td>All other site contaminants</td>
<td>Drinking Water Standard</td>
</tr>
<tr>
<td>Surface Water</td>
<td>All applicable contaminants</td>
<td>Ambient water quality criteria</td>
</tr>
</tbody>
</table>
2.5 Soils OU Remedial Action Implementation

The remedy at the site was based on residential and recreational use scenarios. The majority of the cleanup work started in 1998 and finished in 1999. Remedial actions to address contamination in the soils OU include the following:

- Removed contaminated soil from 19 residential yards, 3 community roads, and 6 road shoulders.
- Removed discrete tailing deposits in wetlands.
- Graded and capped tailings and waste rock piles.
- Implemented a Community Protection Measures (CPM) Program

Additional details of remedial actions performed in the soils OU are included in the construction completion report (MFG 2000a). A brief summary of response actions is included in the following sections.

2.5.1 Residential Soils

The ROD called for excavating soil on residential properties to a depth where the remediation goal of 300 mg/kg arsenic would be achieved or to 1 foot, whichever occurred first. In most residential yards, contaminated soil with more than 300 mg/kg of arsenic was totally removed. When contaminated soils were found below 1 foot deep, 1 foot of clean soil was applied over the contaminated soil and revegetated. Vegetable garden areas were provided enough soil to create a 2-foot layer of uncontaminated soil.

The approach to property cleanup was consistent with the use of the property at the time of the cleanup. Undeveloped properties were evaluated to determine if existing conditions posed a risk of sediment transport by wind or water. These properties were also evaluated for potential exposure pathways that presented unacceptable risks to human health and the environment. If an unacceptable risk was identified, remedial action was taken to address the risk. It was impractical to remediate properties for an unknown future use. If a property did not have the potential for erosion or a viable exposure pathway, near surface contamination may have been left in place. Property owners who choose to develop a property following cleanup are responsible for safely managing all contamination on the property whether below a clean soil barrier or not. DEQ will work with property owners to ensure contamination is managed properly.

Institutional controls are necessary for residential properties and other capped areas that have contaminated material remaining. CPM was developed for the Triumph Mine site and includes institutional controls to ensure contaminated soils are properly handled, disposed of, or capped. Additional details about the Triumph CPM are included in section 2.5.3.

Excavation of contaminated soil materials and replacement with uncontaminated materials was also performed on unpaved roads and road shoulders. Road remediation consisted of road shoulder removal and replacement on both sides of East Fork Road for a distance of 3,000 feet, and removal and replacement of Triumph Circle, East Fork Lane, and Karst Drive. Based on measured arsenic concentrations road shoulders were remediated 6 to 12 inches deep. Roads were remediated 12 inches deep. Gravel was used to replace the contaminated materials removed.
2.5.2 House Dust

House dust was addressed through source control by capping the contaminated soils and tailings. Routine housecleaning by residents after completing the remediation was expected to reduce the metal load within homes because the source of new contaminated dust was controlled by the soils remedy. Follow-up monitoring will be performed to demonstrate house dust levels are within acceptable limits. Results will periodically be included as part of FYRs.

2.5.3 Community Protection Measures

The ROD calls for CPM development when residential properties have soils with arsenic levels greater than 300 mg/kg following remediation. The CPM allows property owners to use their property as they determine appropriate but ensures contaminated soils are properly handled, disposed of, or capped. The CPM applies to current and future residential properties, and other excavation activities located in contaminated areas whether contamination is below a 1-foot soil cap or not.

An Environmental Covenant (EC) under the Uniform Environmental Covenant Act is the type of CPM implemented at the Triumph site. An EC is recorded at the County Assessor’s Office and attached to the property deed. The EC for the Triumph area provides the CPM to current and future property owners so they know how to safely manage the contamination on their property. The EC with the CPM provides information on how to excavate and manage contaminated soil and where to dispose of contaminated soil on state land at no cost. The EC also explains how to replace the soil barrier or create an alternate barrier to prevent direct exposure to contaminated soil. Property owners must document their activities and provide DEQ with a copy to place in their property file. The property file will be available to current and future property owners for real estate disclosures and future construction activities.

Three property owners entered into and recorded ECs for a total of eight properties. Covenants are still needed for six to eight additional parcels. In May 2014 and October 2017, DEQ sent letters to Triumph residents who had not entered into an EC with DEQ. The letter explained the purpose of the EC and requested a signed EC. Only one additional property owner entered into an EC. Entering into an EC is voluntary—DEQ cannot require property owners to enter into the covenant.

Due to property owner’s lack of response to enter into an EC, DEQ requested IDL include a property inspection as part of its site O&M responsibility. This inspection will determine if new excavation or construction activities have occurred that may have disturbed the contaminated soil. If new activities are identified by IDL, the owner is contacted for documentation on how they disposed of the contaminated soil and what type of barrier was installed to prevent direct exposure to contaminated soil. IDL will provide the information to DEQ to keep with the file established for the property. If contaminated soils were not managed properly, IDL and DEQ will assist the property owner with determining the best way to correct the situation. The cost and implementation of the corrective action is the owner’s responsibility. All information gathered as part of the IDL inspection and follow-up will be documented in the property file. Without the owner’s cooperation and a signed EC, it is difficult for IDL and DEQ to certify the integrity of the clean soil cap for real estate disclosures or lender inquiries.
The drinking water CPM was implemented on the property immediately west of the LTP. A restrictive covenant on wells drilled for domestic water purposes was recorded with the county in 2008. The restrictive covenant includes minimum requirements for well depth and maximum contaminant concentrations in water used for human consumption. Since obtaining the restrictive covenant for this property, IDL acquired ownership of the property. IDL’s ownership of the property makes future development and domestic well installation unlikely. Ongoing groundwater monitoring and analysis will determine the need for the additional CPM for drinking water.

2.5.4 Tailings Piles

The tailings piles were addressed by grading, capping, and water management. Small isolated tailings accumulations located adjacent to the main piles were consolidated onto the LTP or UTP. The piles were graded to prevent standing water that might infiltrate into the waste instead of running off. Stormwater runoff from the surface of the tailings piles is directed toward rock-lined drainage ditches that prevent erosion of the tailings piles embankments. After grading, a clean soil cap was installed with a minimum thickness of 6 inches. The cap was seeded to create a vegetative cover. The vegetated soil cap serves as a barrier to reduce exposures to people and the environment. The cap also prevents contaminant migration through wind and water erosion. A 12-inch soil cap buffer was created on the tailings piles directly adjacent to residential yards, where no physical barrier exists, such as a road or fence between the residential yard and the tailings piles.

Water management included minimizing the interaction between the tailings and water at the site. Water from Courier Gulch and the springs near the UTP is conveyed through a geomembrane-lined swale constructed through the center of the UTP. The lined swale is intended to minimize erosion of the tailings and prevent infiltration of the spring water into the UTP. To lower the ground water elevation in the southwest corner of the UTP, a toe drain was installed.

Before remediation, water levels in the permanent pond located on private property north east of the LTP were 4 to 5 feet higher than current levels. If not managed properly, water will flow over and through the tailings causing contaminants to leach from the waste. The solution identified in the ROD included draining the pond, but this was determined to be infeasible during the remedial design phase because of a significant amount of upwelling ground water and a deeper than anticipated pond depth. The alternative to draining the pond was installing a pipeline to control water levels in the pond and conveying water past the tailings to a basin located southwest of the LTP (Figure 2).

Some repairs on the LTP were completed. In October and November of 2014, IDL contractors performed additional LTP cover repairs (Golder 2015a):

- Filled depressions with general soil fill to achieve positive drainage at all locations on the cover surface.
- Placed topsoil to a thickness of 6 inches in areas where vegetation was not adequately established.
- Applied seed in the new topsoil areas, in other disturbed areas, and in areas where vegetative cover was partially established.
• Installed permanent erosion control measures in localized areas where rilling or gullying were present on the LTP.
• Installed six auxiliary ditches and associated perimeter berms to control drainage.
• Moved waste materials generated from local landowners that potentially contain tailings to a permanent disposal area, covered with 6 inches of clean soil, and applied seed.
• Defined the temporary disposal area on the LTP with concrete blocks.

During spring 2017, a blockage in the permanent pond water level control pipeline caused the pond to overflow for an extended period during the spring snowmelt. Water was flowing over the clean soil cap placed on the tailings pile but did not erode into the tailings. The continuous flow of water on top of the tailings pile may have caused the underlying tailing to become saturated causing several contaminated seeps to develop at the toe of the tailings pile. IDL replaced the pipeline in fall 2017 (IDL 2019b). The area will be monitored during the spring snowmelt to detect seepage. If seepage is detected, additional measures may be necessary to correct the condition.

2.5.5 Process Areas

In the old process area (Figure 2), 3,200 cubic yards of clean fill was placed over the processing facility foundations to create a final surface consistent with the surrounding topography. The tops of the concrete foundations are still visible in this area. A final cap consisting of a minimum of 6 inches of clean soil was placed over the area, and the area was reseeded.

A single, privately owned property encompasses the majority of the old process area. An EC for the property was recorded with Blaine County on February 22, 2019. Based on the presence of the old process area on the property, an additional provision is included as part of the EC requiring DEQ approval for any excavation activities conducted at the old process area. DEQ’s approval of excavation in this area will ensure the requirements of EC are met. Approval will require measures for preventing dust generation, ensuring proper disposal of contaminated soils, preventing the redistribution or recontamination of remediated areas during excavation or transport of contaminated soils, and preventing redistribution of contaminated soils by wind and water erosion. Another small area on the boundary of the old process area is included in a separate private parcel. An EC is preferred for this property but is not in place at this time. The property will be inspected as part of IDL’s ongoing O&M obligations to ensure the clean soils barrier is properly managed.

The new process area (Figure 2) was regraded and covered with a minimum of 6 inches of clean fill. Areas near residential lots were covered with 12 inches of soil and reseeded. The new process area is composed of three private parcels. An EC for the property encompassing the northern nonresidential portion of the new process area was recorded with Blaine County on November 21, 2011. Two residential parcels comprise the southern portion of the area, and no ECs are in place at this time. These properties will be inspected as part of IDL’s ongoing O&M obligations to ensure the clean soils barrier is properly managed.

2.5.6 Waste Rock Pile

The waste rock pile (Figure 2) was graded and covered with a 6-inch vegetative cap to eliminate direct exposure and airborne emissions from the area. Stormwater control benches draining
towards runoff chutes were installed to prevent erosion of the cap. The waste rock pile is composed of four separate properties. DEQ holds the western parcel received as part of the ASARCO bankruptcy settlement. The DEQ property is under government control so no EC is necessary. BLM manages the parcel located east of the DEQ property. IDL performs regular O&M inspections of the BLM property, and intergovernmental coordination is sufficient to ensure the remedy is properly managed in this area. Two private parcels are located to the east of the BLM property. The northern parcel is not a residential parcel, and an EC was recorded with Blaine County on November 21, 2011. The southern residential parcel does not have an EC in place at this time. The property will be inspected as part of IDL’s ongoing O&M obligations to ensure the clean soils barrier is properly managed.

2.5.7 Wetlands

Visible tailings and soil hot spots were removed from the wetland areas (Figure 2) and disposed on the tailings piles. Areas of barren soil that pose a risk of erosion and contain arsenic greater than the remediation goal were excavated or capped. The wetlands provide important metal-absorbing and habitat functions at the site and have been left largely undisturbed. During 2018, IDL purchased the property immediately west of the LTP. The property includes some of the remediated wetland areas. IDL ownership of this property will facilitate improved opportunities for monitoring and eliminates the potential for the installation of domestic water wells. No EC is required for wetland areas under IDL’s control.

2.5.8 Mine Water Drainage Ditch

The Triumph tunnel water drainage ditch south of the East Fork Road (Figure 2) was excavated to a depth where the remediation goal of 300 mg/kg arsenic was achieved or to 1 foot, whichever occurred first. A soil cover was placed in the ditch if soil containing COCs above the remediation goal remained. The materials excavated from the ditch were highly contaminated and were disposed on the tailings pile within a lined cell to ensure these materials do not leach. The majority of the ditch is on IDL-owned property, and no EC is required. A small section of the ditch along East Fork Road is located on BLM property and is under the jurisdiction of Blaine County, which maintains stormwater infrastructure along the road. IDL performs regular O&M inspections of the remediated mine water ditch, and intergovernmental coordination ensures the remedy is properly managed in this area.

2.5.9 Ground Water

The ROD calls for establishing CPM to prevent ingestion of impacted ground water downstream of the LTP. The CPM protects residents from ingesting water with elevated manganese concentrations until manganese levels are reduced through source control to less than the risk-based concentration of 0.84 mg/L and other COCs satisfy drinking water standards. A restrictive covenant on wells drilled for domestic water purposes was recorded with the county in 2008 for the IDL property immediately west of the LTP. The restrictive covenant includes minimum requirements for well depth and maximum contaminant concentrations in water used for human consumption. Additional restrictive covenants may be necessary based on the results of ground water monitoring.
Ground water monitoring is part of the O&M requirements for the soils OU to assess the effectiveness of the remedy on water quality. If manganese levels do not reach the remediation goal after the remedy is implemented, DEQ will determine the appropriate next steps to protect human health and the environment. Controlling sources is required by the selected remedy and is consistent with appropriate next steps. The remediation progress will be reviewed at least every 5 years.

