- Drainage from Mine/tailings on Wessman property;
- Drainage from ponded area, north of tailings;
- Springs on State Park Land;
- Alkali Spring below and east of pond/dam;
- Mine pond;
- Zuur well;
- Prison Farm well; and
- Marsh Creek Springs Resort well.

These samples were analyzed for general water quality parameters and metals. The Site Characterization Report (SGI 2010a) includes a summary of these water sample results. In general, these results documented the continuous discharge of high concentrations of minerals and metals derived from surface water interactions with tailings materials and from spring discharges at the Mine.

2.3.2 J.L. Iovenitti, Weiss Associates, and J. Wessman, *Mount Diablo Mine Surface Impoundment Technical Report*

In 1989, a technical report evaluating the geohydrochemical setting of the Lower Pond SI, the source of contaminants in the Lower Pond SI, waste control alternatives, and preliminary cost estimates for these alternatives was prepared as part of the application to qualify for an exemption authorized by the Amendment to the Toxic Pits Cleanup Act of 1984 (Iovenitti, 1989).

The report characterized the contaminants in the Lower Pond SI based on historical data obtained from 11 water samples collected from the surface impoundment from 1953 through 1988. The surface water samples were analyzed for general water quality parameters and metals. The results indicated that the metals concentrations detected in the water within the surface impoundment exceeded primary drinking water standards and that sediment contained mercury and nickel in exceedance of soluble threshold limits concentrations (STLCs).

2.3.3 Professor Darell G. Slotton, Marsh Creek Watershed Mercury Assessment Project

Contra Costa County sponsored a three-year study (Slotton,1996; 1997; and 1998) of the Marsh Creek Watershed to comprehensively determine the sources of mercury in the Marsh Creek Watershed, both natural and anthropogenic. These studies also documented mercury concentrations in indicator species, surface water, and sediment to evaluate mercury bioavailability within the Marsh Creek Watershed. These studies were designed to characterize baseline conditions of the Marsh Creek Watershed and to evaluate the relative effectiveness of potential future remedial actions at the Mine.

The results of the 1995 study are summarized in a March 1996 report titled "*Marsh Creek Watershed 1995 Mercury Assessment Project – Final Report*" prepared by Darell G. Slotton, Shaun M. Ayers, and John E. Reuter (Slotton, et al., 1996). The 1995 study evaluated aspects of mercury loading within the Marsh Creek Watershed. As part of this Mercury Assessment Project, sampling was conducted at the Site, including the Lower Pond SI, the spring on State Park property, the spring emanating from the tailings pile, and other locations upstream in Dunn Creek and downstream along Marsh Creek.

The results of the 1996 study are summarized in a July 1997, report titled "*Marsh Creek Watershed Mercury Assessment Project – Second Year (1996) Baseline Data Report*" prepared by Darell G. Slotton, Shaun M. Ayers, and John E. Reuter (Slotton, et al., 1997). The 1996 study, (the second year of the three-year baseline study), evaluated mercury availability in indicator species and sediment within stream sites and the Marsh Creek Reservoir by collecting 175 individual and composite samples of invertebrates, sediment, and young fish from 13 stream sites and the Marsh Creek Reservoir (Slotton, et al., 1997).

The results of the 1997 study are summarized in a June 1998 report titled "*Marsh Creek Watershed Mercury Assessment Project – Third Year (1997) Baseline Data Report with 3-Year Review of Selected Data*" prepared by Darell G. Slotton, Shaun M. Ayers, and John E. Reuter (Slotton, et al., 1998). As with the 1996 study, the 1997 study (i.e., final year of the three-year baseline study) focused on evaluating mercury availability in indicator species and sediments within stream sites and the Marsh Creek Reservoir and involved the collection of 137 individual and composite samples of invertebrates, sediment, and young fish from 12 stream sites and the Marsh Creek Reservoir (Slotton, et al., 1998).

