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EXECUTIVE SUMMARY

This Analysis of Brownfields Cleanup Alternatives (ABCA) compares different cleanup scenarios for the inactive Plymouth Mercury Mine (Plymouth Mine). It was requested by the Coordinating Committee of the Westside Subregion of the Proposition 84 Sacramento River Funding Region (Westside CC) for Integrated Regional Water Management (IRWM) planning. The Westside CC comprises four participating regional public agencies (Lake County Watershed Protection District, Napa County Flood Control and Water Conservation District, Solano County Water Agency, and Water Resources Association of Yolo County), and represents primarily the Cache Creek and Putah Creek watersheds. The Westside Brownfields Coalition Assessment Project (Project) is a special project of the Westside CC funded by a grant from the U.S. Environmental Protection Agency’s (USEPA) Brownfields Assessment Program.

Plymouth Mine consists of about 0.25-acre of disturbed land in southern Lake County along Hoffman Creek, a tributary to St. Helena Creek, which is a tributary to Putah Creek upstream from Lake Berryessa. Plymouth Mine is located to the southeast of other historical mercury mines in the area and consists of adits and shafts advanced to explore for a continuation of the ore body exploited at the other mines.

This ABCA is based on information summarized in Phase I and Phase II environmental site assessments (Burleson 2017 and 2018) and completed on behalf of the Westside CC for IRWM planning. The current landowner is financially unable to undertake potential response actions and is not associated with any of the historical mining operations at the Site.

The following environmental concerns were identified in the reports referenced above:

1. Humans and biota could be exposed to mercury through inhalation, incidental ingestion, and dermal contact at the waste rock pile adjacent to Hoffman Creek.
2. Infiltrating water could mobilize mercury from waste rock adjacent to Hoffman Creek.
3. Erosion of mercury-containing mine waste delivers mercury from the site to downstream waters via Hoffman Creek.

Three options were evaluated for the site based on effectiveness, implementability, and cost as summarized in Table ES-1:

1. No action.
2. Excavation and on-site storage in a repository.
3. Excavation and off-site disposal.

Effectiveness is compared among options as the satisfaction of cleanup goals and the protection of human and environmental health/safety. Implementability addresses the technical and administrative feasibility of the option.

If no corrective action is taken, Plymouth Mine will continue to pose a risk to human health and the environment. To minimize mobilization of mercury and protect human and ecological receptors, sequestration of mine waste in an on-site repository, or removal of mine waste for off-site disposal is required.
Table ES-1
Summary and Comparison of Cleanup Alternatives for Plymouth Mine, Lake Co.

<table>
<thead>
<tr>
<th>Alternative</th>
<th>Actions</th>
<th>Effectiveness</th>
<th>Implementability</th>
<th>Approximate Cost</th>
<th>Considerations</th>
</tr>
</thead>
<tbody>
<tr>
<td>1: No Action</td>
<td>None</td>
<td>Low</td>
<td>Easy</td>
<td>None</td>
<td>Current situation maintained.</td>
</tr>
</tbody>
</table>
| 2: On-site consolidation of mine waste | Design, operate, and close an appropriate repository to contain excavated mine waste at the site. | High          | Easy             | $704,000         | • Potential for future liability if repository cover erodes and mine waste is exposed.  
  • Ongoing LCRS maintenance and monitoring required.  
  • Land use restriction required. |
| 3: Excavation and off-site disposal of mine waste | Transport excavated mine waste to a permitted off-site disposal facility. | High          | Easy             | $450,000         | • Potential for future liability if disposal facility experiences a release.  
  • Increased carbon emissions and traffic hazard associated with transport to disposal facility in short term.  
  • Land use restriction not necessary. |
1.0 Introduction and Background

This Analysis of Brownfields Cleanup Alternatives (ABCA) compares different cleanup scenarios for the inactive Plymouth Mercury Mine (Plymouth Mine). It was requested by the Coordinating Committee of the Westside Subregion of the Proposition 84 Sacramento River Funding Region (Westside CC) for Integrated Regional Water Management (IRWM) planning. The Westside CC comprises four participating regional public agencies (Lake County Watershed Protection District, Napa County Flood Control and Water Conservation District, Solano County Water Agency, and Water Resources Association of Yolo County), and represents primarily the Cache Creek and Putah Creek watersheds. The Westside Brownfields Coalition Assessment Project (Project) is a special project of the Westside CC funded by Grant No. 99T30301 from the U.S. Environmental Protection Agency’s (US EPA) Brownfields Assessment Program.

Plymouth Mine consists of about 0.25-acre of disturbed land in southern Lake County along Hoffman Creek, a tributary to St. Helena Creek, which is a tributary to Putah Creek upstream from Lake Berryessa. The Plymouth Mine was identified as a smaller mine that was part of the Mirabel Quicksilver Company operations (C. P. Ross, USGS Bulletin 922-L 1940). The Plymouth Mine is located to the southeast of the former Mirabel Mercury Mine and consists of adits and shafts advanced to explore for a continuation of the ore body exploited at the other mine. The Plymouth Mine is located within ancestral lands of the Yocha Dehe Wintun Nation.

This ABCA is based on information summarized in Phase I and Phase II environmental site assessments (ESA) (Burleson 2017 and 2018) and completed on behalf of the Westside CC for IRWM planning. The landowner is financially unable to undertake potential response actions. The purpose of the ABCA is to evaluate possible remedial alternatives, based on site conditions and the anticipated reuse of the site. A site cleanup plan for review by the community, project partners, and the regulatory oversight agency will be prepared to describe the selected alternative.

1.1 Site Location

Plymouth Mine occupies about 0.25-acre of assessor’s parcel number (APN) 013702817 in Sections 23 and 24, Township 10 North, Range 7 West (Mount Diablo Base and Meridian). This parcel consists of about 117 acres in total, located in southern Lake County, CA, about 4 miles south of Middletown, California (Figure 1). Plymouth Mine is located on mostly undeveloped private rural land with small areas developed for residential and agricultural use.

Plymouth Mine is located within the Mayacamas Mercury District that includes more than 100 mercury mines in Lake and Napa counties. Plymouth Mine is a silica carbonate mercury deposit as described by Rytuba (1986).

The Site is located in a westward sloping valley that is drained by Hoffman Creek into Saint Helena Creek (Figure 2). The Site consists of two adits, a shaft, underground workings, surface excavations, and a small area of waste rock at the surface.

Other features of the Site include a private road that connects with California State Highway 29 about 0.5-mile west of the Site, a residential dwelling located about 0.1-mile north of the mine, and agricultural development.

1.2 Ownership and Previous Use

Ownership and previous use information was obtained as part of a literature search conducted...
during completion of the Phase I and II ESAs.