Ground water monitoring at the site began in 1995. Initially, ground water monitoring included four monitoring wells just west of the LTP. These wells were monitored until 2008, when they were closed out due to a loss of access from the private landowner. During 2018, IDL acquired easements and installed wells MW-20 and MW-21 west of and downgradient from the LTP (section 8.1.5, Figure 5). The new wells coupled with an existing monitoring well located approximated 450 feet to the southwest of the LTP (MW-5A) will be sampled to assess progress toward reaching the remediation goal.

### 2.6 Mine Water OU Remedial Action Implementation

The selected remedy for water discharging from the Triumph tunnel is a phased approach that will meet applicable or relevant and appropriate requirements. In the first step, a mine plug was installed and monitored to evaluate discharge from seeps, connected mine workings, and leakage around the plug. The ROD called for collection, treatment, excavation, or other appropriate measures to address contamination caused by any discharge.

Remedial actions to address the mine water discharging from the tunnel include the following:

- Construction of the lined surge pond and associated pipelines and overflow ditches to manage mine water discharge in 1999.
- Construction of a concrete mine plug 1,175 feet within the Triumph tunnel in 2003.
- Construction of a concrete mine plug 235 feet within the Triumph tunnel in 2016.

Details of the remedial actions performed in the mine water OU are included in the construction completion reports (MFG 2000a; MFG 2003a; Tetra Tech 2016). A brief summary of the remedial actions conducted to address mine water at the site are provided in the following sections.

#### 2.6.1 Mine Water Management System

The mine water remedial actions included constructing infrastructure designed to manage the flow from the Triumph tunnel (Figure 2). Under normal operating conditions, water discharging from the mine portal is captured by a grated drop inlet structure located at the portal. The mine water is conveyed 700 feet through an 8-inch buried pipeline to a 1.68 million gallon lined surge pond. The surge pond is located west of the portal on the mine’s waste rock pile. If the grated drop inlet at the portal becomes blocked or increased discharge from the mine occurs, a drainage swale on the ground surface is designed to convey excess water from the portal to the surge pond.

Under normal operating conditions, water discharging from the surge pond is conveyed approximately 1,300 feet through an 8-inch pipeline. The pipeline terminates in a belowground...
basin on the valley floor located south of the mine portal. Increased discharge from the mine in excess of the capacity of the 8-inch discharge pipeline is conveyed through the surge ponds emergency spillway. Water exiting the surge pond through the emergency spillway is conveyed through a rock-lined drainage swale to a 24-inch culvert under East Fork Road and into the wetlands located southwest of the mine portal. Excessive quantities of water entering the wetlands can potentially discharge to the East Fork Wood River.

### 2.6.2 Mine Plug at 1,175 Feet

The ROD requires reduced water flow from the mine portal, and a closure system was installed in the mine following tunnel rehabilitation. Tunnel rehabilitation was required because a section of the tunnel collapsed due to the poor ground conditions of the geologic formation through which the tunnel was originally installed. Tunnel rehabilitation was completed in 2001 and included removing sediment, rock, and debris, installing new ground support, and constructing 500 feet of new tunnel to bypass the collapsed area in the original tunnel.

By the end of 2003, a plugging system was installed in the mine consisting of (1) a reinforced concrete plug constructed in the mine approximately 1,175 feet from the portal, and (2) a 6-inch high-density polyethylene (HDPE) pipeline from the plug to the portal. The pipeline was originally installed as a contingency to control water levels behind the plug. The HDPE pipeline has a wall thickness of 0.95 inches. Additional protection was provided by covering the pipeline with a minimum of 12 inches of backfill with most of the line covered in 18 to 24 inches of backfill.

The plug was installed 1,175 feet from the portal, where the Triumph tunnel consists of good quality argillite with scattered zones of calcareous argillite. The overall rock quality designation at the plug location was estimated to be fair to good. The rock cover over the plug is approximately 450 feet. Rock samples from the plug area were tested for specific gravity, porosity, and unconfined compressive strength. The results indicated sound, dense rock with good strength characteristics (MFG 2003a).

To prevent seepage through the rock surrounding the plug and provide a more stable plug and rock interface under the design hydraulic head, pressure grouting of the rock near and downstream of the plug location was performed. The grouting work consisted of drilling 3 rings of 12 holes 25 to 35 feet into the rock. The rings were drilled approximately 10, 5, and 1 foot from the downstream plug face. Each ring was pressure grouted to a maximum pressure of 250 to 300 pounds per square inch (psi) (MFG 2003a).

The plug at 1,175 feet is 16-feet thick and constructed of reinforced concrete. The average plug dimension on the upstream, wet side is approximately 11 x 12 feet. The average plug dimension on the downstream, dry side, is approximately 10 x 11 feet. The plug was constructed by pumping approximately 70 cubic yards of concrete into a formwork constructed of 3/8-inch steel. The concrete plug is anchored to the mine walls by 16 steel bars, 7/8-inch in diameter, grouted approximately 3 feet into the rock, and protrudes 2 to 2.5 feet into the plug. A steel reinforcing mat constructed of 3/4-inch diameter bars was incorporated into the plug about 2 feet from the plug’s downstream face. Pressure grouting was conducted 1 month after plug installation to seal the interface between the plug and mine portal walls and to eliminate seepage through fractures in the immediate vicinity of the plug.
The plug was designed to contain two times the maximum possible plug pressure estimated at 212 psi. Two times the maximum potential plug pressure (424 psi) is a greater load than the maximum seismic horizontal ground acceleration (earthquake) plus the maximum plug pressure. The greater load was selected as the design criteria.

Before plug installation, flow from the mine ranged from 90 to 190 gpm. Flow measured during late 2003 and 2004, just after plug installation, varied between approximately 2 to 4 gpm. The low flow rate measured after plug installation reflects the small volume of water contained behind the plug at that time and the associated low water pressure. As the tunnels located behind the plug continued to fill and pressure increased, the corresponding seepage around the plug also increased to approximately 15 to 18 gpm by 2011.

In June 2010, Rahe Engineering evaluated the mine plug at 1,175 feet for DEQ to determine how to close out the work and move into the O&M phase (Rahe 2011). During the initial evaluation, a collapsed tunnel was encountered 285 feet from the tunnel entrance. This prevented access to the plug at 1,175 feet. Access to the plug was needed for inspection to determine if additional grouting would slow the flow of water from the mine.

Although the plug could not be inspected, Rahe’s evaluation concluded “the likelihood of a catastrophic failure of the plug or surrounding rock is very low because of the high safety factors used in the design, and the good construction practices utilized during installation.” The report concluded the greatest long-term risk for the mine plug remedy is the rupture of the pipeline that runs 1,175 feet from the plug to the tunnel opening. A pipeline rupture could result in the release of 200 million gallons of water with possible debris flow from the collapsed area. The risk of a pipeline rupture was mitigated by abandoning the pipeline and installing a plug at 235 feet in 2016 (section 2.6.3).

### 2.6.3 Mine Plug at 235 Feet

In June 2011, DEQ entered into a contract with Tetra Tech, Inc. for an engineering evaluation/cost analysis (EE/CA) for mine closure alternatives (Tetra Tech 2014). In September 2013, before the EE/CA was completed, a borehole was installed that intercepts the Triumph tunnel behind the plug. The borehole was used to monitor the mine pool behind the plug and to potentially seal the plug pipeline inlet structure. Concrete was pumped into the borehole to seal the plug pipeline inlet but was not successful.

The EE/CA was completed in April 2014. Based on the recommendations in the evaluation a second borehole was drilled closer to, but still behind the plug at 1,175 feet. Concrete was pumped into the borehole to block the plug pipeline inlet but was again unsuccessful.

Following the recommended approach identified in the EECA, on August 11, 2016, a second concrete plug was completed 235 feet from the mine portal. This plug was intended to further reduce the flow of water from the mine, improve water quality, and prevent the uncontrolled release of mine water and debris from the mine. In addition to plug construction, the pipeline leading from the portal to the plug at 1,175 feet was abandoned behind the new plug location. Evaluations of the mine pool elevation data concluded the pipeline would not be required to control the elevation of the mine water behind the plug at 1,175 feet. If the pipeline ruptures in the future, abandoning the pipeline behind the plug at 235 feet would prevent an uncontrolled
release of water from the mine. Before constructing the plug at 235 feet, the pipeline was cut behind the plug location and closed with a permanent cap hot-welded to the end. As an additional measure, 50 feet of the pipeline was injected with a two-component polyurethane resin that cures to a rigid polymer.

The potential plug location was limited due to the collapse of the Triumph tunnel at 285 feet from the portal. Locating the plug closer to the mine portal was not possible because the overburden was insufficient above the plug to prevent hydraulic jacking of the overlying formation. As a result, the plug was placed in a location with less desirable ground conditions. The rock surrounding the plug at 235 feet contained a less than desirable hydraulic conductivity classification. Noticeable shear zones and carbonaceous faulting was also present in the area. These deficiencies were addressed during plug design by grouting the surrounding formation before and after plug installation.

The plug located at 235 feet from the portal is 17-feet thick and constructed of steel reinforced concrete. Approximately 175 feet of rock cover is present above the plug. The maximum plug dimension on the upstream, wet side is approximately 16 x 23 feet. The maximum dimension on the downstream, dry side is approximately 16 x 18.5 feet. The plug was constructed by pumping approximately 221 cubic yards of concrete into a steel and wood formwork. The concrete plug is anchored to the mine walls and back by 35 steel bars 1 inch in diameter grouted into the rock and protruding 1 foot into the plug. A steel reinforcing mat constructed of 1-inch diameter bars was incorporated into the plug about 1 foot from both the plug’s upstream and downstream faces. Pressure grouting was conducted 1 month after plug installation to seal the interface between the plug and mine portal walls and to eliminate seepage through fractures in the immediate vicinity of the plug.

To prevent seepage through rock surrounding the plug and provide a more stable plug and rock interface under the design hydraulic head, 16 boreholes 20 feet deep were pressure grouted along the centerline of the plug location. Four additional 6-foot boreholes were installed and pressure grouted in the mine floor half way between the plug centerline and the upstream, wet side of the plug. Pressure grouting of 14 additional boreholes ranging in depth from 8 inches to 7 feet was completed in select areas in and around the plug location to address the less than optimal ground conditions.

The plug design was based on ground conditions surrounding the plug and the structural strength required to withstand hydraulic force exerted by the impounded water. Due to poor ground conditions, the plug design is longer than necessary for structural strength purposes.

On June 12, 2018, during a scheduled O&M inspection of the Triumph Mine, a collapsed tunnel wall was observed approximately 100 feet from the plug face at 235 feet. The collapse caused an estimated 30,000 to 50,000 gallons of mine water to pool up between the collapse and the concrete plug installed 235 feet from the mine entrance. The pooled water was flowing over the top of the collapsed material. On November 5, 2018, Harrison Western Construction Corporation removed the pooled water, cleared the collapsed material from the tunnel, and rehabilitated the tunnel wall. The contractor performed additional grouting work in the formation surrounding the plug at 235 feet to further stabilize the tunnel in this location. Work was completed in December 2018 (Tetra Tech 2019a).
3 Soils OU Status of Remedial Action Implementation

The status of the soils OU remedial actions at the Triumph Mine Tailings Piles Site is provided in the sections below.

3.1 Residential Soils

All soils-related remedy work at the site was completed in December 1999. The residential soils remedial action can be certified complete when all owners of property with contaminants remaining have entered into an EC with DEQ and IDL. In the interim IDL is finalizing a revised O&M plan that includes inspection of the applicable properties. DEQ provided comments to IDL on a draft revised O&M plan, and property inspections were initiated on May 31, 2018. Ongoing work to finalize the O&M plan will continue.

3.2 House Dust

House dust was addressed through source control and capping of contaminated soils and tailings. All soils-related remedy work at the site was completed in December 1999. Follow-up monitoring to demonstrate house dust levels are within acceptable limits is ongoing.

3.3 Community Protection Measures

All soils-related remedy work at the site was completed in December 1999, and the CPM was developed in conjunction with this work. Since 1999, the CPM has guided property owners in properly managing the contaminated soils remaining on their property on a voluntary basis. The first EC requiring compliance with all CPM terms and conditions was recorded with Blaine County in 2010. Since then, three property owners have entered into and recorded ECs for a total of eight properties. Covenants are still needed for six to eight additional parcels. In the interim, to ensure contamination is properly managed, a revised O&M plan that includes inspecting the applicable properties is under development. Implementing the CPM program long term will require the following:

- Oversight to guide future development and new barrier creation.
- Guidance, education, and oversight of activities with the potential to impact the barriers installed as part of the cleanup.
- Review, storage, and retrieval of CPM compliance documentation as this information is submitted to and requested from DEQ.
- Maintenance of a contaminated soils disposal area.

Additional CPM was implemented in 2018 as part of the settlement with the Idaho Conservation League to address concerns about the potential existence of contaminants at the site. To address areas of seepage around the LTP, IDL installed signs warning residents and visitors of the potential for contact with contaminants. To address concerns about possible access to the surge pond, DEQ installed no trespassing signs around the pond’s perimeter. The signs are in addition to a 6-foot high fence with three strands of barbed wire that was installed when the pond was constructed in 1999.
3.4 Tailings Piles

All soils-related remedy work at the site was completed in December 1999. Ongoing operations maintenance and monitoring will be necessary over the long term.