As part of this Mercury Assessment Project, sampling was also conducted at the Mine area including the Lower Pond SI, the spring on State Park property, the spring emanating from the waste rock, and other locations upstream in Dunn Creek and downstream along Marsh Creek. Based on the results of the 3-year study and extensive sampling of the entire Marsh Creek watershed, the Slotton report concluded that the Mount Diablo Mercury Mine, and specifically the exposed tailings and waste rock (Bradley's waste) above the existing pond combined with acidic discharge from the spring emanating from the waste rock above the pond, was the dominant source of mercury in the watershed. Sampling of Dunn Creek above the Lower Pond SI indicated minimal sourcing of mercury was occurring from the watershed immediately above the Lower Pond SI.

As specifically stated by Slotton, et al. (1996) the data indicates that *"the great majority of the mercury load emanating from the tailings is initially mobilized in the dissolved state. This dissolved mercury rapidly partitions onto particles as it moves downstream. The bulk of downstream mercury transport is thus particle-associated."* The Slotton report also states that *"...major mitigation focus should be directed toward source reduction from the tailings piles themselves, with subsequent containment of the remaining mobile mercury fraction being a secondary consideration."*

Slotton, et al.'s three-year study and extensive sampling of the entire Marsh Creek Watershed (Slotton, 1996) specifically concluded that the Mt. Diablo Mercury Mine region contributed the great majority of the entire watershed's mercury loading (95 percent with 88 percent directly traceable to the ongoing drainage from exposed tailings, [Bradley's waste]) at the Site (Slotton, et al., 1996).

The results of the Slotton studies were incorporated in the design of follow on studies implemented by Sunoco as described in the following Section 2.3.4.

2.3.4 2010 Site Characterization

Initial Investigation

Initial work conducted by SGI on behalf of Sunoco included research, acquisition, review and analysis of existing published information and data related to the former Mine and attendant water quality impacts, field surveys of the Mine conducted over a period of two years, property owner interviews, and two surface water sampling events at the Mine Site. This work is documented in the Site Characterization Report (SGI, 2010a).

A total of 23 surface water samples were collected at the following 16 locations during the two sampling events conducted in April and May of 2010:

- Bradley Tailing Piles (four locations, SW-01, SW-02, SW-03, and SW-15);
- Springs (three locations, including the Adit Spring [SW-01, SW-15], Mount Diablo State Park Spring [SW-04] and the Ore House Spring [SW-14]);
- Run-off water between the Bradley Tailings Piles and the Lower Pond SI (SW-05);
- Storm Water Retention Ponds (three locations, including the Upper Pond [SW-06], the Middle Pond [SW-10], and the Lower Pond [SW-09]);
- Dunn Creek (three locations, including downstream of the Lower Pond SI [SW-07], between the Middle Pond and My Creek [SW-08], and upstream of My Creek [SW-16]); and
- My Creek (three locations, including upstream, within, and downstream of the Northern Waste Dump [SW-12, SW-11, and SW-13, respectively]).

Upstream surface water sampling locations SW-12 and SW-16 were considered background locations. The 2010 surface water sampling locations are presented on Figure 2-7.

Additional Investigations

In response to the results of a Site Characterization Report (SGI, 2010a) technical review meeting with the CVRWQCB and subsequent correspondence, SGI, on behalf of Sunoco, conducted additional investigations (SGI, 2011).

This work supplemented SGI's initial investigation (SGI, 2010a), which identified data gaps and recommended work elements to complete characterization of the Site pursuant to the Rev. Order. CVRWQCB staff concurred with the proposed additional elements in its August 30, 2010 letter to Sunoco. SGI then presented a detailed scope of work in its Additional Characterization Work Plan (SGI, 2010b), which included the following activities:

- Performance of a detailed 2-foot topographic survey;
- Installation of two groundwater monitoring wells: 1) a well within the Bradley Mine workings, specifically, in the 165 level (completed at a total depth of 85 feet below ground surface

[bgs] and; 2) a well into the former DMEA/Cordero underground Mine workings, specifically, into the Cordero 360 level lateral tunnel (completed at a total depth of 275 feet bgs);

- Sampling and analysis of groundwater and evaluation of gradients within these wells; and
- Surface water sampling at 16 locations to determine and/or confirm sources of mercury to Site surface waters to assist the CVRWQCB's evaluation of remedial alternatives.