The current owner, TAZ Investment, Inc., purchased the property in 2015 and was not aware of historical mining activities.

Plymouth Mine was developed prior to 1945. According to the 1965 U.S. Bureau of Mines report, the Plymouth Mine had a small output of mercury, produced by ore processing at the nearby Mirabel Mine, from approximately 2,500 feet of shallow shafts, adits, drifts, and crosscuts which are now inaccessible. The area around Plymouth Mine was undeveloped rural land through the early 1990s. The existing residence was constructed beginning in 1993.

1.3 Previous Investigations

Previous investigations of the Plymouth Mine consist of Phase I and Phase II ESAs (Burleson 2017 and 2018) completed on behalf of the Westside CC for IRWM planning. The investigation sample results and findings were used to prepare this ABCA.

Phase I Environmental Site Assessment. The Phase I ESA comprised a literature review, regulatory database search, site visit, and interview of the current resident. The Phase I literature review identified the Site history to before 1945 as being developed as a mercury mine (US Bureau of Mines 1965). Review of historical topographic maps and aerial photographs document that the property was mostly undeveloped rural land until 1993 when the existing residence was constructed. Review of regulatory databases did not identify any records of the use, release, disposal, or treatment of hazardous substances at the property. The interview did not result in the identification of any recognized environmental conditions. Site reconnaissance identified the presence of mine waste from the Plymouth Mine adjacent to Hoffman Creek. The Phase I ESA identified mercury in waste rock at the Plymouth Mine as a recognized environmental condition.

Phase II Environmental Site Assessment. The Phase II ESA comprised mapping of mine features and mine waste, waste rock, reference soil, sediment, and surface water sampling. The Phase II ESA analytical results are summarized in Tables 1 to 6.

Mapping of the mine features and waste rock identified the extent of waste rock at three locations associated with the Plymouth Mine and located a previously unidentified shaft at the Site. No evidence for on-site processing or roasting of mercury ore to recover elemental mercury was observed at the Plymouth Mine.

Waste rock sampling and laboratory analyses identified the presence of elevated mercury (up to 1,600 milligrams per kilogram [mg/kg]) in waste rock at the adit, located adjacent to Hoffman Creek. Other metals detected in waste rock were present at concentrations similar to or below background soil concentrations and/or were detected at concentrations within screening benchmarks for human and ecological receptors. The waste rock was found to be unlikely to produce acid based on acid-generation potential results.

Creek-bed sediment samples showed a five-fold increase in total mercury from upstream (0.14 mg/kg) to downstream (0.79 mg/kg) of the adit waste rock along Hoffman Creek. Sediment samples from St. Helena Creek upstream and downstream from the confluence with Hoffman Creek showed a large increase in total mercury in the downstream sample (750 mg/kg) compared with that upstream sample (0.1 mg/kg). The Phase II ESA concluded that the adit waste rock is a source for mercury to sediment in Hoffman Creek, and suggested that additional sediment sampling is necessary to determine if mercury in St. Helena Creek is attributable to the Plymouth Mine.
Leachate formed by mixing the waste rock with deionized water in accordance with California waste extraction test protocols (DI WET) contained mercury at concentrations above the screening benchmark. Because the adit waste rock is adjacent to Hoffman Creek, the Phase II ESA concluded that adit waste rock poses a threat to surface water quality associated with leaching of mercury.

1.4 Project Goal

The adit waste rock contains total mercury at concentrations significantly above risk-based screening benchmarks, and contributes mercury to surface water and sediment in Hoffman Creek, and may contribute mercury to sediment in St. Helena Creek. The private owner desires to reduce potential human and wildlife exposure to mercury. The project goals are to reduce the threat of exposure to mercury in mine waste, and reduce off-site migration of mercury in sediment and surface water.

2.0 Applicable Regulations and Cleanup Standards

This section of the ABCA describes the agency responsible for cleanup oversight, cleanup standards, and laws and regulations applicable to the cleanup.

2.1 Cleanup Oversight Responsibility

The California State Water Resources Control Board (SWRCB) and the Department of Toxic Substances Control (DTSC) have the authority to regulate cleanup of polluted/contaminated sites in California. In order to improve the coordination between agencies on oversight of Brownfields cleanups, a Memorandum of Agreement (MOA) was signed on March 1, 2005. The MOA describes the process and considerations used to determine the appropriate lead agency for a particular Brownfields site. The SWRCB has delegated cleanup authority to the Regional Water Quality Control Boards (RWQCB). RWQCBs oversee cleanup of inactive mines under relevant provisions of the California Water Code, as implemented in Title 27 of the California Code of Regulations.

Plymouth Mine is identified in the DTSC EnviroStor database of properties with known contamination or where there may be reasons to investigate further. The EnviroStor database provides access to detailed information on hazardous waste-permitted and corrective action facilities, as well as existing site cleanup information. The Envirostor database identifies Plymouth Mine as Site Number 60002750, and DTSC as the lead agency as of November 1, 2018. Information in the Envirostor database includes the Phase I and Phase II ESA reports.

Future response activities such as any additional sampling and analysis, and cleanup activities should be conducted under a voluntary regulatory program such as California’s voluntary cleanup program (VCP). The VCP provides for oversight of voluntary cleanups by either the RWQCB or DTSC depending on the site characteristics.

2.2 Cleanup Standards

This section describes metals detected above risk-based thresholds, and identifies cleanup standards based on water quality. Risk based thresholds selected for comparison with Site data are US EPA Regional Screening Levels from the composite worker soil table (RSL), DTSC Human and Ecological Risk Office (HERO) Note 3 for protection of commercial and industrial use, and US Department of the Interior Bureau of Land Management (BLM) Risk Management
Criteria for Metals at BLM Mining Sites (BLM 2004) for wildlife and livestock. Risks are characterized in accordance with BLM (2004) suggestions as follows:

- Less than criteria: low risk
- 1-10 times the criteria: moderate risk
- 10-100 times the criteria: high risk
- >100 times the criteria: extremely high risk

2.2.1 Risk Evaluation

Waste rock and background soil total metals concentrations were compared in Table 1. This comparison determined that all metals analyzed, except for mercury in waste rock, are similar to or within background concentrations. Mercury concentrations from waste rock samples were 38 mg/kg at the shaft and 1,600 mg/kg at the adit, exceeding the 0.86 mg/kg to 1.9 mg/kg mercury concentrations from the two background soil samples and the 0.6 mg/kg USGS background concentration for Lake County soil. All other metals were detected below screening benchmark levels and were similar to background concentrations.