3.5 Process Areas

All soils-related remedy work at the site was completed in December 1999. Ongoing operations maintenance and monitoring will be necessary over the long term.

3.6 Waste Rock Pile

All soils-related remedy work at the site was completed in December 1999. Ongoing operations maintenance and monitoring will be necessary over the long term.

3.7 Wetlands

All soils-related remedy work at the site was completed in December 1999. Ongoing operations maintenance and monitoring will be necessary over the long term.

3.8 Triumph Tunnel Drainage Ditch

All soils-related remedy work at the site was completed in December 1999. Ongoing operations maintenance and monitoring will be necessary over the long term.

3.9 Ground Water

All soils-related remedy work at the site was completed in December 1999. A restrictive covenant on wells drilled for domestic water purposes was recorded with the county in 2008 for the IDL property immediately west of the LTP. Ongoing operations maintenance and monitoring will be necessary over the long term. Additional restrictive covenants may be necessary based on the ground water monitoring results. If manganese levels do not reach the remediation goal following remedy implementation, DEQ will determine the appropriate next steps to protect human health and the environment. Controlling sources as required by the selected remedy is consistent with appropriate next steps.

4 Mine Water OU Status of Remedial Action Implementation

The mine water OU remedial actions at the Triumph Mine Tailings Piles Site are ongoing. Consistent with the remedial actions selected in the ROD, phase one of the remedy was implemented. Two mine plugs were installed, and monitoring was implemented to determine if discharge would occur at other locations or if impacts to community drinking water wells would result from plugging. Only a single seep has appeared in North Star Gulch, and no impacts to the community water wells were measured since plug installation. Monitoring the mine pool
Additional evaluations are needed to identify and select an approach to complete tunnel closure. Tunnel closure is consistent with and a continuation of the mine plug remedy selected in the ROD. The ground water seep will also be evaluated to determine if significant contamination is present. Consistent with the ROD, contamination related to the seep will be addressed through collection, treatment, excavation, or other appropriate measures to address the contamination caused by the discharge.

The mine water remedy selected in the ROD included a treatment component to comply with the applicable water quality standards. Additional tunnel closure actions must be evaluated and implemented and potential water quality changes evaluated to determine if a treatment component will be necessary. Treatment may be required before completing the cleanup actions selected in the ROD based on the discharge limits included in the pending National Pollutant Discharge Elimination System permit. As part of the settlement agreement with the Idaho Conservation League for discharging pollutants without a permit, DEQ and IDL submitted an application to the EPA for a National Pollutant Discharge Elimination System permit on September 24, 2019, for discharge of the mining-impacted waters. The discharge permit application is being processed at this time.

5 Operation and Maintenance

The status of O&M in the soils OU and mine water OU is included in sections 5.1 and 5.2.

5.1 Soils OU Operations and Maintenance

The O&M plan was implemented after completing remedial actions in the soils OU in 1999 (MFG 2000b). After the ASARCO bankruptcy, the O&M plan, including water quality monitoring for the soils portion of the remedy, has been implemented by the IDL. The O&M plan for the soils OU includes inspection and monitoring of the following areas:

- Tailings piles
- Waste rock piles
- Process areas
- Residential areas
- Roads and road shoulders
- Permanent pond discharge system
- Ground water monitoring

Several changes occurred at the site since the initial remedial action was completed in 1999. IDL began performing updates to the O&M plan during 2018. The modifications to the O&M plan include the following:

- Monitoring well locations were modified based on landowner permission for access.
- The approach to residential property inspections was added to ensure CPM is implemented on properties with contamination remaining.
DEQ O&M obligations related to the mine water OU were separated from IDL O&M activities related to the soils OU.

The wells supplying the Triumph PWS will no longer be sampled as part of the Triumph Tailings Piles Site O&M requirements. In 2015, the community well system was enrolled in Idaho’s Drinking Water Program administered by DEQ. The official water system is listed at the Drinking Water Supply Watch website (http://dww.deq.idaho.gov/IDPDWW/) as The Woodenhills Water Works, Water System No. ID5070093. DEQ's Drinking Water Program protects public health by ensuring drinking water from PWS in Idaho is safe. DEQ is authorized to administer Idaho's Drinking Water Program through the federal Safe Drinking Water Act and the “Idaho Rules for Public Drinking Water Systems” (IDAPA 58.01.08). PWSs are required by the federal Safe Drinking Water Act to monitor their water for certain regulated contaminants and to report the monitoring results to the states. Standards on what contaminants must be monitored for and how often monitoring must take place are set by EPA. Monitoring of certain unregulated contaminants is required as well. As this system is currently monitored as a PWS and has filed the required reporting since February 2015, it is unnecessary to sample the wells as part of the Triumph Mine O&M plan.

5.2 Mine Water Operation and Maintenance

Following completion of remedial actions in the mine water OU in 2003, the O&M plan was implemented (MFG 2003b). After the ASARCO bankruptcy, the operation, maintenance, and monitoring plan for the mine water OU has been implemented by the DEQ. The O&M plan for the mine water OU includes inspection and monitoring of the following areas:

- Mine plug
- Mine pool
- Portal discharge system
- Surge pond
- Surge pond discharge system
- Access roads and gates
- Seep/discharge survey
- Ground water monitoring

Several changes have occurred at the site since the initial remedial action was completed in 2003. The plug system O&M plan needs to be updated to incorporate these changes once complete. The anticipated updates, while largely administrative, reflect the current conditions at the site. The procedures and processes in the existing O&M plans (MFG 2000b; MFG 2003b) needed for the performance of the plug system O&M remain applicable. The necessary modifications to the O&M plan include the following:

- Update DEQ O&M obligations related to the mine water OU to reflect the separation from IDL O&M activities related to the soils OU.
- Remove details related to inspection of the adit pipeline, which was abandoned behind the plug installed at 235 feet.
- Remove details related to monitoring the wells supplying the Triumph PWS. These wells will no longer be sampled as part of the Triumph Mine Tailings Piles Site O&M.
requirements. DEQ's Drinking Water Program protects public health by ensuring
drinking water from PWSs in Idaho are safe.

- Update text to reflect ground water, surface water and mine pool elevation monitoring
  included in the current DEQ Quality Assurance Project Plan for the Triumph Mine Adit
  Water Control Monitoring Project (DEQ 2018a).

- Update text to incorporate O&M requirements necessary for operating the infrastructure
  associated with discharge of mine water to the environment and associated National
  Pollutant Discharge Elimination System permit.

- Update text to reflect the development of the Triumph Mine Emergency Response Plan
  (DEQ 2017). A draft emergency response plan was developed and will be implemented
  in the event of an emergency, but additional coordination with applicable stakeholders is
  necessary. The hazard evaluations and risk analyses completed previously suggest, based
  on the current engineered plugging system installed in the mine tunnel, an uncontrolled
  release from the mine is a low probability (Rahe 2011; DEQ 2017). The installation of
  the second engineered mine plug at 235 feet and the abandonment of the adit pipeline in
  2016 were measures implemented to mitigate the greatest potential risks. Existing
  response procedures and infrastructure are in place in the unlikely event of an
  uncontrolled release from the mine. Work to finalize the emergency response plan will be
  ongoing.

6 Progress since the Last Review

The protectiveness determinations, protectiveness statements, status of the issues, and
recommendations are included in the 2014 FYR (DEQ 2014). Table 3 provides the
protectiveness determinations and statements for the 2014 FYR. The status of issues and
recommendations are discussed in the following sections.

<table>
<thead>
<tr>
<th>Operable Unit</th>
<th>2014 Protectiveness Determination</th>
<th>2014 Protectiveness Statement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Soils OU</td>
<td>Protective</td>
<td>The remedy at the Soils OU is expected to be protective of human health and the environment upon completion of all remedial actions, and in the interim, exposure pathways that could result in unacceptable risks are being controlled.</td>
</tr>
<tr>
<td>Mine water OU</td>
<td>Protective</td>
<td>The remedy at the mine water OU is expected to be protective of human health and the environment upon completion of all remedial actions, and in the interim, exposure pathways that could result in unacceptable risks are being controlled.</td>
</tr>
<tr>
<td>Site wide</td>
<td>Protective</td>
<td>The remedy at the soils and mine water OUs are expected to be protective of human health and the environment upon completion of all remedial actions, and in the interim, exposure pathways that could result in unacceptable risks are being controlled.</td>
</tr>
</tbody>
</table>
6.1 Soils OU Certification of Completion

The 2014 FYR identified three pending issues related to certifying the completion of the remedy in the soils OU.

The first issue is the ad-hoc basis that DEQ and IDL use to establish ECs with property owners to meet the CPM objectives. The residential soils remedy cannot be certified complete because all applicable property owners have not entered into an EC.

As a short-term solution, DEQ requested IDL to include an inspection of the applicable properties as part of their site O&M responsibility. Property inspections were initiated on May 31, 2018. Monitoring of applicable properties by IDL will be necessary until the applicable property owners enter into an EC to ensure the CPM is implemented. Once all applicable properties have entered into an EC, the residential soils remedy can be certified as complete.

The second issue with the completion certification in the soils OU is insufficient house dust data were available to assess the continued success of the soil remedy. No recent house dust data were available for review during the 2014 review. To address this issue, house dust samples were collected in May 2014 and October 2018 for a total of 9 samples. Participation in house dust sampling is voluntary, and it will remain difficult to increase the sample size without willing residents. The results of house dust sampling are discussed in section 8.1.3. House dust samples will be requested from residents periodically for ongoing evaluations of remedy effectiveness. This work will be included as part of the ongoing O&M at the site.

The third issue hindering the completion certification in the soils OU was a concern about high flow events on the East Fork Wood River and spring runoff from the foothills that resulted in water on the LTP. This concern is addressed under the 1999 consent order between DEQ and IDL that ensures long-term monitoring and maintenance activities are conducted in the soils OU (IDHW 1999). Updates to the O&M plan also address this concern.

6.2 Ground Water

The 2014 FYR identified the absence of ground water monitoring wells and the short period of record for ground water west of the LTP as an issue. Monitoring wells were installed in the wetlands immediately west of the LTP in 1995 and 1997. These wells were sampled through September 2008 and then abandoned due to a loss of permission to access the private property the wells were located on. Continued monitoring is required to evaluate the effectiveness of the mine water and soils remedial actions at reducing metal concentrations in ground water. The 2014 review recommended installing new monitoring wells and evaluating domestic wells west (downstream) of the Triumph Mine to ensure the water quality remains acceptable for drinking water purposes.

Several steps were taken to address the ground water issues identified in the 2014 FYR. First, an IDL contractor performed a water quality trend analysis on the available ground water data (Golder 2014b). The analysis concluded the historical ground water dataset was not considered adequate to provide accurate quantitative statistical analysis using standard methods due to a lack of data points and inconsistent monitoring frequency.
In 2014 and 2018, IDL collected ground water samples from privately owned domestic wells located west of the site, resulting in four ground water samples collected from three different domestic wells. IDL sampled the domestic wells located nearest the site. These wells provide valuable information about the acceptability of using ground water for drinking water purposes in proximity to the site.

As a courtesy, DEQ also sampled two domestic wells at the request of the owners. One well was located approximately 5 miles west and downstream of the site, and the second well was located upstream of the site. The proximity of the domestic wells sampled by DEQ limits the value of the results for assessing the effectiveness of the cleanup.

In 2014, DEQ installed two ground water monitoring wells (MW-2S and MW-3D) (section 8.2.2, Figure 11) downstream from the Triumph tunnel plug, waste rock pile, and surge pond to assess the result of the mine plugging work on ground water quality.

In 2018, IDL installed two monitoring wells (MW-20 and MW-21) (section 8.1.5, Figure 5) west of the LTP but east of the domestic wells located nearest the site. The goal for the new wells is to provide long-term ground water quality monitoring to aid in determining the effectiveness of the remedial actions taken at the site and ensure the water is acceptable for drinking water purposes.

The results of ground water monitoring are discussed in sections 8.1.5 and 8.2.4.

6.3 Lower Tailings Pond

The 2014 FYR recommended addressing areas of failed vegetation on the LTP. In October and November of 2014, IDL contractors performed cover repair on the LTP to repair the failed vegetation (Golder 2015a).

6.4 House Dust

The 2014 FYR recommended additional sampling of house dust to confirm the soil caps are protecting against metal transport into homes. Four house dust samples were collected in May 2014, and an additional five samples were collected in October 2018. The results of house dust sampling are discussed in section 8.1.3.

6.5 Community Protection Measures

The 2014 FYR recommended IDL and DEQ work with property owners to obtain the necessary ECs recorded with Blaine County. In May 2014 and October 2017, DEQ sent letters to Triumph residents who had not entered into an EC with DEQ. The letter explained the purpose of the document and requested them to sign an EC. Limited success was achieved with only one additional property owner entering into an EC. Efforts to execute ECs with the remaining property owners will be ongoing.