The 2011 surface water sampling locations are presented on Figure 2-8.

The data collected during this phase of investigation enabled a more complete understanding of the relationships between different water sources and overland flow patterns at the Site. Specifically, water sampling results from the two monitoring wells (ADIT-1 and DMEA-1) enabled comparison of these results to the surface water sampling events that have been carried out in 2010 and 2011. This comparison and evaluation has resulted in more holistic understanding of the sources of surface water present at the Site, which specifically falls into three general categories: water sourced from underground Mine workings (i.e., the Bradley Mine workings); water sourced from overland flow through Mine tailings and waste rock; and surface water which does not come in contact with Mine tailings.

The review of historical data (including scientific studies, corporate records and regulatory reports), the georeferencing of historical features with the current physical disposition of the Mine Site, the physical mapping of Site features such as tailings piles and surface water drainage, and the collection of surface water samples, including the comparison to historical data set, combine to paint a detailed physical picture of current Mine Site conditions (SGI, 2010a).

As represented in the Site Characterization Report, both historical documentation and surface water analytical data collected in 2010 support the conclusion that the majority (93 percent based on Slotton [1995] calculations) of the mercury mass loading into the Marsh Creek Watershed originates via run-off over and through Bradley's operation-derived waste rock and tailings piles. The Mine wastes contain trace amounts of pyrite and other sulfur-containing minerals. These minerals, when exposed to air, oxidize to form sulfates. The sulfates, once dissolved in water, form sulfuric acid which depresses the pH. This low pH drainage is able to solubilize minerals and release metals such as mercury. The cycle of wetting and drying of soils, promotes the formation of acid and the release of minerals from the Mine waste.

The primary path from the mining waste is through overland flow into the Lower Pond SI into nearby Dunn Creek that subsequently leads into the greater Marsh Creek Watershed. The works of Slotton (Slotton, 1996) and of SGI's surface water sampling in 2010 quantified the concentrations of mercury and other chemical constituents emanating from the various Mine Site features via overland water flow. The water from My Creek, along with the Dunn Creek water above the Lower Pond SI, have no detectable mercury concentrations and have a chemical signature distinct from the water that had come in contact with the Bradley tailings piles. My Creek collects drainage water from the Northern Waste Dump. Water Quality data from My Creek indicates that material present in the Northern Waste Dump do not contribute mercury or other chemicals of concern (COCs) to surface water runoff in that area.

The Site surface water sampling locations (Figure 2-8) associated with run-off of surface water through the Bradley Tailings Piles and into the Lower Pond SI (SW-15, SW-02, SW-03, SW-05 and SW-09) fairly consistently exceeded water quality criteria for total and dissolved mercury, nickel, lead, and zinc, and less consistently exceeded the same criteria for methyl mercury, arsenic and chromium (e.g., Lower Pond SI sample location SW-09 had no methyl mercury, arsenic or chromium exceedances).

In summary, data analysis indicates that groundwater in the Mine workings is chemically no different than background spring water and that Acid Mine Drainage (AMD) discharges may be solely generated by the interaction of water from natural springs, the Mine workings, and rainfall in contact with exposed Mine wastes.

Dunn Creek Surface Water Quality

Surface sample location SW-07 (Figure 2-8) was collected in Dunn Creek, downstream of surface water from the Site, and is considered a point-of-compliance sampling point. As such, the analytical results from this sampling location and all other surface sampling locations were compared to water quality criteria developed for bodies of freshwater by the CVRWQCB and the USEPA. The comparisons indicated several key points including:

- Mercury and arsenic were not detected above water quality criteria in SW-07;
- Methyl mercury, alkalinity, total dissolved solids, chloride, iron, and nickel were detected above water quality criteria in SW-07; and
- With the exception of methyl mercury, all of these compounds were also detected at concentrations exceeding the water quality criteria in SW-04, at the background State Park Spring sample location.