Mercury occurs at Plymouth Mine in the form of cinnabar (HgS) the principal ore mineral for mercury. Kim and Others (2005) found that for silica-carbonate type mercury deposits such as the Plymouth Mine, insoluble mercury sulfide minerals make up nearly 100 percent of the mercury present. Thus, mercury in waste rock at Plymouth Mine is most likely to be present as a sulfide mineral. Because no evidence for the presence of furnaces or retorts used to roast cinnabar ore and recover elemental mercury was observed at the Plymouth Mine or described in historical mining literature for the Plymouth Mine, the total mercury concentrations described herein are considered to represent the presence of mercury sulfide. Mercury sulfide in waste rock is the principle threat at Plymouth Mine.

Comparison with Risk-Based Screening Criteria. For human health, mercury in waste rock exceeds the most conservative screening criteria (4.6 mg/kg DTSC) by more than 350 times and about 9 times in Adit waste rock and Shaft waste rock respectively, indicating extremely high and moderate risk to commercial/industrial users. However, these screening values are based on the presence of elemental mercury. Screening values based on mercury chloride (190 mg/kg DTSC) are higher and the risks associated with the Adit waste rock (high) and Shaft waste rock (moderate) are less. For terrestrial wildlife, mercury exceeded the 8 mg/kg BLM screening criterion by 200 times, indicating extremely high risk.

The mercury chloride-based screening values are considered herein to better represent risks at Plymouth Mine than those based on elemental mercury. However, mercury chloride-based screening levels are also expected to significantly overestimate the risk of human and terrestrial ecological exposure at Plymouth Mine because mercury chloride compounds are much more soluble than cinnabar (mercury sulfide). Mercury in waste rock at Plymouth Mine is most likely to be present as a sulfide mineral and the risks described above are likely over-stated because they are based on more soluble mercury chloride.

Water Quality Assessment. Aluminum, iron, and nickel concentrations in DI WET extracts from waste rock exceeded water quality criteria, but were below background DI WET extract concentrations, and thus not considered a risk to water quality in Hoffman Creek. Mercury was reported at 0.0023 milligrams per liter (mg/L) and 0.0015 mg/L in DI WET extracts from waste rock samples. These concentrations exceeded background and are roughly 5,000 times the
screening criteria of 0.00005 mg/L (California Toxics Rule Freshwater Protection of Human Health). Zinc was reported at 0.89 mg/L in the Shaft waste rock extract, slightly exceeding the 0.73 mg/L background concentration, and roughly 3 times the screening criteria of 0.26 mg/L (California Toxics Rule Freshwater Protection of Aquatic Life). Mercury and zinc in waste rock at the Plymouth Mine appear to be mobile at concentrations that could degrade surface water quality.

The Shaft waste rock is located about 275 feet from Hoffman Creek and 100 feet in elevation uphill from the creek. The intervening slopes are covered in thick chaparral. This vegetated slope distance is expected to allow for sufficient attenuation to protect water quality in Hoffman Creek from degradation by any leachate migrating from the Shaft waste rock at the Plymouth Mine.

The Adit waste rock is on the bank of Hoffman Creek, exposed, and not well vegetated. The mercury and zinc from this waste rock pile likely degrade water quality in Hoffman Creek. The principle threats to water quality at Plymouth Mine are mercury in infiltrating runoff that flows to Hoffman Creek from the Adit waste rock, and erosion and transport of mercury containing particles from waste rock to sediment within Hoffman Creek.

**Risk Evaluation Summary.** Human health and terrestrial ecological receptor risks at Plymouth Mine are likely overestimated because published risk-based screening levels are based on soluble mercury chloride compounds or elemental mercury, and the mercury in Plymouth Mine waste rock is likely present as insoluble mercury sulfide. The waste rock exposure area for human or terrestrial ecological receptors is also very small (< 0.1 acre) further reducing the likelihood for significant risk.

The threat to water quality exists from leaching of mercury from Adit waste rock adjacent to Hoffman Creek. Sediment mercury concentrations show a five-fold increase in total mercury in Hoffman Creek sediment downstream from the Adit waste rock.

Human health and terrestrial ecological receptor risks are likely low to moderate because of the likely predominance of mercury sulfide in the waste rock. Water quality is threatened and appears to be degraded by the Adit waste rock based on available data.

Management of mine waste in a manner protective of water quality is expected to also minimize any potential threats to human and terrestrial ecological receptors.

### 2.2.2 Water Quality Based Clean Up Standards

As noted above, DI WET leachate analytical results identified threats to water quality, and surface water sampling confirmed a local increase in total mercury within sediment attributable to the Adit waste rock. These findings suggest that the Adit waste rock at Plymouth Mine is a source for mercury to Hoffman Creek surface water and sediment. Numerical and narrative water quality objectives for fish tissue that may be applicable to Plymouth Mine are summarized in Table 7.

Cleanup alternatives should focus on identifying those activities that, when completed in accordance with approved work plans, are expected to reduce mercury loading from the Plymouth Mine to Hoffman Creek. Implementing such activities is also expected to contribute to compliance with the objectives summarized above in Table 7.
2.3 Laws and Regulations Applicable to the Cleanup

Site cleanup and redevelopment should be conducted in compliance with laws and regulations applicable to the release of hazardous substances at abandoned mine sites.

This section summarizes potential federal and State of California requirements. Three categories of environmental requirements, chemical-, location- and action-specific, are described below including analysis of the exemption of mining wastes from regulation as a hazardous waste under Section 3001(a)(3)(A)(ii) of the Resource Conservation and Recovery Act (RCRA) (Bevill Amendment exemption) and under the California Health and Safety Code, Section 25143.1(b)(1) and (2).

2.3.1 Chemical-Specific Requirements

Chemical-specific requirements are generally health- or risk-based numerical values or methodologies applied to site-specific conditions that result in the establishment of a cleanup level. The medium to be addressed at Plymouth Mine is mine waste.

Potential State requirements for Hoffman Creek are the RWQCB Basin Plan and Resolutions 68-16 and 92-49. Identification of surface water requirements depends on the beneficial uses of the water. Surface water beneficial uses in California are identified in water quality control plans, known as Basin Plans. Basin Plans are adopted and amended by RWQCBs with input from the public, environmental review by the state, and approval by the SWRCB. Basin Plans are regulatory references for meeting the state and federal requirements for water quality control. The Basin Plan for the Central Valley RWQCB (Central Valley RWQCB 2018) does not specifically identify Hoffman Creek which is a tributary to St. Helena Creek, a tributary to Putah Creek upstream from Lake Berryessa. The Basin Plan identifies beneficial uses for Lake Berryessa and notes that beneficial uses also apply to tributaries. Surface water beneficial uses identified in the Basin Plan for Lake Berryessa include municipal, agricultural, possible power generation, contact and non-contact recreation, warm and cold-water habitat, warm water spawning, and wildlife habitat. These beneficial uses are associated with numerical limits intended to protect each beneficial use.