Because of the lack of response to DEQ’s request for property owners to enter into an EC, DEQ requested IDL include an inspection of the applicable properties as part of their site O&M responsibility. Property inspections were initiated on May 31, 2018. To fully implement the
inspection and documentation procedures, IDL is currently revising the O&M plan for the soils OU.

6.6 Mine Water

Issues were identified during the 2014 FYR related to conditions within the Triumph tunnel. An increase in mine water discharge suggested additional steps were needed to reduce flow. A collapse located 285 feet into the tunnel also needed to be addressed. The collapse created a barrier to water discharging freely from the tunnel and could allow water to pool up behind it. If water pools and the barrier failed, a surge of mine water and debris could flow from the tunnel. The pipeline leading from the plug at 1,175 feet was also identified as a risk that needed addressed. If the pipeline is damaged, it could cause a release of mine water difficult to control. The pipeline was a contingency outlined in the ROD if it was necessary to manage the mine pool elevation or treat the mine water. Based on improved water quality and equilibrium of the mine pool, it was determined the pipeline would not be needed. The 2014 FYR concluded the pipeline must be abandoned.

The second concrete plug installed 235 feet into the tunnel during 2016 addressed the issues with the plug installed at 1,175 feet. Before installation of the second plug, the pipeline leading to the plug at 1,175 feet was abandoned and permanently capped at a location behind the plug at 235 feet. With the second plug installed, an uncontrolled release from the pipeline was mitigated. Installation of the second plug also prevents a discharge of mine water pooled behind any collapsed material located between the plug at 1,175 feet and the plug at 235 feet. A monitoring well was installed behind the plug at 1,175 feet to allow continued monitoring of the mine pool elevation.

7 Five-Year Review Process

DEQ conducted this 2019 FYR and completed the report according to EPA’s comprehensive FYR guidance (EPA 2001) and site-specific conditions at the Triumph Mine Tailings Piles Site. This 2019 FYR was conducted using data from the site monitoring program. A request for public input on the review topics was sent to stakeholders on February 12, 2019. Although not required under EPA’s FYR guidance, a public comment period was held in October and November 2019. Public comments received will be considered during future actions and reviews. The FYR results and report will be available on DEQ’s website at www.deq.idaho.gov/.

8 Data Review

This section provides a review of the data collected to assess the effectiveness of remedial actions taken at the Triumph Mine Tailings Piles Site.

8.1 Soils OU Data Review

Monitoring in the soils OU during the FYR period combined physical sample collection and visual inspection associated with regular O&M activities. Visual inspections performed as part of
regular O&M are sufficient to evaluate the protectiveness of some portions of the remedy. For example, visual inspection of clean soils caps and remediated residential yards is sufficient to determine if the protective barrier was compromised. Further sampling in these areas will not provide additional information in most cases. When deficiencies are identified during regular O&M inspections, corrective actions are taken to address the problems. Section 2.5 discusses corrective actions taken to address deficiencies identified in the O&M inspections conducted during the FYR.

Monitoring to assess the effectiveness of remedial actions in the soils OU includes the following:

- Visual inspections performed as part of regular O&M
- Periodic collection of yard soil samples from residential properties
- House dust sample collection
- Permanent pond water quality monitoring
- Ground water sampling

The monitoring results are discussed in the following sections.

### 8.1.1 Operations and Maintenance Inspections

Regular soils OU O&M inspections were completed in May 2014, November 2014, May 2015, October 2017, and May 2018 (Golder 2014a; Golder 2015b; Golder 2015c; IDL 2017; IDL 2018). No significant issues impacting the protectiveness of the remedy were noted during the regular inspections.

### 8.1.2 Yard Soils

During the review period, soil sampling was performed on two residential properties where recent construction had occurred (Golder 2015b, c). At least one sample was collected for every 500 square feet of area disturbed during the construction. At each sample location, soil was collected from discrete depth intervals that included 0.0–1.0 inch, 1.0–6.0 inches, 6.0–12.0 inches, and 12.0–18.0 inches. For each property, analysis for lead and arsenic was performed on a composite sample of each depth interval.

Results from all depth intervals on both properties were below the Triumph Mine soil action level of 300 mg/kg arsenic. Results for all depth intervals from 0.0 to 12.0 inches on both properties were below EPA’s lead screening level of 400 mg/kg.

### 8.1.3 House Dust

During the review period, four dust samples were collected in May 2014 and an additional five samples were collected in October 2018 from homes within the Triumph community (Golder 2014a; IDL 2019a). Seven homes were tested with two homes tested in both 2014 and 2018. Samples of house dust are obtained by collecting a sample directly from the vacuum canister or vacuum bag provided by the residents on a voluntary basis. Samples were analyzed for lead and arsenic.

Results were compared to the Triumph Mine soil action level of 300 mg/kg arsenic and EPA’s lead screening level of 400 mg/kg. The maximum arsenic concentration was 197 mg/kg.
measured in one house dust sample collected in 2014. Results for all remaining arsenic samples were less than 100 mg/kg. The maximum lead concentration was 332 mg/kg, which is below EPA’s lead screening level of 400 mg/kg.

8.1.4 Permanent Pond Water

The permanent pond located in the northwest corner of the LTP (Figure 2) is sampled regularly for arsenic, manganese, zinc, cadmium, and lead. Arsenic and manganese concentrations are of the greatest interest because these metals are detected regularly and concentrations regularly exceed water quality standards. While other constituents may be detected or exceed water quality standards periodically, it is not necessary to fully quantify these constituent concentrations because any future actions taken to address manganese and arsenic will also address other constituents detected periodically.

Historical manganese and arsenic concentrations measured in the permanent pond are shown in Figure 3 and Figure 4 (MFG 2001; Golder Associates 2015c; Tetra Tech 2010; DEQ 2018b). During the FYR period, the permanent pond was sampled six times. Results are consistent with previous sampling. Arsenic concentrations exceeded the AWQC of 0.01 mg/L in all samples (Figure 3). Arsenic exceeded the ground water quality standard of 0.05 mg/L in three out of six samples. Manganese concentrations exceeded the risk-based ground water remediation goal of 0.84 mg/L once during the review period (Figure 4). No AWQC has been established for manganese so results are compared to ground water-based standards and cleanup goals.

Figure 3. Triumph Mine Tailings Piles Site arsenic concentrations measured in permanent pond samples.
The soils OU monitoring wells are shown in Figure 5. Private domestic well locations are not shown to protect the identity of the owners. Soils OU ground water samples were collected from three site monitoring wells, three private domestic wells, and two PWS wells during the FYR period. Site monitoring wells, MW-5A, MW-20, and MW-21, are completed in the valley fill coarse-grained sediments and are located down valley and hydraulically downgradient from the LTP. MW-5A was constructed in September 1995, to a depth of 5-feet below ground surface (bgs) with a 1-foot long well screen. Four water quality samples were collected from MW-5A between 1995 and 1996 (Kennedy Jenks Consultants 1997). No additional samples were collected from this well until the October 2018 and January 2019 sampling events (IDL 2019a). MW-20 and MW-21 were constructed in October 2018 to depths of 30-feet bgs, with 20-foot long well screens located at the bottom of the boreholes. Both wells were sampled in October 2018 and January 2019 (IDL 2019a). The Triumph community has two PWS wells—GW-1 and GW-3 (Woodenhills Water Works, ID5070093). GW-1 is located on the east side of the Triumph community and was constructed in 1978 to a completion depth of 48-feet (bgs) with perforations between 30 and 45 feet bgs (Golder 2014b). GW-3, located in the central part of the community, closest to the area impacted by mining. Well GW-3 was constructed in 1972 to a depth of 56 feet bgs with perforations between 40 and 53 feet bgs.

Depths to water in the site’s monitoring wells ranged from 3.6 to 6.8 feet bgs. Insufficient data exist to estimate ground water flow directions for the recent monitoring events. Previous monitoring results indicate the ground water flow direction in the upper alluvial sand and gravel aquifer at the site is to the southwest, parallel to the longitudinal axis of the East Fork Wood River Valley.
Figure 5. Triumph Mine Tailings Piles Site soils OU ground water monitoring map.
Between 1995 and 1997, arsenic concentrations at MW-5A only exceeded the federal drinking water standard during the initial sampling event. No additional metals concentrations exceeded federal drinking water standards at this location before cleanup. During October 2018, laboratory analyses of MW-5A ground water samples resulted in total antimony, arsenic, iron, and lead, concentrations exceeding Idaho’s ground water quality standard and the federal drinking water standards. The total manganese concentrations from MW-5A exceeded the Triumph Mine risk-based remediation goal of 0.84 mg/L. Dissolved metals concentrations during the October sample event were all below the federal drinking water standards and the Triumph Mine risk-based remediation goal (Table 4). Based on current data, there is the potential for the extended periods of disuse and subsequent sediment buildup causing exceedances of water quality standards in MW-5A. The January 2019 samples from MW-5A resulted in total and dissolved metals concentrations at or below Idaho’s ground water quality standards, the federal drinking water standard, and the Triumph Mine risk-based remediation goal.

Laboratory analyses of MW-20 ground water samples collected during the October 2018 and January 2019 events resulted in one exceedance of both the secondary ground water quality standards and the secondary federal drinking water standard of 0.3 mg/L for total iron. Dissolved iron concentrations were below the secondary federal drinking water standards and are significantly lower than the total concentrations during the October sample event (Table 4). The potential for the recent drilling-related impacts causing exceedances cannot be ruled out.

Laboratory analyses of MW-21 ground water samples resulted in exceedance of the secondary ground water quality standards and the secondary federal drinking water standards of 0.3 mg/L for iron and 0.05 mg/L for manganese during the October and January events. Manganese concentrations during both events were just below the Triumph Mine risk-based remediation goal of 0.84 mg/L. The enforceable secondary ground water quality standards are based on aesthetic qualities and not on protecting human health. The secondary federal drinking water standards are non-mandatory water quality standards established as guidelines to assist PWSs in managing their drinking water for aesthetic considerations. The secondary federal drinking water standards are not enforceable but exceeding these levels may cause the water to appear cloudy or colored, or to taste or smell bad.

Ground water samples were collected from three private wells located hydraulically downgradient of the site in May 2014 and January 2019 (Golder 2014a; IDL 2019a). Wells GW-210 and GW-214 are located down valley of the site and south of the East Fork Wood River. Well GW-213 is located down valley of the site and north of the East Fork Wood River. The well construction of GW-210 is unknown. Two wells completed in the vicinity of this address have varying completions; one is screened in the valley fill sediments and the other in the underlying bedrock (IDWR 2019). Well GW-213 is reportedly completed 50 to 60 feet bgs (Golder 2014a). GW-214 is screened in the bedrock underlying the valley fill sediments and is screened from 150 to 189 feet bgs (IDWR 2019). Results of the private well sampling are shown in Table 5. Results of the May 2014 sampling showed COC concentrations in GW-213 and GW-214 met all drinking water standards except for total lead in GW-213 (0.0876 mg/L). The dissolved lead fraction of 0.00262 mg/L was below the drinking water standard of 0.015 mg/L for lead. The owner indicated the well had not been used for several months (Golder 2014a). Based on the current dataset, the potential for exceedances in GW-213 caused by a buildup of sediments from well disuse or from a natural occurrence cannot be ruled out.
Results of the January 2019 sample from GW-214 showed concentrations of total iron (4.32 mg/L) and manganese (0.07 mg/L) above the federal secondary drinking water standards of 0.3 mg/L and 0.05 mg/L, respectively. Total manganese was below the site’s human health risk-based criteria of 0.84 mg/L. Except for iron and manganese, all constituent concentrations in GW-214 met drinking water standards and risk-based criteria. As with the site monitoring wells, potential exceedances in GW-214 caused by a buildup of sediments from well disuse or from natural occurrence cannot be ruled out based on the current dataset. Results from GW-210 met the drinking water standards for all constituents tested.

Regular quarterly sampling of the Triumph community PWS wells GW-1 and GW-3, over the FYR period, have shown no exceedances for site-related COCs (i.e., arsenic, lead, and selenium) (DEQ 2019a).