As reported by Dr. Slotton of the University of California at Davis, methyl mercury is pervasively present in aquatic systems that include any oxic/anoxic interface. Sampling of surfaces waters in and around the Mt. Diablo mercury mine have confirmed the consistent and natural presence of methyl mercury in site and background waters. Methyl mercury has only been detected in down-gradient surface water sample SW-07 (detected at maximum of 6.56 nanograms per liter [ng/l]) above water quality criteria (3 ng/l) on one of five sampling events (SGI, 2011). This sampling event was conducted in late October corresponding with the driest part of the year. This one time exceedance is likely related to the subsurface discharge of waters through the toe of the Lower Pond Surface Impoundment mixing with State Park Spring waters flowing at normal reduced dry-season flows.

This point of compliance and water quality criteria evaluation shows that in general, water downgradient of the Mine exceeds water quality criteria only for compounds present in background samples above water quality criteria. Although COCs from the Mine are travelling into Dunn Creek, the volume contribution of the water from these sources is so small compared to other sources (i.e., State Park Spring, normal watershed run-off that does not come in contact with tailings), the presence of these compounds are reduced to background or near background levels at point of compliance sampling location SW-07.

2.3.5 Previous Remedial Actions

The current property owner, Jack Wessman, over the period of his ownership since 1974, has conducted work in an effort to minimize the impact of exposed Mine waste material to surface water run-off. This work has included earth moving at the Site involving the importation of a large quantity of fill material (reported by Jack Wessman to be on the order of 50,000 cubic yards), and the movement and grading of this fill material around the Site to cover Mine waste. In 1978, Order No. 78-114, Waste Discharge Requirements for the Mount Diablo Quicksilver Mine, was issued to Mr. and Mrs. Wessman, prohibiting the direct discharge of Mine waste to surface waters or surface water drainage courses. That same year, a cleanup and Abatement Order was issued ordering the Wessmans to, among other things, (1) "*...redivert the springs from the Mine overburden...back to the storage reservoir [surface impoundment] to abate further discharge", and (2) "...complete the repair of the storage reservoir...*". In compliance with this order, the surface impoundment was rebuilt in 1978/1979 by the Wessmans.

Based on SGI's discussions with Jack Wessman during Site inspections in 2008, this work has specifically included: 1) infilling and covering of the original collapsed Mine workings area, 2) filling of the DMEA Shaft and filling and capping of waste rock below the shaft toward the furnace, 3) filling and capping of a small pond located west of the DMEA Shaft, 4) grading of waste rock and tailings piles located to the east of and overlying the Mine workings as part of surface drainage control actions, 5) re-configuring, enhancing and maintaining impoundments around the lower waste ponds, and 6) installing drains and drainage pipe for the purpose of re-directing surface rainfall run-off in the upper Mine area around the exposed tailings and waste rock into Dunn Creek directly bypassing flow through the Lower Pond SI.

Current surface drainage for the higher elevations of the Site, including the Cordero operations around the DMEA Shaft area, is captured and routed around the exposed tailings and waste rock, and around the Lower Pond SI, emptying directly into Dunn Creek at a location upgradient of the Lower Pond SI (Figure 2-6).

Sunoco conducted follow on work relating to stabilization of the surface impoundment in 2008/2009. In response to a Unilateral Administrative Order for the Performance of Removal Action from the United States Environmental Protection Agency (USEPA), Sunoco conducted an emergency stabilization of the southeastern wall of the Lower Pond SI's impoundment dam to prevent continued storm flow erosion of the impoundment in 2008/2009. This work was documented in the SGI report titled "*Final Summary Report for Removal Action to Stabilize the Impoundment Berm*" (SGI, 2009).