Potential federal surface water requirements for tributaries to Lake Berryessa are the Safe Drinking Water Act (SDWA) and the Clean Water Act (CWA) regulations.

Plymouth Mine was identified as a potential source for mercury detected above water quality numerical limits in Hoffman Creek, the most stringent numerical limits protective of the beneficial uses are summarized in Table 7.

2.3.2 Location-Specific Requirements

Location-specific requirements are restrictions on the conduct of activities solely because they are in specific locations such as floodplains, wetlands, historic places, and sensitive ecosystems or habitats. The Endangered Species Act of 1973 (ESA), the National Historic Preservation Act...
(NHPA), the Fish and Wildlife Coordination Act, the Migratory Bird Treaty Act, and various California natural resource laws are potential requirements. Each is summarized below.

**Endangered Species Act of 1973.** The Endangered Species Act, 16 United States Code (USC) Chapter 35, was enacted to protect the ecosystems upon which endangered and threatened species depend, and to conserve and recover endangered and threatened species. The ESA applies to actions taken or funded by federal agencies. Though there is no direct evidence that any threatened or endangered plant or animal species occurs along any segment of the surface water migration pathway, the area of the Site is potential (elevation) habitat for numerous special status species, including the threatened California red-legged frog (*Rana aurora draytonii*). The area also provides potential (elevation) habitat for the protected bald eagle and California spotted owl, in addition to many other resident and migratory birds. Underground mine workings that remain open may also shelter bats.

**National Historic Preservation Act.** Section 106 of the NHPA, 16 USC Section 470s, requires federal agencies to take into account the effects of their undertakings on historic properties and afford a reasonable opportunity for comment on such undertakings.

The Section 106 process seeks to accommodate historic preservation concerns with the needs of federal undertakings through consultation among the agency officials and other parties with an interest in the effects of the undertaking on historic property, establishes procedures to provide for preservation of historical and archeological data that might be destroyed through alteration of terrain as a result of a federal construction project or a federally licensed activity or program. If any action would cause irreparable loss or destruction of significant scientific, prehistoric, historical, or archeological data, it would be necessary to follow the procedures in the statute to provide for data recovery and preservation activities. Cultural resource surveys would be conducted if required to determine how to comply with the NHPA.

**Fish and Wildlife Coordination Act.** The Fish and Wildlife Coordination Act, 16 USC Section 661, was enacted to protect fish and wildlife when federal actions result in the control or structural modification of a natural stream or body of water. The statute requires federal agencies to take into consideration the effect that water-related projects would have on fish and wildlife and then act to prevent loss or damage to these resources.

**Migratory Bird Treaty Act.** The Migratory Bird Treaty Act, 16 USC Section 703, establishes federal responsibility for the protection of international migratory bird resources. It prohibits at any time, using any means or manner, the pursuit, hunting, capturing, killing or attempting to take, capture, or kill any migratory bird.

**California Wildlife Statutes.** California Fish and Game Code Section 3005 prohibits the taking of any mammal or bird with poison. California Fish and Game Code Section 5650 makes it unlawful to “deposit in, permit to pass into, or place into waters of the state … substances or materials deleterious to fish, plant life, or bird life.”

**California Lake and Streambed Alteration Program.** California Fish and Game Code Sections 1600 through 1616 prohibit alteration of streambeds or impeding natural flow in streambeds without an agreement with the California Department of Fish and Wildlife (CDFW).

### 2.3.3 Action-Specific Requirements

Action-specific requirements are technology- or activity-based requirements or limitations on actions taken with respect to hazardous substances. These requirements are triggered by the particular activities selected. This section summarizes the general action-specific requirements
for the alternatives.

**Lake County Air Pollution Control District Regulations.** Lake County Air Quality Management District (AQMD) rules and regulations include prohibitions against emissions that create a nuisance. Use of machinery to implement remediation activities at the Plymouth Mine should comply with current AQMD rules.

**Clean Water Act.** The CWA contains permit requirements for discharges to waters of the United States. For those alternatives that would involve discharge to surface water, the substantive requirements of 40 Code of Federal Regulations (CFR) Part 122 are potential requirements.

The US Army Corps of Engineers (USACE) and the US EPA regulate the discharge of dredged or fill material into waters of the United States under Section 404 of the CWA. The purpose of the CWA is to “restore and maintain the chemical, physical, and biological integrity of the nation’s waters.” Section 404 of the CWA prohibits the discharge of dredged or fill material into waters of the United States without a permit from the USACE. Pending a formal wetlands delineation, all wetlands are considered potentially jurisdictional by the USACE. In addition, Section 401 of the CWA (33 USC 1341) requires any applicant for a federal license or permit to conduct any activity that may result in a discharge of a pollutant into waters of the United States to obtain a certification that the discharge will comply with the applicable effluent limitations and water quality standards. A Water Quality Certification or waiver pursuant to Section 401 is required for Section 404 permit actions; this certification or waiver is issued by the RWQCB.

The State of California regulates any discharge of storm water runoff associated with construction. The proposed remedy must meet the substantive requirements of the General National Pollutant Discharge Elimination System Permit for Storm Water Discharges Associated with Construction Activity, Order 2009-0009-DWQ, issued by the SWRCB pursuant to its delegated authority under the CWA.

**Off-Site Disposal of Mine Waste.** Off-site disposal of mine wastes would require compliance with California and federal transportation requirements and compliance with relevant disposal criteria. In particular, RCRA land disposal restrictions require that wastes be analyzed for the potential to create leachate using the toxicity characteristics leaching procedure (TCLP) prior to off-site disposal.

**2.3.4 Mining Waste Regulations**

All of the mine wastes at Plymouth Mine are the result of mineral extraction or beneficiation at the Site.

**Resource Conservation and Recovery Act (RCRA).** Under RCRA Section 3001(a)(3)(A)(ii), 42 USC 6921(a)(3)(A) (ii) (also known as the "Bevill Amendment"), US EPA has exempted most mining wastes from regulation as hazardous waste. Exempted material includes waste generated from the extraction and beneficiation of minerals, and some mineral processing wastes (including amalgam) (see 40 CFR Section 261.4(b)(7)).

**State Exclusion of Mining Waste from Regulation as Hazardous Waste.** California’s Health and Safety Code recognizes the Bevill Amendment exclusion, so that wastes that would otherwise be regulated by the California Hazardous Waste Control Law, the California analogue to RCRA, are instead subject to the requirements of Water Code Section 13172, detailed in 27 CCR Section 22470. Under Health and Safety Code Section 25143.1(b)(1 and 2) as stated below:

“Wastes from the extraction, beneficiation, and processing of ores and minerals that are
not subject to regulation under Subchapter III (commencing with Section 6921) of Chapter 82 of Title 42 of the USC are exempt from the requirements of this chapter, except the requirements of Article 9.5 (commencing with Section 25208) and Chapter 6.8 (commencing with Section 25300). The wastes subject to this subdivision are subject to Article 9.5 (commencing with Section 25208) and Chapter 6.8 (commencing with Section 25300) if the wastes would otherwise be classified as hazardous wastes pursuant to Section 25117 and the regulations adopted pursuant to Section 25141.”