### Table 4. Soils OU ground water quality results from site monitoring wells.

<table>
<thead>
<tr>
<th>Location ID</th>
<th>Sample Date</th>
<th>Fraction</th>
<th>Antimony (mg/L)</th>
<th>Arsenic (mg/L)</th>
<th>Cadmium (mg/L)</th>
<th>Iron (mg/L)</th>
<th>Lead (mg/L)</th>
<th>Manganese (mg/L)</th>
<th>Selenium (mg/L)</th>
<th>Zinc (mg/L)</th>
</tr>
</thead>
<tbody>
<tr>
<td>MW-4A</td>
<td>10/30/2018</td>
<td>Total</td>
<td>0.007</td>
<td>0.104</td>
<td>0.0017</td>
<td>15.8</td>
<td>0.063</td>
<td>1.92</td>
<td>&lt;0.005</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td></td>
<td>1/3/2019</td>
<td>Total</td>
<td>&lt;0.005</td>
<td>&lt;0.0025</td>
<td>&lt;0.0005</td>
<td>&lt;0.05</td>
<td>&lt;0.005</td>
<td>&lt;0.005</td>
<td>&lt;0.005</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td></td>
<td>10/30/2018</td>
<td>Dissolved</td>
<td>&lt;0.005</td>
<td>&lt;0.002</td>
<td>&lt;0.0005</td>
<td>&lt;0.05</td>
<td>&lt;0.005</td>
<td>&lt;0.005</td>
<td>&lt;0.006</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td></td>
<td>1/3/2019</td>
<td>Dissolved</td>
<td>&lt;0.005</td>
<td>&lt;0.0021</td>
<td>&lt;0.0005</td>
<td>&lt;0.05</td>
<td>&lt;0.005</td>
<td>&lt;0.005</td>
<td>&lt;0.006</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>MW-20</td>
<td>10/30/2018</td>
<td>Total</td>
<td>&lt;0.005</td>
<td>&lt;0.002</td>
<td>&lt;0.006</td>
<td>&lt;0.58</td>
<td>&lt;0.005</td>
<td>0.017</td>
<td>&lt;0.01</td>
<td>&lt;0.01</td>
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<tr>
<td></td>
<td>1/3/2019</td>
<td>Total</td>
<td>&lt;0.005</td>
<td>&lt;0.002</td>
<td>&lt;0.005</td>
<td>&lt;0.05</td>
<td>&lt;0.005</td>
<td>&lt;0.011</td>
<td>&lt;0.01</td>
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</tr>
<tr>
<td></td>
<td>10/30/2018</td>
<td>Dissolved</td>
<td>&lt;0.005</td>
<td>&lt;0.002</td>
<td>&lt;0.006</td>
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<tr>
<td></td>
<td>1/3/2019</td>
<td>Dissolved</td>
<td>&lt;0.005</td>
<td>&lt;0.002</td>
<td>&lt;0.006</td>
<td>&lt;0.05</td>
<td>&lt;0.005</td>
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<tr>
<td>MW-21</td>
<td>10/30/2018</td>
<td>Total</td>
<td>&lt;0.005</td>
<td>&lt;0.002</td>
<td>0.0014</td>
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<td>1/3/2019</td>
<td>Total</td>
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<td>&lt;0.006</td>
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<td>&lt;0.005</td>
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<td>&lt;0.01</td>
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<td>1/3/2019</td>
<td>Dissolved</td>
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<td>0.82</td>
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| Triumph Risk Based Remediation Goal for Groundwater | NA       | NA       | NA       | NA       | NA       | 0.84 | NA       | NA       |
| Primary Drinking Water Standard | 0.006 | 0.01 | 0.006 | NA       | 0.015 | NA | 0.06 | NA       |
| Secondary Drinking Water Standard | NA | NA | 0.3 | NA | 0.05 | NA | 5 |
| Idaho GWQS Primary | 0.005 | 0.05 | 0.005 | NA | 0.015 | NA | 0.06 | NA |
| Idaho GWQS Secondary | NA | NA | 0.3 | NA | 0.05 | NA | 5 |

Notes:
- GWQS - Groundwater Quality Standards
- NA - Not Applicable
- The analyte was analyzed for, but was not detected ("Non-detect") at or above the MRL/MDL.

Exceeds Standard
Table 5. Soils OU ground water quality results from private wells.

<table>
<thead>
<tr>
<th>Location ID</th>
<th>Sample Date</th>
<th>Fraction</th>
<th>Antimony (mg/L)</th>
<th>Arsenic (mg/L)</th>
<th>Cadmium (mg/L)</th>
<th>Iron (mg/L)</th>
<th>Lead (mg/L)</th>
<th>Manganese (mg/L)</th>
<th>Selenium (mg/L)</th>
<th>Zinc (mg/L)</th>
</tr>
</thead>
<tbody>
<tr>
<td>GW-213</td>
<td>5/20/2014</td>
<td>Total</td>
<td>NA</td>
<td>0.0009</td>
<td>0.0003</td>
<td>NA</td>
<td>0.087</td>
<td>0.006</td>
<td>NA</td>
<td>0.15</td>
</tr>
<tr>
<td>GW-213</td>
<td>5/20/2014</td>
<td>Dissolved</td>
<td>NA</td>
<td>0.0007</td>
<td>0.0003</td>
<td>NA</td>
<td>0.003</td>
<td>0.005</td>
<td>NA</td>
<td>0.025</td>
</tr>
<tr>
<td>GW-214</td>
<td>1/3/2019</td>
<td>Total</td>
<td>&lt;0.005</td>
<td>&lt;0.002</td>
<td>&lt;0.0005</td>
<td>4.32</td>
<td>&lt;0.005</td>
<td>0.07</td>
<td>&lt;0.005</td>
<td>0.15</td>
</tr>
<tr>
<td>GW-214</td>
<td>5/20/2014</td>
<td>Dissolved</td>
<td>NA</td>
<td>&lt;0.0005</td>
<td>&lt;0.00004</td>
<td>NA</td>
<td>0.002</td>
<td>0.02</td>
<td>NA</td>
<td>1.5</td>
</tr>
<tr>
<td>GW-210</td>
<td>1/3/2019</td>
<td>Total</td>
<td>&lt;0.005</td>
<td>&lt;0.002</td>
<td>&lt;0.0005</td>
<td>0.06</td>
<td>&lt;0.005</td>
<td>&lt;0.05</td>
<td>&lt;0.005</td>
<td>0.13</td>
</tr>
</tbody>
</table>

Triumph Risk Based Remediation Goal for Groundwater

| Primary Drinking Water Standard | NA | NA | NA | NA | 0.84 | NA | NA |
| Secondary Drinking Water Standard | NA | NA | NA | 0.05 | NA | NA |
| Idaho GWQS Primary             | 0.006 | 0.05 | 0.005 | NA | 0.015 | NA | NA |
| Idaho GWQS Secondary           | NA | NA | NA | 0.3 | NA | 0.05 | NA |

Notes:

GWQS - Groundwater Quality Standards

NA - Not Applicable

< - The analyte was analyzed for, but was not detected ("Non-detect") at or above the MRL/MDL

Exceeds Standard

8.2 Mine Water OU Data Review

Monitoring in the mine water OU during the FYR period combined physical sample collection and visual inspection associated with regular O&M activities. Corrective actions were taken when deficiencies were identified in regular O&M inspections that occurred during the FYR period (section 2.6).

Monitoring to assess the effectiveness of remedial actions in the mine water OU during the FYR period includes the following:

- Visual inspections conducted as part of regular O&M activities
- Measurement of the mine pool elevation
- Measurement of the mine water discharge
- Evaluation of mine water quality
- Ground water monitoring
- Survey for new or increased seepage of mine water
- Evaluation of seep water quality

The results of the remedial effectiveness monitoring are discussed in the following sections.

8.2.1 Mine Water

The mine water discharge is sampled regularly for arsenic, manganese, zinc, and iron. These metals are detected regularly and are useful indicators of changing water quality. Additional constituents are sampled when necessary to address specific design questions. Arsenic and manganese concentrations are of the greatest interest because cleanup goals are identified in the ROD, and concentrations regularly exceed water quality standards.

Mine water seeping past the plugs generally shows decreasing metals concentrations as water travels through the mine water management system. Figure 6 shows average total arsenic and
manganese concentrations measured between 2006 and 2018 at various locations in the water management system (Rahe 2011; DEQ 2019b; Golder 2015b; Tetra Tech 2010). Sample locations include the mine pool behind the plugs, mine portal, surge pond outlet, and discharge pipe just before discharge to the environment. During most of the year, mine water metals concentrations are diluted in the discharge pipe as mine water mixes with the permanent pond water.

Figure 6. Triumph mine water discharge average total arsenic and manganese concentrations at select locations throughout the mine water management system (2006–2018).

Figure 7 shows mine water discharge compared with manganese and arsenic concentrations at the mine portal (Kennedy Jenks Consultants 1997; MFG 2000a; CAS and Associates 2003, 2004, 2005a, 2005b; Rahe 2011; DEQ 2018b; DEQ 2019b). After the plug at 1,175 feet was installed in 2003, mine water discharge decreased dramatically. Mine water discharge increased slightly as the mine workings filled behind the plug at 1,175 feet, pressure increased, and water was forced through fractures in the geologic formation surrounding the plug. Although limited pre-plug data are available, arsenic concentrations appeared to decrease, and manganese concentrations appeared to increase after plug installation. These results are not unexpected due to the reduced conditions within the mine workings and surrounding formation. Although manganese concentrations appeared to increase, the overall discharge of manganese and arsenic from the mine each day dramatically decreased following plug installation due to the overall reduction in flow from the mine (Figure 8). The 2016 installation of the plug at 235 feet resulted in additional flow reductions and corresponding reductions in metals load. Additional monitoring is required to determine if long-term changes in metals concentrations will result from installing the second plug.

After mine water exits the Triumph tunnel, metals concentrations continue to decrease as oxidation facilitates the precipitation of metals within the surge pond. Little to no additional treatment occurs between the discharge from the surge pond and the release of the mine water to the environment.

During the FYR period, the surge pond was sampled seven times (DEQ 2018b; Golder 2015b). Results are consistent with previous sampling (CAS and Associates 2005b; Golder 2015b; Rahe 2011; Tetra Tech 2010); arsenic and manganese frequently exceeded water quality standards.
Arsenic exceeded the AWQS of 0.01 mg/L in all samples and exceeded the ground water quality standard of 0.05 mg/L in two samples (Figure 9). Manganese exceeded the secondary ground water quality standard of 0.05 mg/L in five samples and exceeded the risk-based remediation goal of 0.84 mg/L in four samples (Figure 10). Additional monitoring is required to determine if changes in surge pond metals concentrations will result from installing the second mine plug.

Figure 7. Triumph mine water discharge compared with arsenic and manganese concentrations measured at the portal.

Figure 8. Total pounds of manganese and arsenic discharged daily from the Triumph tunnel.
8.2.2 Mine Pool Elevation

The elevation of the mine pool is monitored from two locations along the length of the Triumph tunnel. Monitoring well MW-1 was installed in 2013 and is located on the ridge above the tunnel just behind the plug at 1,175 feet (Figure 11). The tunnel is located 498.5 feet below the ridge top. The well is 408 feet deep with a 40-foot screen interval in siltstone bedrock. Mine pool elevation is also monitored behind the plug at 235 feet by converting plug pressure readings to
water column height. The mine pool depth behind the plug at 1,175 feet is approximately 286 feet. The mine pool depth behind the plug at 235 feet is approximately 31 feet.

Figure 11 shows the mine water OU monitoring locations. Figure 12 shows significant features related to the rising mine pool and the changes measured in the mine pool elevation since the plug was installed at 1,175 feet (DEQ 2019b). After the plug was installed in 2003, the mine pool elevation began to rise as the mine workings behind the plug filled. After 10 years, the mine pool appeared to stop rising and potentially showed a small decrease. After the second plug was installed at 235 feet, another small increase of approximately 30 feet occurred. It is unclear if the recent increase is related to the influence of the plug installed at 235 feet on the elevation of the water table or the continued filling of the mine workings.

Currently, the approximate mine pool elevation is 6,484 feet above mean sea level. Water levels in the workings need to reach an elevation of about 6,567 feet to enter the 300-foot level of the Triumph Mine. Reaching the 300-foot level will allow water to flow into the old North Star mine workings. Water levels must reach an elevation of 6,681 feet to flow out of the Plumber tunnel of the North Star Mine. The Plummer tunnel is the lowest elevation opening with a known connection to the Triumph tunnel. Based on the historical rate of increase in the mine pool elevation, it is unlikely the mine water will discharge from the Plummer tunnel before equilibrium conditions are achieved, but a discharge from the Plummer tunnel cannot be ruled out at this time.

The Challenger tunnel located in Triumph Gulch to the west of the Triumph tunnel and the North Star Gulch prospects were locations believed to potentially generate mine water seeps after the plug at 1,175 feet was installed (MFG 1999). No notable changes in flow characteristics from the Challenger tunnel are apparent since the plug was installed at 1,175 feet. This location will continue to be monitored for changes. The seepage from the area near the North Star Gulch prospects is discussed in section 8.2.3.
Figure 11. Mine water OU monitoring locations.
8.2.3 Seep Survey and Discharge

In May 1998, before the plug was installed at 1,175 feet, a survey of seeps and springs was performed (MFG 1999). The survey covered areas potentially affected by the changing hydrologic conditions that resulted from plugging the Triumph tunnel. While several seeps were identified in Triumph Gulch to the west and Courier Gulch to the east of the Triumph tunnel, no seepage was noted in North Star Gulch directly east of the tunnel or the unnamed gulch directly west of the tunnel (Figure 11). Following plug installation, seep surveys are performed annually with the O&M activities. In 2009, one new seepage area was identified in North Star Gulch prospects (Figure 11 and Figure 12), and the area has been sampled periodically (Golder 2011; DEQ 2018b). Discharge has remained at 2 gallons per minute or less, and the water quickly infiltrates back into the ground. Results from water quality monitoring suggest the water is influenced by mining activities with sulfate concentrations more than double the bicarbonate concentrations (Table 6). Cadmium is the only constituent to exceed the primary ground water quality standard of 0.005 mg/L. Primary ground water quality standards are based on protecting human health. Iron, manganese, zinc, and sulfate all exceeded their respective secondary ground water quality standards, which are based on aesthetic qualities. When compared to mine pool water quality, lower concentrations of arsenic, iron, and manganese suggest the lack of a direct connection with the mine pool.
### Table 6. Water quality results for mine water seepage in North Star Gulch, Triumph, Idaho.