Waste rock at the Plymouth Mine is Bevill exempt and should be managed in accordance with the California Water Code. Any material subject to off-site disposal would be resampled and analyzed as part of the profiling process, and would be disposed of based on profile sample results.

**Surface Mining Control and Reclamation Act.** The Surface Mining Control and Reclamation Act (SMCRA), 30 USC Section 1201, establishes a nationwide program for the protection of human health and the environment from the adverse effects of surface coal mining operations. Although SMCRA addresses abandoned coal mines, it may be relevant and appropriate to cleanup of other types of mining sites. In its CERCLA Compliance with Other Laws Manual, US EPA explained that SMCRA may be relevant and appropriate at (1) sites with sulfide-containing geologic materials and where there is a release or threat of release of acid and at (2) sites subject to erosion and thus releases are contaminated by heavy metals. The following regulations, which provide guidelines for post-mining rehabilitation and reclamation of surface mines (Part 816) and underground mines (Part 817) may be potentially appropriate (US EPA 1988):

- 30 CFR 816.43/817.43 – standard for diversions of flow from disturbed areas
- 30 CFR 816.56/817.56 – post mining rehabilitation of sedimentation ponds, diversions, and impoundments
- 30 CFR 816.97/817.97 – protection of fish and wildlife
- 30 CFR 816.111/817.11, 816.114/817.114, and 816.116/817.116 – revegetation requirements

**California Mining Waste Regulations.** Pursuant to California Water Code Section 13172, the State of California has adopted regulations designed to address the management of mining waste. These regulations are found at 27 CCR 22470 through 22510. The regulations establish three groups of mining waste:

- Group A – mining waste that must be managed as hazardous waste provided the RWQCB finds that such mining wastes pose a significant threat to water quality.
- Group B – mining wastes that consist of or contain hazardous wastes that qualify for a variance, provided that the RWQCB finds that such mining wastes pose a low risk to water quality, or mining wastes that consist of or contain nonhazardous soluble pollutants of concentrations that exceed water quality objectives for, or could cause, degradation of waters of the state.
- Group C – wastes from which any discharge would be in compliance with the applicable water quality control plan, including water quality objectives other than turbidity.

Classification of the mining waste as hazardous under the Hazardous Waste Control Act is used to determine which group designation is appropriate. Adit waste rock at the Plymouth Mine is
most likely a Group B mining waste due to mobility of mercury under site conditions and location of the Site in a groundwater discharge area at Hoffman Creek. The regulations contain specific requirements on siting, construction, monitoring, and closure and post-closure maintenance of existing and new units. These requirements apply to alternatives that involve the creation of an on-site disposal unit or closure of existing units.

3.0 Evaluation of Brownfields Cleanup Alternatives

Each suggested action is considered with respect to Site conditions and the criteria of effectiveness, implementability, and cost, as suggested in “Guidance for Conducting Non-Time Critical Removal Actions under CERCLA” (US EPA 1993), described in the following paragraphs.

**Effectiveness Evaluation.** The ability of the cleanup project to protect human health and the environment is reviewed during an evaluation of the effectiveness of a technology (US EPA 1993). Protection is achieved by reducing the toxicity, mobility, or volume of metals in mine waste over short-term and long-term periods while complying with applicable or relevant and appropriate environmental requirements.

Effectiveness relates to the potential of a technology to achieve remediation goals, considering the chemical and physical characteristics of the source and Site conditions. Potential impacts to human health and the environment during construction and implementation phases as well as process reliability with respect to Site conditions are also considered. The evaluation considers effectiveness as low, moderate, high, or uncertain.

**Implementability Evaluation.** The technical and administrative feasibility of constructing, operating, and maintaining the technology is considered during an evaluation of the implementability of each suggested technology (US EPA 1993). Technical feasibility considers whether the technology applies to and can be properly constructed and operated at the Site. The evaluation considers long-term operation, maintenance, and monitoring of the technology as it would be implemented. Administrative feasibility considers regulatory approval and scheduling constraints, as well as the availability of disposal services, disposal locations, and the necessary construction expertise and equipment. This evaluation considers implementability as easy, moderately difficult, or difficult.

**Cost Evaluation.** The types of costs assessed include the following:

- Capital costs, including both direct and indirect costs (excluding permitting and design costs)
- Annual operation and maintenance (O&M) costs, including the monitoring cost to evaluate long-term effectiveness
- Net present worth of capital, O&M costs, and periodic costs

In accordance with US EPA guidance (US EPA 1993, 2000), these engineering costs are estimates that are expected to be within plus 50 to minus 30 percent of the actual project cost (based on 2019 dollars). Cost estimates were prepared in accordance with US EPA guidelines (US EPA 2000) using engineer’s estimates, historical costs for similar projects, and vendor quotes. Changes in the cost elements are likely to result from new information and changing economic conditions (e.g., energy costs, labor and equipment availability, new regulations).

The present worth cost of each alternative provides the basis for the cost comparison. The
present worth cost represents the amount of money that, if invested in the initial year of the action at a given interest rate, would provide the funds required to make future payments to cover all costs associated with the alternative over its planned life. The present worth analysis is compared for all alternatives using a 5 percent discount rate (the historical average) over a period of 5 years.

Estimated costs do not include costs associated with permitting, environmental evaluations to comply with the National Environmental Policy Act (NEPA), California Environmental Quality Act (CEQA), or design costs. Permitting, NEPA/CEQA evaluations and design will be undertaken as part of detailed planning after identification of the alternatives and before implementation of remediation.

3.1 Cleanup Action Objectives

The Phase I and II ESAs identified the presence of mercury in mine waste at the Plymouth Mine that is mobilized to Hoffman Creek through erosion and transport and chemical interaction with infiltrating rainfall. The objective of the cleanup at the Plymouth Mine is to reduce or prevent potential risk to human health and/or the environment from mercury in mine waste.

3.2 Remediation Technologies

This evaluation of alternatives is based on the Interstate Technology Regulatory Council (ITRC) mining waste decision tree (https://www.itrcweb.org/miningwaste-guidance/decision_tree.htm ). The ITRC decision tree was developed to provide an overview of technologies that can be used to address mining wastes, and provides a guide to identify a set of treatment technologies that can be used at a particular site such as the Plymouth Mine.

The decision tree was approached with the understanding that there is not an immediate need to act at Plymouth Mine. The decision tree includes both solid mining waste and mining-influenced water treatment technologies.

Each of the suggested actions was considered with respect to Site conditions and the criteria of effectiveness, implementability, and cost, as suggested in “Guidance for Conducting Non-Time Critical Removal Actions under CERCLA” (US EPA 1993).

3.3 Identification and Evaluation of Cleanup Alternatives

Based on the planned reuse, three options were evaluated – 1) No Action, 2) On Site consolidation of mine waste, and 3) Excavation and off-site disposal of mine waste. Evaluation criteria include effectiveness, implementability, and cost as described above. Table 8 presents costs for each alternative.

Alternative 1 – No Action

The No Action Alternative is included as a baseline for comparison to the other proposed alternatives. The No Action Alternative assumes that Site conditions will remain unchanged, and none of the proposed actions in the other alternatives would be initiated.

Effectiveness: This alternative would not reduce the actual or potential risks posed by the presence of mercury in waste rock at the Site. The current Site conditions have been documented to add mercury to Hoffman Creek. If no corrective action is taken, the Site will continue to pose a risk to human health and the environment.

Implementability: This alternative is easily implemented; however, this alternative is not likely
to be acceptable to the RWQCB or DTSC.

**Cost:** No costs would be incurred during implementation of this alternative.

**Alternative 2 – On-Site consolidation of mine waste**

On-site consolidation of mine waste would require planning, design of an on-site repository, excavation and transport of mine waste to the repository, repository closure, and site restoration. These activities require long-term maintenance and monitoring to maintain long-term effectiveness. Future Site development would be restricted through administrative controls to preserve the repository integrity.

**Effectiveness:** Contaminated media would remain at the Site, but would no longer pose a significant threat to water quality or human health and the environment. During remediation, workers could be exposed to mercury; however, required training and worker protection would minimize such exposures.

**Implementability:** This alternative is readily implemented after appropriate planning, design, and permitting are completed. Adit waste rock at the Plymouth Mine is most likely a Group B mining waste due to mobility of mercury under site conditions. The presence of residential wells at the target property indicates that the groundwater at the site is being used. Proximity of the Plymouth Mine to Hoffman Creek suggests that the Site is at a groundwater discharge location. These considerations make it likely that an on-site repository would be required to be constructed with a leachate control and removal system (LCRS), engineered cover system and a groundwater detection monitoring system.

**Cost:** Capital costs are estimated at $639,000 and the present worth costs of five years of maintenance are estimated at $65,000. The total estimated five-year present worth cost is $704,000.

**Alternative 3 – Excavation and off-site disposal of mine waste**

Excavation and off-site disposal of the mine waste would require planning, excavation, transport of mine waste to a properly permitted off-site disposal facility and site restoration. These activities would require maintenance and monitoring of disturbed areas for a limited time to maintain long-term effectiveness. No restriction on future site development would be associated with this alternative.

**Effectiveness:** Most mine waste would be removed from the Site, and would no longer pose a significant threat to water quality or human health and the environment. Residual mine waste would be covered during site restoration, and stabilized to prevent direct contact and erosion. During remediation, workers could be exposed to mercury; however, required training and worker protection would minimize such exposures. During transport of material for off-site disposal, this alternative would consume fuel, create carbon emissions, and pose increased traffic hazards associated with overland transport.

**Implementability:** This alternative is readily implemented after appropriate planning and permitting are completed.

**Cost:** Capital costs are estimated at $440,000 and the five years of maintenance are estimated at $9,000. The total estimated five-year present worth cost is $449,000.
Table 8. Estimated Costs for Alternatives, Plymouth Mine, Lake County

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<thead>
<tr>
<th>Alternative</th>
<th>Plan and Permit</th>
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**Note:** Costs are estimated based on present worth for 5 years at a 5% discount rate.

3.4 Comparison of Alternatives

Alternative 1: *No Action* would not prevent continued water quality impacts and is dismissed with no further evaluation.

Alternative 2: *On-site consolidation of mine waste* is expected to reduce risks and improve water quality, and is therefore considered preferable to Alternative 1. This alternative does not entail increased traffic hazards to the degree Alternative 3 does, and would not increase carbon emissions due to off-site transport. This alternative would require land use restrictions; however, such restrictions are not inconsistent with potential future use of the property for ongoing residential and agricultural uses and/or recreation. The cost and complexity of building and maintaining a repository with LCRS and an engineered cover system is very high with respect to the volume of Adit waste rock to be isolated. Even if a suitably designed repository could be constructed at the property, long-term maintenance requirements would likely prove very difficult for the landowner to sustain. Alternative 3 may be preferable to Alternative 2.

Alternative 3: *Excavation and off-site disposal of mine waste* is expected to reduce risks and improve water quality, and is therefore considered preferable to Alternative 1. This alternative entails increased traffic hazards and results in increased carbon emissions, compared with Alternative 2, due to off-site transport. This alternative is at least as protective of human health and the environment than Alternative 2 and costs less. In addition, a land use restriction and long-term active maintenance and monitoring would not be necessary as part of this alternative. Therefore Alternative 3 is preferred over Alternative 2.

3.5 Consideration of Climate Change Impacts

Scientific evidence demonstrates that the climate is changing at an increasingly rapid rate, outside the range to which society has adapted in the past. These changes can pose significant challenges to US EPA’s ability to fulfill its mission. US EPA must adapt to climate change if it is to continue fulfilling its statutory, regulatory, and programmatic requirements. US EPA is therefore anticipating and planning for future climate changes to ensure it continues to fulfill its mission of protecting human health and the environment even as the climate changes.

temperature increase and its impact on urban areas, wildfire prevalence, agricultural and ocean productivity, and habitat loss and ecosystem shift. Priority is being placed on mainstreaming climate adaptation within US EPA and to encourage adaptation planning across the entire federal government.

Cleanup at the Plymouth Mine would attempt to anticipate the impacts of climate change by revegetating disturbed areas using locally adapted native strains of drought and fire resistant plants to provide genetic resiliency in the face of climate change effects.

3.6 Green and Sustainable Remediation Guidance

When implemented effectively, green and sustainable remediation practices enhance the environmental benefits offered by federal cleanup and redevelopment programs such as the US EPA Brownfields Program. The principles governing green and sustainable remediation for US EPA cleanup programs have been outlined in greater detail but generally seek to “optimize environmental performance and implement protective cleanups that are greener by increasing our understanding of the environmental footprint and, when appropriate, taking steps to minimize that footprint.”

The following benefits can be reached through preferential use of green remediation approaches:

- Waste production and use of materials can be minimized
- Impacts to water quality and water resources can be avoided
- Air emissions and greenhouse gas production can be reduced
- Natural resources and energy can be better conserved.