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Milligram per liter</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Antimony</td>
<td>NM</td>
<td>0.0036</td>
<td>NM</td>
<td>&lt;0.003</td>
<td>0.006</td>
</tr>
<tr>
<td>Arsenic</td>
<td>0.02</td>
<td>0.0011</td>
<td>&lt;0.025</td>
<td>&lt;0.003</td>
<td>0.05</td>
</tr>
<tr>
<td>Cadmium</td>
<td><strong>0.021</strong></td>
<td><strong>0.022</strong></td>
<td><strong>0.0128</strong></td>
<td>NM</td>
<td>0.005</td>
</tr>
<tr>
<td>Calcium</td>
<td>580</td>
<td>510</td>
<td>NM</td>
<td>570</td>
<td>NA</td>
</tr>
<tr>
<td>Chromium</td>
<td>&lt;0.025</td>
<td>&lt;0.025</td>
<td>0.0128</td>
<td>NM</td>
<td>0.1</td>
</tr>
<tr>
<td>Copper</td>
<td>0.046</td>
<td>0.043</td>
<td>&lt;0.01</td>
<td>NM</td>
<td>1.3</td>
</tr>
<tr>
<td>Hardness</td>
<td>2,000</td>
<td>1,800</td>
<td>NM</td>
<td>NM</td>
<td>NA</td>
</tr>
<tr>
<td>Iron</td>
<td><strong>0.91</strong></td>
<td>0.042</td>
<td><strong>0.346</strong></td>
<td>0.154</td>
<td>0.3^a</td>
</tr>
<tr>
<td>Lead</td>
<td>0.011</td>
<td>0.0016</td>
<td>&lt;0.0075</td>
<td>NM</td>
<td>0.015</td>
</tr>
<tr>
<td>Magnesium</td>
<td>130</td>
<td>120</td>
<td>NM</td>
<td>132</td>
<td>NA</td>
</tr>
<tr>
<td>Manganese</td>
<td>0.033</td>
<td>0.0021</td>
<td>0.022</td>
<td><strong>0.162</strong></td>
<td>0.05^a</td>
</tr>
<tr>
<td>Mercury</td>
<td>0.000058</td>
<td>0.000033</td>
<td>NM</td>
<td>NM</td>
<td>0.002</td>
</tr>
<tr>
<td>Potassium</td>
<td>11</td>
<td>9.2</td>
<td>NM</td>
<td>11.3</td>
<td>NA</td>
</tr>
<tr>
<td>Selenium</td>
<td>0.0014</td>
<td>0.0018</td>
<td>&lt;0.04</td>
<td>NM</td>
<td>0.05</td>
</tr>
<tr>
<td>Silver</td>
<td>0.00065</td>
<td>&lt;0.002</td>
<td>&lt;0.005</td>
<td>NM</td>
<td>0.1^a</td>
</tr>
<tr>
<td>Sodium</td>
<td>8.2</td>
<td>7.6</td>
<td>NM</td>
<td>7.57</td>
<td>NA</td>
</tr>
<tr>
<td>Zinc</td>
<td><strong>5.4</strong></td>
<td><strong>5.4</strong></td>
<td>1.39</td>
<td><strong>7.33</strong></td>
<td>5^a</td>
</tr>
<tr>
<td>Sulfate</td>
<td><strong>1,300</strong></td>
<td>NM</td>
<td>NM</td>
<td><strong>1,670</strong></td>
<td>250^a</td>
</tr>
<tr>
<td>Chloride</td>
<td>6.3</td>
<td>NM</td>
<td>NM</td>
<td>6.04</td>
<td>250^a</td>
</tr>
<tr>
<td>Bicarbonate</td>
<td>NM</td>
<td>NM</td>
<td>NM</td>
<td>420</td>
<td>NA</td>
</tr>
<tr>
<td>Total Alkalinity</td>
<td>NM</td>
<td>NM</td>
<td>NM</td>
<td>420</td>
<td>NA</td>
</tr>
</tbody>
</table>

a. Secondary standard based on aesthetic qualities.

Notes: NM = not measured; **Bold** = exceeds Ground Water Quality Standard; NA = not applicable (no standard)

### 8.2.4 Mine Water OU Ground Water

The mine water OU ground water monitoring locations are shown in Figure 11. In 2014, DEQ installed two ground water monitoring wells (MW-2S and MW-3D) southwest of the Triumph tunnel plugs, surge pond, and waste rock pile. MW-2S is 45 feet deep with a 20-foot screen interval in the valley fill sand and gravel sediments. MW-3D is 120 feet deep with a 40-foot screen interval located in bedrock.

The changes in mine pool elevation at MW-1 and behind the plug at 235 feet compared to water table elevations at MW-2S and MW-3D do not show close correspondence. Water table measurements taken between June 2015 and October 2018 in MW-2S and MW-3D showed 1.15 feet and 2.4 feet of elevation change, respectively (DEQ 2018b). Currently, no notable trends in water table elevation are present at these wells. During the same time period, the mine pool elevation measured at MW-1 increased approximately 30 feet (DEQ 2019b). In addition, the plug installed at 235 feet has impounded mine water in 900 feet of additional tunnel and raised the water table approximately 30 feet at the plug location. The lack of correspondence...
between the water table changes in mine pool elevation and the monitoring wells suggest the presence of separate ground water systems.

Table 7 summarizes the MW-2S and MW-3D analytical results for total metals concentrations. The strength of the connectivity between the mine pool and monitoring wells MW-2S and MW-3D is not clear, but ground water monitoring can assess the potential impacts of the mine plugging work on ground water quality at the well locations. Water quality samples were collected from these wells yearly from 2015 to 2018 (DEQ 2018b). Except for one dissolved antimony sample, COC concentrations collected from MW-2S remained below site remediation goals. Analytical results of MW-3D samples showed total antimony, iron, and lead concentrations exceeded site remediation goals. Total iron exceeded secondary ground water quality standards during all four sampling events between 2015 and 2018. While total manganese concentrations were below the site's human health risk-based remediation goal of 0.84 mg/L, it exceeded the secondary ground water standards of 0.05 mg/L during all four events. Over the current FYR period, total iron, lead, and manganese concentrations from MW-3D displayed decreasing trends. Total iron concentrations have fallen from 27.2 mg/L in 2015 to 3.5 mg/L in 2018, total lead decreased from 0.0359 mg/L to 0.0063 mg/L, and total manganese concentrations decreased from 0.748 mg/L to 0.288 mg/L over the same period. The dissolved fractions of iron and manganese show similar results.
### Table 7. Mine water OU total ground water metals concentrations.

<table>
<thead>
<tr>
<th>Analyte</th>
<th>Ground Water Remediation Goal</th>
<th>2015</th>
<th>2016</th>
<th>2017</th>
<th>2018</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Milligram per liter</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Well MW-2S</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Antimony</td>
<td>0.006</td>
<td>&lt;0.02</td>
<td>0.00126</td>
<td>&lt;0.003</td>
<td>&lt;0.002</td>
</tr>
<tr>
<td>Arsenic</td>
<td>0.01</td>
<td>&lt;0.025</td>
<td>&lt;0.004</td>
<td>&lt;0.003</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>Barium</td>
<td>2</td>
<td>0.0172</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>Cadmium</td>
<td>0.005</td>
<td>&lt;0.002</td>
<td>0.0007</td>
<td>NA</td>
<td>&lt;0.002</td>
</tr>
<tr>
<td>Chromium</td>
<td>0.1</td>
<td>&lt;0.006</td>
<td>0.0017</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>Copper</td>
<td>1.3</td>
<td>&lt;0.01</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>Iron&lt;sup&gt;a&lt;/sup&gt;</td>
<td></td>
<td>0.3</td>
<td>&lt;0.06</td>
<td>0.181</td>
<td>&lt;0.1</td>
</tr>
<tr>
<td>Lead</td>
<td>0.015</td>
<td>&lt;0.0075</td>
<td>&lt;0.0018</td>
<td>NA</td>
<td>&lt;0.005</td>
</tr>
<tr>
<td>Manganese&lt;sup&gt;b&lt;/sup&gt;</td>
<td></td>
<td>0.84</td>
<td>&lt;0.004</td>
<td>0.0024</td>
<td>&lt;0.008</td>
</tr>
<tr>
<td>Selenium</td>
<td>0.05</td>
<td>&lt;0.04</td>
<td>&lt;0.009</td>
<td>NA</td>
<td>0.0184</td>
</tr>
<tr>
<td>Silver&lt;sup&gt;a&lt;/sup&gt;</td>
<td></td>
<td>0.1</td>
<td>&lt;0.005</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>Zinc&lt;sup&gt;a&lt;/sup&gt;</td>
<td></td>
<td>5</td>
<td>0.017</td>
<td>0.026</td>
<td>0.025</td>
</tr>
<tr>
<td><strong>Well MW-3D</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Antimony</td>
<td>0.006</td>
<td>&lt;0.02</td>
<td>0.0234</td>
<td>0.00437</td>
<td>0.0181</td>
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<tr>
<td>Arsenic</td>
<td>0.01</td>
<td>&lt;0.025</td>
<td>&lt;0.004</td>
<td>&lt;0.003</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>Barium</td>
<td>2</td>
<td>0.291</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>Cadmium</td>
<td>0.005</td>
<td>0.0049</td>
<td>0.0009</td>
<td>NA</td>
<td>&lt;0.002</td>
</tr>
<tr>
<td>Chromium</td>
<td>0.1</td>
<td>0.0557</td>
<td>0.0122</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>Copper</td>
<td>1.3</td>
<td>0.0679</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>Iron&lt;sup&gt;a&lt;/sup&gt;</td>
<td></td>
<td>0.3</td>
<td>27.2</td>
<td>5.77</td>
<td>2.83</td>
</tr>
<tr>
<td>Lead</td>
<td>0.015</td>
<td>0.0359</td>
<td>0.0034</td>
<td>NA</td>
<td>0.00634</td>
</tr>
<tr>
<td>Manganese&lt;sup&gt;b&lt;/sup&gt;</td>
<td></td>
<td>0.84</td>
<td>0.748</td>
<td>0.319</td>
<td>0.28</td>
</tr>
<tr>
<td>Selenium</td>
<td>0.05</td>
<td>&lt;0.04</td>
<td>&lt;0.009</td>
<td>NA</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>Silver&lt;sup&gt;a&lt;/sup&gt;</td>
<td></td>
<td>0.1</td>
<td>&lt;0.005</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>Zinc&lt;sup&gt;a&lt;/sup&gt;</td>
<td></td>
<td>5</td>
<td>0.573</td>
<td>0.233</td>
<td>0.113</td>
</tr>
</tbody>
</table>

<sup>a</sup> Secondary Drinking Water Standard  
<sup>b</sup> Triumph risk-based remediation goal for ground water  
**Notes:** **Bold** = exceeds Water Quality Standard

### 8.3 Combined Mine Water and Permanent Pond Water Discharge

In October 2018, sampling of the combined mine water and permanent pond water discharge was required by the settlement agreement with the Idaho Conservation League for alleged violations of the CWA. Results of the additional combined sampling are consistent with the results of individual samples collected from the permanent pond and mine water as part of the ongoing cleanup. Arsenic and manganese frequently exceed water quality standards and other constituents are detected or exceed water quality standards periodically.
From October 2018 through June 10, 2019, the combined discharge pipeline was sampled 22 times for manganese and arsenic (DEQ 2019c). Arsenic exceeded the AWQC of 0.01 mg/L in all samples and exceeded the ground water quality standard of 0.05 mg/L in 17 samples (Figure 13). Manganese exceeded the risk-based remediation goal of 0.84 mg/L in eight samples (Figure 14).

From October 2018 through June 2019, the combined discharge was also sampled nine times for antimony, mercury, selenium, cadmium, copper, lead, nickel, silver, and zinc (Tetra Tech 2019b). Cadmium, copper, lead, nickel, and silver have never been detected. Zinc was detected three times and exceeded the hardness based AWQC of 0.13 mg/L two times. Antimony and mercury were each detected one time but did not exceed their respective AWQC of 0.19 mg/L and 0.000012 mg/L. Selenium was detected in all nine samples and exceeded the AWQC of 0.005 mg/L three times.

![Figure 13. Arsenic concentrations in combined mine water and permanent pond water discharge.](image1)

![Figure 14. Manganese concentrations in combined mine water and permanent pond water discharge.](image2)
8.4 **East Fork Wood River**

Sampling of the East Fork Wood River is required by the settlement agreement with the Idaho Conservation League for alleged violations of the CWA. In October 2018 and June 2019, samples were collected from a location upstream of the site and a location downstream of the site below the alleged discharge. Results are consistent with the results from 1991 through 1995 reported in the remedial investigation report (Kennedy Jenks Consultants 1997); the downstream metals concentrations are not significantly different than the upstream concentrations. The downstream sampling resulted in no exceedances of the AWQC (Tetra Tech 2019b). These results suggest the site and alleged discharge are not impacting the East Fork Wood River at the downstream sample location.

8.5 **Site Inspection**

While annual O&M inspections were performed, a site inspection assessing the protectiveness of the remedy and supporting this FYR was conducted between November 5, 2018 and December 11, 2018. The results of the inspection and corrective actions are presented below:

- Iron precipitates were observed at the ground surface in several locations: (1) in the roadside ditch between East Fork Road and the north toe of the LTP; (2) in the rock-lined basin at the outlet of spillway chute culvert at the northwest toe of the LTP; and (3) in the ditch along the western toe of the LTP. Although the arsenic concentration of the precipitates was not measured, concentrations likely exceed the 300 mg/kg remediation goal. This exceedance will be confirmed during future monitoring. The areas appear well vegetated and airborne transport by wind seems unlikely. The potential exists for human and wildlife exposure to contaminants through direct contact. A more significant concern is the potential for contaminant transport at the ground surface during storm events or spring runoff and the potential for contaminant transport through the ground water pathway. The continued appearance of seepage and precipitates around the toe of the LTP suggests recurring saturation of the tailings. During 2018, IDL installed warning signs to prevent direct human contact with the contaminated material. However, signage does not prevent wildlife contact, contaminant transport during runoff events, or downgradient dispersal of contaminants in ground water. Further evaluations to identify potential solutions to the problem will be necessary.

- The condition of the access road leading to the residential soils repository located on the LTP is poor. The access road is overgrown with vegetation, making access difficult. If the condition is not corrected, residents may not use the repository to dispose of contaminated soils. IDL is currently taking steps to correct this issue through regular O&M activities.

- A small area of burned vegetation was found near the power drop on BLM property just east of the surge pond. Charred electrical equipment was noted on one power pole. DEQ contacted Idaho Power, and they disconnected the power to this location to prevent the potential for a fire in the future.

- The East Fork Road ditch near the permanent pond was damaged during spring runoff. Water and sediment flowing in the ditch could potentially discharge into the permanent pond. Sediment entering the pond may clog the ponds outlet pipeline or the discharge basin causing the pond to overflow. DEQ met with Blaine County Road and Bridge to
discuss the issue and potential solutions. Blaine County sent a crew to correct the problem and address several other dilapidated culverts along East Fork Road.

- One resident expressed concern that beaver activity in the wetlands surrounding the site has raised ground water elevations in the area. An increase in ground water levels could influence remedy protectiveness by causing additional tailings saturation and metals leaching. To address this concern, the water level was measured in a historical ground water monitoring well located between the UTP, LTP, and East Fork Wood River. The measurement was compared with historical water levels from 1995 and 1996. The average of four historical water level measurements from 1995 and 1996 was 4 inches above the level measured during the FYR inspection. Based on these results, it appears water levels have dropped at this location, which suggests beaver activities are not raising water levels in the area surrounding the well.

- During spring runoff, water discharging from Courier Gulch caused erosion of Victor Drive and East Fork Road. Sediment eroded from Victor Drive was deposited in the ditch along East Fork Road. The runoff also damaged or clogged several driveway culverts along East Fork Road. Victor Drive is outside the jurisdiction of Blaine County, and it is presumed the stormwater management work to fix the erosion was initiated by the residents living on Victor Drive. Similar to the historical Courier Gulch drainage pathway, the reconstructed ditch routes all drainage west onto the north side of East Fork Road. Discharge travels under East Fork Road through several culverts or over the road during more significant runoff events. The Courier Gulch discharge is conveyed through the geomembrane-lined swale constructed through the center of the UTP and out into the wetland to the southwest. The Blaine County Road and Bridge crew removed the excess sediment and replaced several culverts along East Fork Road. Although the road and bridge crew was aware of the existence of the clean cap along the road shoulder, it is not clear at this time if contaminated sediments were exposed during the storm event or subsequent repairs.

9 Technical Assessment for Soils OU

Under EPA guidance there are three key questions that need to be answered in the technical assessment of the remedy. These questions are listed and answered in this section for the soils OU.

9.1 Is the Remedy Functioning as Intended by the Decision Documents?

9.1.1 Residential Soils

The remedy for residential soils is functioning as intended. Contaminated soils have been removed and disposed of on site, and barriers have been created that encapsulate contaminated material remaining at the site. These actions have broken the exposure pathway from contaminated soil to humans. Inspection found no evidence of damage to barriers in residential properties.
New home construction has occurred on one property since the last FYR. It is not known if the construction was performed according to the CPM because there was no EC in place for this property at the time. A conversation with the current property owner suggests that additional clean soil was brought in as part of the house construction. This property may be sampled in the future to determine the depth of clean soil. This property entered into an EC that was recorded with Blaine County on February 22, 2019.

Soil sampling was performed on two residential properties where recent construction had occurred. Results from all depth intervals on both properties were below the Triumph Mine soil action level for arsenic of 300 mg/kg.

The remedy for residential roads and road shoulders requires follow-up to assess continued protectiveness. Recent storm events that deposited excess sediment in the roadside ditch required removal. Although contaminated material is not believed to be exposed, testing is necessary to confirm this. Seepage along the toe of the LTP collected in the side ditch along East Fork Road and potentially recontaminated the ditch. The ditch remains well vegetated and generation of windblown dust is unlikely, but the precipitates at the surface create a potential exposure pathway. The contaminated material at the surface also creates the potential for redistribution by stormwater runoff and spring snowmelt. The extent of recontamination must be evaluated and potential solutions determined. Follow-up is required to assess the protectiveness of the road shoulders, however, limited risk is associated with this area due to infrequent public access and warning signs installed by IDL.

### 9.1.2 House Dust

The remedy for residential house dust is functioning as intended. Vacuum bag samples were collected as part of this FYR. Results for all homes tested were below the remediation goals for arsenic of 300 mg/kg, and the EPA lead screening level of 400 mg/kg.

### 9.1.3 Community Protection Measures

The CPM program implemented at the site is functioning as intended, but increased participation is necessary. The 2014 FYR recommended IDL and DEQ work with property owners to obtain ECs and record these with Blaine County. Entering into an EC is voluntary, and many residents are unwilling to enter into this agreement with the agencies. To address this problem, DEQ requested IDL include an inspection of the applicable properties as part of their site O&M responsibility. IDL initiated property inspections on May 31, 2018. Efforts to execute ECs with the remaining applicable property owners will be ongoing. Once a property is covered by an EC, the properties can be removed from IDL’s property inspection checklist.

### 9.1.4 Tailings Piles

The tailings capping remedy is functioning as intended. The O&M inspections of the UTP and LTP ensure the barrier stays in place. When problems are identified, repairs are completed to maintain the integrity of the clean soil cap. No significant deficiencies in the barriers were noted despite the extended period of permanent pond overflow during the 2017 spring snowmelt. Although water was flowing over the clean soil cap placed on the tailings pile, it did not erode into the tailing. IDL replaced the pipeline in the fall 2017 to prevent the pond from overflowing.
in the future. All closure area surfaces are stable, run-on control measures remain effective, and positive drainage to the outer perimeter of remediated areas is occurring. Vegetative cover continues to meet remediation goals.

The remedy originally selected for the permanent pond was found to be infeasible and an alternative remedy that controlled pond levels was implemented during the 1999 remedial actions. This portion of the remedy is functioning as intended. The permanent pond no longer contributes to standing water on the LTP surface, and water does not flow over the LTP. Saturation of the tailings is reduced, which prevents leaching of metals to ground water and surface water. The existence of the permanent pond in proximity to the tailings pile is problematic. Tailings saturation and seepage of pond water through the tailings pile may contribute to seepage areas noted along the toe of the tailings pile. This seepage may be contributing to recontamination of remediated areas, and additional evaluations and corrective measures are necessary.

The proximity of the permanent pond to the LTP also contributes to contaminant concentrations in pond water and associated discharge that do not meet water quality standards or the manganese remediation goal for ground water. The risk associated with the permanent pond is the human consumption pathway, and the pond is not used as a drinking water source. The pond was also not found to be a significant pathway in the baseline ecological risk assessment (Tetra Tech 1997b) for the site. Additional evaluations and measures are necessary to address the discharge of this water in accordance to the CWA.

9.1.5 Process Areas

The remedy for the process areas is functioning as intended. Contaminated soils have been removed and disposed on site, and barriers have been created that encapsulate contaminated material remaining at the site. These actions have broken the exposure pathway from contaminated soil to humans. The inspection found no evidence of damage to barriers in the process areas.

9.1.6 Waste Rock Pile

The remedy for the waste rock pile is functioning as intended. Contaminated soils have been removed and disposed on site, and barriers have been created that encapsulate contaminated material remaining at the site. These actions have broken the exposure pathway from contaminated soil to humans. The inspection found no evidence of damage to barriers on the waste rock piles.

9.1.7 Wetlands

The remedy for the wetlands is functioning as intended. Contaminated soils have been removed and disposed on site, barriers have been created in areas that pose a risk of erosion and are above the arsenic remediation goal. A restrictive covenant on wells drilled for domestic water was recorded with the county in 2008. The restrictive covenant includes minimum requirements for well depth and maximum contaminant concentrations in water used for human consumption. Since obtaining the restrictive covenant for this property, IDL acquired ownership of the
property. IDL’s ownership makes future development and domestic well installation unlikely. These actions have broken the exposure pathway from contaminated soil to humans.

9.1.8 Triumph Tunnel Drainage Ditch

Contaminated soils have been removed and disposed of on site, and barriers have been created that encapsulate contaminated material remaining at the site. These actions have broken the exposure pathway from contaminated soil to humans. During spring 2017, contaminated seepage from the permanent pond overflow has recontaminated the rock-lined basin at the outlet of the spillway chute culvert and tunnel drainage ditch. The precipitates at the surface create a potential exposure pathway. The potential for generation of windblown dust appears unlikely due to vegetation and rock riprap in the ditch and basin, but the contaminated material at the surface creates the potential for redistribution during periods of stormwater runoff and spring snowmelt. IDL installed signs to inform the public of potential contamination, which should be effective at preventing exposure. Additional signage or other institutional controls should be considered as well as addressing concerns about the redistribution of contaminants by water conveyed in the ditch.

9.1.9 Soils OU Ground Water

The ground water cleanup objective was to prevent human ingestion of ground water at levels above acceptable risk levels. The federal drinking water standards are the acceptable risk levels for contaminants found in ground water used as drinking water. Manganese is the only exception; to ensure protection of human health, a remediation goal of 0.84 mg/l was established for manganese in ground water.

The remedy called for continued monitoring of the community drinking water wells. Monitoring shows COC concentrations meet drinking water standards, and the community wells are not impacted by mine waste.

Only limited data are available to assess ground water quality downgradient of the site. While initial exceedances of drinking water standards in 2018 are noted in MW-5A, more recent results meet drinking water standards and correspond to the historical results obtained in the mid-1990s. The long period of inactivity at this monitoring location limits the value of the initial results. Significantly lower dissolved concentrations compared to total concentrations in the initial sample also raises questions about the value of the initial results. The well is located on IDL property, and human ingestion of ground water from this location does not occur. The ground water remedy is functioning as intended at this location.

Monitoring wells MW-20 and MW-21 both show exceedances of secondary ground water standards for iron and manganese, but concentrations remained below the health-based remediation goal for manganese. All remaining COC concentrations measured during the monitoring events remained below drinking water standards and most were not detected at all. Based on these limited results and the absence of human ingestion of ground water from this location, the ground water remedy is functioning as intended at this location.

During the FYR period, ground water samples were collected from three private wells located hydraulically downgradient of the site. Based on the limited results available, it is difficult to
conclude a connection exists between the results of domestic well sampling and the mining-impacted ground water. The exceedance of total lead in GW-213 is a primary concern. The absence of manganese in the GW-213 sample raises significant doubt about a potential connection with the mining impacted waters. GW-214 exceeded the secondary standards for iron and manganese but met the drinking water standards for all other constituents tested. Although in GW-214 manganese exceeded the secondary standard, the concentration remained below the Triumph Mine risk-based remediation goal. The measured metals concentrations, the well location, and the well completion raise doubts about the strength of the connection between GW-214 and the mining impacted waters.

Due to the limited ground water data available, downgradient monitoring should continue. Additional ground water monitoring and modeling being performed for discharge permitting purposes should lead to a better understanding of ground water downgradient of the site. Ongoing ground water monitoring and analysis are required to conclude the remedy is functioning as intended at domestic well locations. Additional monitoring is also required to determine if additional restrictive covenants are required.

9.2 Are the Exposure Assumptions, Toxicity Data, Cleanup Levels, and Remedial Action Objectives Used at the Time of Remedy Selection Still Valid?

Promulgated standards affecting the protectiveness of the soils OU selected remedies have changed. The federal drinking water standard for arsenic decreased from 0.05 to 0.01 mg/L. The cleanup objective for ground water prevents human ingestion of ground water at levels above acceptable risk levels. The acceptable risk levels for contaminants found in ground water are the federal drinking water standards. To meet the cleanup objective for arsenic in ground water, ground water used as drinking water must be evaluated against the revised drinking water standard. In this FYR, the results were evaluated against the revised arsenic standard.

Except for the arsenic concentrations in ground water used as drinking water, the exposure assumptions, toxicity data, cleanup levels, and cleanup objectives used at the time of remedy selection remain valid. No modifications to the cancer slope factors were found in EPA’s Integrated Risk Information System (IRIS). Although the reference dose values for arsenic have not changed, some minor changes in the reference doses for several chemicals of potential concern have been incorporated into EPA’s IRIS.