Green remediation practices are suggested below in categories of administrative, operations, and bioremediation.

3.6.1 Administrative Suggestions

Emphasis should be placed on selecting contractors, including laboratory subcontractors, that follow green remediation best management practices. Use of contractors that place priority on clean fuel and emission technologies should be encouraged. Redevelopment plans and future use of the Site should guide the type of sampling and remediation, ensuring efficient and sustainable methods. Reporting efforts, both draft and final documents, should be submitted in digital format, rather than as hard copies. Outreach to local communities should optimize the use of electronic and centralized communication.

3.6.2 Operations Suggestions

The following suggestions should be considered to help achieve green and sustainable remediation at the Site:

- Sustainable practices, such as utilizing existing structures, native vegetation, and natural attributes on-site, should be encouraged.
- Passive technologies such as those relying on gravity to move water will be sought to minimize long term energy consumption.
- Environmentally preferable products, as outlined in US EPA’s Environmentally Preferable Purchasing guidance (http://www.epa.gov/epp), should be utilized, including environmentally friendly electronics, recycled products, and energy-efficient lighting.
• Mobilization during field efforts should use fuel-efficient and/or alternative fuel vehicles, encourage carpooling, and should avoid environmentally sensitive areas when placing operations centers and command posts.

• Waste should be minimized, through conservation efforts, recycling, and reuse of items.

• Field screens should use non-invasive technologies where feasible, such as ground penetrating radar, seismic refraction/reflection, electromagnetic survey, electrical resistivity tomography, and borehole radar tomography.

• Quantity of field samples should be minimized, and mobile laboratories should be prioritized.

• Drilling and excavation activities should incorporate clean fuel and emissions controls, including idle reduction devices, use of ultra-low sulphur diesel and/or fuel-grade biodiesel, advanced emission controls, US EPA or California Air Resources Board verified emission control technology, and the performance of routine engine maintenance.

• Efficiency during transport and disposal operations should be maximized, and practices such as back-loading should be used whenever possible.

3.6.3 Bioremediation Considerations

Bioremediation is a natural process which relies on bacteria, fungi, and plants to degrade, break down, transform, or essentially remove contaminants from soil and water. Bioremediation options potentially provide a low cost, non-intrusive, natural method of addressing soil contamination at a site. More information about bioremediation alternatives can be found at http://www.epa.gov/tio/download/citizens/a_citizens_guide_to_bioremediation.pdf.

Bioremediation potential of the Site was not be examined or considered because mercury methylation is subject to uncertain impacts via changing the vegetation community.

4.0 Limitations and Additional Assessment Needs

The Phase I and II ESAs provide valuable characterization of current and historical conditions of the Plymouth Mercury Mine, including a summary of historical Site use, previous investigations, regulatory involvement, and Site reconnaissance.

These investigations documented the presence of mercury in mine waste, and contributions of Adit waste rock mercury to Hoffman Creek. These investigations and this ABCA provide mitigation guidance but are not removal characterizations; information herein represents the site-specific recognized environmental conditions and opinions of the environmental professional.

Additional information necessary to complete detailed planning and design of a removal action includes verification of the regulatory classification of the mine waste in accordance with disposal facility requirements. Design requirements for a repository are dependent on regulatory concurrence that is not currently available.

5.0 References Cited


(http://www.epa.gov/oswer/greenercleanups/principles.html)
### Table 1: Total Metals In Waste Rock and Reference Soil

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**Notes:**
1. California Department of Toxic Substances Control (DTSC) Human and Ecological Risk Office (HERO) Note 3–April 2019
4. California Human Health Screening Levels
5. US Environmental Protection Agency

- lb = pounds
- mg/kg = milligrams per kilogram
- meq = milliequivalents
- NA = not analyzed
- RSL = regional screening levels
- TOC = total organic carbon

**bold** = exceeded one or more screening criteria

< = less than
# Table 2: General Chemistry for Soil

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Notes:
- **CACO3=** Calcium carbonate
- **CEC=** Cation exchange capacity
- **meq/100g=** Milliequivalents per 100 grams
- **mg/kg=** Milligram per kilogram
- **NA=** Not analyzed
- **TOC=** Total organic carbon
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<td>-</td>
<td>-</td>
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</tr>
<tr>
<td>USGS Background&lt;sup&gt;4&lt;/sup&gt;</td>
<td>78,000</td>
<td>-</td>
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<td>-</td>
<td>-</td>
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<td>-</td>
<td>-</td>
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<td>-</td>
</tr>
</tbody>
</table>

Notes:
1 = California Department of Toxic Substances Control (DTSC) Human and Ecological Risk Office (HERO) Note 3 – April 2019
- = not applicable
BLM = Bureau of Land Management
CHHSL = California Human Health Screening Levels
EPA = Environmental Protection Agency
RSL = regional screening levels
mg/kg = milligrams per kilogram
NA = not analyzed
**bold** = exceeded one or more screening criteria
**bold** = exceeded one or more screening criteria but below background concentrations
<table>
<thead>
<tr>
<th>Sample ID</th>
<th>Aluminum (mg/L)</th>
<th>Antimony</th>
<th>Arsenic</th>
<th>Barium</th>
<th>Beryllium</th>
<th>Cadmium</th>
<th>Chromium</th>
<th>Cobalt</th>
<th>Copper (mg/L)</th>
<th>Iron (mg/L)</th>
<th>Lead</th>
<th>Manganese</th>
<th>Molybdenum</th>
<th>Mercury (mg/L)</th>
<th>Nickel</th>
<th>Selenium</th>
<th>Silver</th>
<th>Thallium</th>
<th>Vanadium</th>
<th>Zinc</th>
</tr>
</thead>
<tbody>
<tr>
<td>Waste Rock</td>
<td>SWR 0.14</td>
<td>&lt;0.041 0.00069</td>
<td>0.85</td>
<td>&lt;0.00043</td>
<td>&lt;0.0028</td>
<td>0.019</td>
<td>&lt;0.0076</td>
<td>&lt;0.0032</td>
<td>3.7</td>
<td>0.0113</td>
<td>0.068</td>
<td>&lt;0.0097</td>
<td>0.0023</td>
<td>0.26</td>
<td>&lt;0.0011</td>
<td>0.0028</td>
<td>&lt;0.0011</td>
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<tr>
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<td>WRA 0.056 0.0006</td>
<td>&lt;0.041</td>
<td>0.0006</td>
<td>0.23</td>
<td>&lt;0.00043</td>
<td>&lt;0.0028</td>
<td>&lt;0.0099</td>
<td>&lt;0.02</td>
<td>&lt;0.02 1.5</td>
<td>0.00088</td>
<td>0.012</td>
<td>&lt;0.0097</td>
<td>0.0015</td>
<td>0.057</td>
<td>&lt;0.0011</td>
<td>0.0003</td>
<td>&lt;0.0011</td>
<td>&lt;0.003</td>
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</tr>
<tr>
<td>Background</td>
<td>R1 2.3</td>
<td>&lt;0.041</td>
<td>0.0017</td>
<td>2.7</td>
<td>&lt;0.00043</td>
<td>&lt;0.0028</td>
<td>0.12</td>
<td>0.038</td>
<td>0.073</td>
<td>16</td>
<td>0.014</td>
<td>0.18</td>
<td>&lt;0.0097</td>
<td>0.0003</td>
<td>1.1</td>
<td>0.002</td>
<td>0.00024</td>
<td>0.00071</td>
<td>0.0037</td>
<td>0.73</td>
</tr>
<tr>
<td></td>
<td>R2 0.07</td>
<td>&lt;0.041</td>
<td>0.00058</td>
<td>0.073</td>
<td>&lt;0.00043</td>
<td>&lt;0.0028</td>
<td>&lt;0.0099</td>
<td>&lt;0.0076</td>
<td>&lt;0.0032</td>
<td>0.85</td>
<td>0.00048</td>
<td>0.019</td>
<td>&lt;0.0097</td>
<td>0.00018</td>
<td>0.034</td>
<td>&lt;0.0011</td>
<td>0.00019</td>
<td>&lt;0.00011</td>
<td>&lt;0.003</td>
<td>0.013</td>
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<tr>
<td>Water Quality Numerical Limits (^1)</td>
<td>EPA AWQC</td>
<td>0.006</td>
<td>0.01</td>
<td>1</td>
<td>0.04</td>
<td>0.0058</td>
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<td>0.05</td>
<td>0.027</td>
<td>1</td>
<td>0.0098</td>
<td>0.2</td>
<td>0.001</td>
<td>0.00065</td>
<td>0.15</td>
<td>0.005</td>
<td>0.031</td>
<td>0.0017</td>
<td>0.05</td>
<td>0.26</td>
</tr>
</tbody>
</table>