The oral reference dose for manganese in water has changed from 0.005 mg/kg-day to 0.14 mg/kg-day. The lower reference dose used during the risk assessment provides a more conservative estimate of risk and does not result in a reevaluation of the cleanup levels for protecting human health. The manganese risk-based remediation goal for ground water of 0.84 mg/L remains applicable to the site.

For risk assessment purposes, the vanadium oral reference dose was reduced from 0.007 mg/kg-day to 0.005 mg/kg-day as recommended in the US Regional Screening Levels (EPA 2019). The higher reference dose used during the risk assessment provides a less conservative estimate of risk. However, based on a relatively small reduction in the reference dose, the low risk calculated initially, cleanup of contaminated soils above the arsenic remediation goal, and lack of recent
vanadium detections in ground water and surface water, the change does not result in a reevaluation of the cleanup levels for protecting human health.

A Provisional Peer-Reviewed Toxicity Value (PPRTV) for thallium was developed (EPA 2012). The PPRTV is defined as a toxicity value derived for use in the US EPA Superfund Program when such a value is not available in EPA’s IRIS because of limitations in the database of toxicological information. Although it has its limitations, EPA Region 10 recommended use of the PPRTV reference dose of 0.00001 mg/kg-day for risk assessments. The recommended reference dose used during the human health risk assessment was 0.00008 mg/kg-day. The higher reference dose used during the risk assessment provides a less conservative estimate of risk. Based on the cleanup of contaminated soils above the arsenic remediation goal, a lack of recent thallium detections in ground water and surface water, and a high uncertainty factor required for calculation of the reference dose, the change does not result in a reevaluation of the cleanup levels for protecting human health.

DEQ will continue to evaluate the protectiveness of the remedy in future FYRs and consider any changes to toxicity values and health risk management policies.

9.3 Has Any Other Information Come to Light that could call into question the Protectiveness of the Remedy?

DEQ is not aware of any additional information suggesting the remedy for the site will not be protective once completely implemented.

9.4 Summary of Soils OU Issues, Recommendations, and Follow-Up Actions

Issues, recommendations, and follow-up actions that were identified during this 2019, or previous, Five-Year Reviews are summarized in Table 8. These recommendations are summarized here to allow DEQ to track this information.
### Table 8. Soils OU summary of issues and recommendations.

<table>
<thead>
<tr>
<th>Remedial Action Component</th>
<th>Issue</th>
<th>Action Item/Recommendation</th>
<th>Responsible Party</th>
<th>Affects Protectiveness?</th>
</tr>
</thead>
<tbody>
<tr>
<td>CPM</td>
<td>Lack of full participation by affected property owners in CPM Program.</td>
<td>Complete additional efforts to secure ECs and increase participation in CPM program. Include property inspections as part of O&amp;M activities.</td>
<td>DEQ/IDL</td>
<td>No</td>
</tr>
<tr>
<td>CPM</td>
<td>Unknown barrier installation as part of new residential construction.</td>
<td>Discuss barrier composition with homeowner and sample as necessary.</td>
<td>IDL</td>
<td>No</td>
</tr>
<tr>
<td>LTP</td>
<td>LTP seepage and recontamination of remediated areas.</td>
<td>Evaluate and implement short- and long-term corrective actions to address recontamination caused by seepage.</td>
<td>IDL</td>
<td>No</td>
</tr>
<tr>
<td>LTP</td>
<td>Permanent pond discharge does not meet water quality standards.</td>
<td>Evaluate alternatives for discharging water according to CWA.</td>
<td>IDL</td>
<td>No</td>
</tr>
<tr>
<td>Roads and road shoulders</td>
<td>Damage to road shoulders and subsequent repairs may have compromised barrier integrity.</td>
<td>Make determination of continued barrier integrity through evaluations and take corrective actions if necessary.</td>
<td>IDL</td>
<td>No</td>
</tr>
<tr>
<td>Stormwater management</td>
<td>Damage to road shoulders during storm events and routing of stormwater.</td>
<td>Work with Blaine County and residents of Victor Drive to maintain roadside barrier integrity and appropriate stormwater conveyance.</td>
<td>IDL</td>
<td>No</td>
</tr>
<tr>
<td>Ground water</td>
<td>Limited ground water data available.</td>
<td>Continue regular ground water monitoring down hydraulic gradient from the site. Develop and implement monitoring plan and evaluations that includes site monitoring wells and domestic wells. Determine if additional monitoring, evaluations, and restrictive covenants are required based on results.</td>
<td>IDL</td>
<td>No</td>
</tr>
</tbody>
</table>

### 10 Technical Assessment for Mine Water OU

Under EPA guidance there are three key questions that need to be answered in the technical assessment of the remedy. These questions are listed and answered in this section for the mine water OU.
10.1 Is the Remedy Functioning as Intended by the Decision Documents?

The remedy for the mine water discharge is functioning as intended. Ground water monitoring of the community wells does not show any impacts from the mine plug installations. The rise in mine pool elevation has slowed significantly, and it seems unlikely the mine water will discharge from the other tunnels before equilibrium conditions are achieved. Significant hillside seeps have not developed. Discharge from the Triumph tunnel has decreased from 90–190 gpm to 6–8 gpm after installing the second plug at 235 feet. The decrease in discharge volume resulted in dramatic decreases in the total pounds of all metals discharged from the mine. In addition most metals concentrations have decreased in the water that continues to seep past the plugs.

The plugs and surrounding formation are not showing signs of failure at this time. Although the 16-foot thick concrete plug located at 1,175 feet could not be inspected in 2010, the Rahe (2011) evaluation concluded “the likelihood of a catastrophic failure of the plug or surrounding rock is very low because of the high safety factors used in the design, and the good construction practices utilized during installation.” Since the Rahe (2011) evaluation was completed, a second 17-foot thick concrete plug was installed 235 feet from the tunnel entrance. The plug at 235 feet was designed for pressure in excess of the maximum potential pressure expected at the plug at 1,175 feet. Based on the second plug installation and abandonment of the pipeline behind the second plug, the probability of a catastrophic failure of the current plugging system remains low. Similarly, based on the distance of nearby faults, fault angles, the perpendicular orientation of faults to the Triumph Mine alignment, and the last fault movement occurring more than 10,000 years ago, Rahe (2011) concluded a seismic event in the area or hydraulic lubrication from the mine pool would be unlikely to influence slope stability of the surrounding hillsides.

While the results of plug installation appear favorable at this time, some issues remain. A draft emergency response plan is available in the event that a release of mine water does occur. The draft Triumph Mine Emergency Response Plan identifies hazards and potential risks associated with the Triumph mine water control program, describes the mitigation measures in place to address these risks, and describes emergency response actions in the case of an uncontrolled release of water from the mine. The scope of the plan is limited to a release from the Triumph Mine and the precautions and procedures necessary to safely respond to a release of contaminants associated with the mine. The emergency response plan is used with existing local, state, and federal emergency response plans. Although a draft emergency response plan was developed and will be implemented in the event of an emergency, ongoing collaboration and input from applicable stakeholders will be necessary before completing the final document.

Subject matter experts suggest there is a low probability of plug and hillside failure, but the long-term stability of the remaining 235 feet of tunnel is anticipated to be problematic. A tunnel failure in this area presents only a limited hazard to the overall plugging system. Due to the short section of tunnel remaining, only a small volume of water can be impounded. The existing surge pond would likely have sufficient capacity to contain any volume of water that would be impounded in the remaining section of tunnel. If a collapse were to occur in the future and impounded water breached the collapse, sediment could enter the discharge management infrastructure, including the surge pond, as the collapsed material is eroded from the tunnel. It will be costly to clean the sediment from the discharge infrastructure and potentially rehabilitate
the tunnel. Ongoing evaluations and actions may be necessary to address long-term tunnel stability. At this time, a tunnel closure evaluation is being performed. This work should continue to ensure sufficient tunnel stability in the future.

Although the total pounds of metals discharging from the Triumph tunnel have decreased dramatically, and water quality improvements are apparent, the remaining discharge does not meet applicable water quality standards at this time. Ongoing evaluations and actions will be necessary to address disposal of mine water discharge according to all applicable regulations. At this time, mine water disposal alternatives are being evaluated. This work should continue in order to discharge the mine water according to the requirements of the CWA.

10.2 Are the Exposure Assumptions, Toxicity Data, Cleanup Levels, and Remedial Action Objectives Used at the Time of Remedy Selection Still Valid?

Promulgated standards affecting the protectiveness of the soils and mine water OU selected remedies have changed. The federal drinking water standard for arsenic decreased from 0.05 mg/L to 0.01 mg/L. The cleanup objective for ground water was to prevent human ingestion of ground water at levels above acceptable risk levels. The acceptable risk levels for contaminants found in ground water are the federal drinking water standards. To meet the cleanup objective for arsenic in ground water, ground water used as drinking water must be evaluated against the revised drinking water standard.

Except for the arsenic concentrations in ground water used as drinking water, the exposure assumptions, toxicity data, cleanup levels, and cleanup objectives used at the time of remedy selection remain valid. No modifications to the cancer slope factors were found in EPA’s IRIS. Although the reference dose values for arsenic have not changed, some minor changes in the reference doses for several chemicals of potential concern have been incorporated into EPA’s IRIS.

The oral reference dose for manganese in water changed from 0.005 mg/kg-day to 0.14 mg/kg-day. The lower reference dose used during the risk assessment provides a more conservative estimate of risk and does not result in a reevaluation of the cleanup levels for protecting human health. The manganese risk-based remediation goal for ground water of 0.84 mg/L remains applicable.

For risk assessment purposes, the vanadium oral reference dose was reduced from 0.007 mg/kg-day to 0.005 mg/kg-day as recommended in the US Regional Screening Levels (EPA 2019). The higher reference dose used during the risk assessment provides a less conservative estimate of risk. However, based on relatively small reduction in the reference dose, the low risk calculated initially, cleanup of contaminated soils above the arsenic remediation goal, and lack of recent vanadium detections in ground water and surface water, the change does not result in a reevaluation of the cleanup levels for protecting human health.

A PPRTV for thallium was developed (EPA 2012). The PPRTV is defined as a toxicity value derived for use in the US EPA Superfund Program when such a value is not available in EPA’s IRIS because of limitations in the database of toxicological information. Although it has its
limitations, EPA Region 10 recommended use of the PPRTV reference dose of 0.00001 mg/kg-day for risk assessments. The recommended reference dose used during the human health risk assessment was 0.00008 mg/kg-day. The higher reference dose used during the risk assessment provides a less conservative estimate of risk. However, based on the cleanup of contaminated soils above the arsenic remediation goal, a lack of recent thallium detections in ground water and surface water, and a high uncertainty factor required for calculation of the reference dose, the change does not result in a reevaluation of the cleanup levels for protecting human health.

DEQ will continue to evaluate the protectiveness of the remedy in future FYRs, considering any changes to toxicity values and health risk management policies.

10.3 Has Any Other Information Come to Light that could call into question the Protectiveness of the Remedy?

DEQ is not aware of any additional information suggesting the remedy for the site will not be protective once completely implemented.

10.4 Summary of Mine Water OU Issues, Recommendations, and Follow-Up Actions

Issues, recommendations, and follow-up actions that were identified during this 2019, or previous, Five-Year Reviews are summarized in Table 9. These recommendations are summarized here to allow DEQ to track this information.

11 Protectiveness Statement

The remedy at the soils and mine water OUs are expected to be protective of human health and the environment upon completion of all remedial actions, and in the interim, exposure pathways that could result in unacceptable risks are being controlled.

12 Next Review

The next FYR report for the Triumph Mine Tailings Piles Site is required 5 years from the completion date of this review.
Table 9. Mine water OU summary of issues and recommendations.

<table>
<thead>
<tr>
<th>Remedial Action Component</th>
<th>Issue</th>
<th>Action Item/Recommendation</th>
<th>Responsible Party</th>
<th>Affects Protectiveness? (Yes/No)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Triumph tunnel stability</td>
<td>Poor ground conditions and decaying ground support from 100 feet inbound to plug face at 235 feet are prone to failure in the near term.</td>
<td>Perform evaluation of tunnel stabilization/closure alternatives and implement selected action in the near term.</td>
<td>DEQ</td>
<td>No</td>
</tr>
<tr>
<td>Triumph tunnel discharge</td>
<td>Discharge does not meet water quality standards. Discharge permit has not been issued.</td>
<td>Evaluate alternative discharge configurations and technologies to meet all applicable water quality regulations. Continue to diligently pursue discharge permit.</td>
<td>DEQ</td>
<td>No</td>
</tr>
<tr>
<td>Mine plugs</td>
<td>Finalize Draft Emergency Response Plan</td>
<td>Perform additional coordination with stakeholders and incorporate necessary changes into Draft Emergency Response Plan.</td>
<td>DEQ</td>
<td>No</td>
</tr>
<tr>
<td>Mine plugs</td>
<td>Update Plug System O&amp;M Plan</td>
<td>Update Plug System O&amp;M Plan to reflect recent changes at the site.</td>
<td>DEQ</td>
<td>No</td>
</tr>
</tbody>
</table>

13 References