Notes:
AqWQ = Aqueous Water Quality
AWQC = Ambient Water Quality Criteria
CTR = California Toxic Rule
DI WET = Deionized Waste Extraction Treatment
HH = Human Health
MCL = Maximum Contamination Level
\(< = less than
\(- = not applicable
\(bold = exceeded screening criteria

Table 4: DI-WET Metals In Waste Rock and Reference Soil
<table>
<thead>
<tr>
<th>Sample ID</th>
<th>Arsenic</th>
<th>Barium</th>
<th>Cadmium</th>
<th>Chromium</th>
<th>Lead</th>
<th>Mercury</th>
<th>Selenium</th>
<th>Silver</th>
</tr>
</thead>
<tbody>
<tr>
<td>Slope Waste Rock</td>
<td>&lt;0.5</td>
<td>&lt;0.5</td>
<td>&lt;0.1</td>
<td>&lt;0.5</td>
<td>&lt;0.5</td>
<td>&lt;0.05</td>
<td>&lt;0.5</td>
<td>&lt;0.5</td>
</tr>
<tr>
<td>Waste Rock Adit</td>
<td>&lt;0.5</td>
<td>&lt;0.5</td>
<td>&lt;0.1</td>
<td>&lt;0.5</td>
<td>&lt;0.5</td>
<td>&lt;0.05</td>
<td>&lt;0.5</td>
<td>&lt;0.5</td>
</tr>
<tr>
<td>TCLP Threshold</td>
<td>5</td>
<td>100</td>
<td>1</td>
<td>5</td>
<td>5</td>
<td>0.2</td>
<td>1</td>
<td>5</td>
</tr>
</tbody>
</table>

Notes:
- mg/L = milligrams per liter
- < = less than
- - = not applicable
<table>
<thead>
<tr>
<th>Sample ID</th>
<th>Antimony</th>
<th>Arsenic</th>
<th>Barium</th>
<th>Beryllium</th>
<th>Cadmium</th>
<th>Chromium</th>
<th>Cobalt</th>
<th>Copper</th>
<th>Lead</th>
<th>Molybdenum</th>
<th>Mercury</th>
<th>Nickel</th>
<th>Selenium</th>
<th>Silver</th>
<th>Thallium</th>
<th>Vanadium</th>
<th>Zinc</th>
</tr>
</thead>
<tbody>
<tr>
<td>SWR</td>
<td>0.11</td>
<td>0.097</td>
<td>3.6</td>
<td>&lt;0.00035</td>
<td>&lt;0.002</td>
<td>1</td>
<td>3.2</td>
<td>0.073</td>
<td>0.14</td>
<td>0.093</td>
<td>0.0015</td>
<td>19</td>
<td>&lt;0.0011</td>
<td>0.013</td>
<td>0.001</td>
<td>0.027</td>
<td>9.3</td>
</tr>
<tr>
<td>WRA</td>
<td>0.06</td>
<td>0.1</td>
<td>1.3</td>
<td>&lt;0.5</td>
<td>&lt;0.5</td>
<td>0.77</td>
<td>1.2</td>
<td>0.22</td>
<td>0.3</td>
<td>0.035</td>
<td>0.0038</td>
<td>10</td>
<td>&lt;0.5</td>
<td>0.027</td>
<td>0.0005</td>
<td>0.023</td>
<td>1.3</td>
</tr>
<tr>
<td>Soluble Threshold</td>
<td>15</td>
<td>5</td>
<td>100</td>
<td>0.75</td>
<td>1</td>
<td>5</td>
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<td>350</td>
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<td>20</td>
<td>1</td>
<td>5</td>
<td>7</td>
<td>24</td>
<td>250</td>
</tr>
</tbody>
</table>

Notes:
- mg/L = milligrams per liter
- < = less than

Table 6: STLC Metals in Waste Rock
Figures
Westside Brownfields Coalition Assessment Project - Plymouth Mine ABCA

Figure 1 - Regional Map

Sources: ESRI Data Server 2017.

Legend

- Target Property

Legend Key:
- Target Property

Sources: Esri, HERE, DeLorme, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, MapmyIndia, © OpenStreetMap contributors, and the GIS User Community
Figure 2 - Site Features

Westside Brownfields Coalition Assessment Project - Plymouth Mine ABCA

Legend
- Surface Water Sample Locations
- Mercury Vapor Sample Location
- Reference Sub Sample Location
- Sediment Sample Location
- Waste Rock Sub Sample Location

Adit
Shaft Waste Rock
Hoffman Creek
SWUS
SEDUS
R1
R2
SWDS
SEDDS

Sources: ESRI Data Server 2017.

Burleson Consulting, Inc.