2.4 Mining-Related Material Waste Characterization

2.4.1 Material Classification

Three main categories of Mine-related waste are targeted for remediation within this Remediation Plan. These wastes have been categorized based on the characterization work conducted by SGI in 2010/2011, which included a review of historic Mine operational documents in combination with field inspections and near surface material examination by tailings experts. In the order of significance, these three waste categories are defined as follows:

1. Main Tailings Pile and Waste Rock Dump. The Main Tailings Pile is located in the eastern perimeter of the Mine workings area as shown on Figure 2-2. The Main Tailings Pile is composed of general Mine tailings including calc-silicate ore zone waste rock that is well graded from small grain processed material to large boulders. Additional waste rock is present in this tailings pile composed of shale and sandstone materials derived from the country rock that surrounds the ore zone. These waste rock materials are inter-mixed with processed tailings and calcines.
2. Pond Sediments. The Lower Pond SI sediments were characterized in 1989 (Iovenetti, 1989). The Lower Pond SI receives run-off from the Main Tailings Pile combined with the steady flow from the Travertine/Adit Spring that emerges from the Main Tailings Pile and travels through and over the Main Tailings Pile on its path to the impoundment. Volume calculations on the Lower Pond SI sediments provided in Table 2-2 include the volume of the impoundment berm.
3. Calcines. North of the Main Tailings Pile and immediately east and down-slope of the old furnace plant is a free-standing calcines pile not apparently mixed with other Mine waste. The calcines consist of the well sorted and highly processed roasted waste material.

2.4.2 Estimation of Mining-Related Material Volumes and Areal Extent of Material

The locations and extent of Mine-related wastes that will be addressed as part of this Remediation Plan are shown in Figure 2-9. An inventory of the Mine-related materials, including volume estimates, is included in Table 2-2.

Volumes of waste rock and tailings piles were estimated using the following procedure:

- The ground topography was surveyed to a 2-foot contour level by a licensed surveyor;
- The pre-accumulation ground surface topography provided on historic DMEA maps was utilized where possible, combined with interpolation of surrounding topography based on the available geolocated base map; and
- Based on a comparative analysis on a point-by-point basis of pre-existing to current topography, a tailing's pile thickness map was developed. Tailings pile volumes were then calculated based on these known and/or estimated thickness determinations.

The preliminary total volume of Mine-related materials to be managed is approximately 124,000 cubic yards. The bulk of this material is made up of waste rock and tailings from the former Bradley Tailings Pile located on the eastern scarp of the Mine Site (102,245 cubic yards). Approximately 7,500 cubic yards of the total is composed of calcines. Approximately 14,089 cubic yards of material is made up of pond sediments from the Lower Pond SI and the impoundment berm. The Lower Pond SI estimate includes the removal of Mine wastes located at the southern foot of the impoundment as shown on Figure 2-9.

2.5 Conceptual Site Model Overview

The conceptual site model (CSM) summarizes available information about potential sources, release mechanisms, contaminant fate and transport, exposure pathways, and potential receptors at the Site. This CSM presented in this section is focused on Mine-related materials within the remedial action area of the Site (Figure 2-9), and is based on SGI's current understanding of Site conditions.

The CSM incorporates the following components:

- Mine-related sources;
- Future land and resource uses; and
- Exposure pathways and receptors of concern.

2.5.1 Mining-Related Sources

Visible Mine-related features that remain on the Site include various Mine buildings, bare uncovered tailings piles, a Middle Pond, and a Lower Pond SI. The Main Tailings Pile is located on the eastern slope of the Mine property bounded on the east by the Lower Pond SI. Spring water discharges from the face of the Main Tailings Pile creating a steady source of surface flow that moves across the lower portion of the Main Tailings Pile and into the Lower Pond SI. The Lower Pond SI is the location of the historic Mine constructed surface impoundment that has been upgraded by the current landowner to provide effective containment of historic Mine derived waste and sediments. The Lower Pond SI contains sediments largely sourced via stormwater flow and Travertine Spring/Adit discharge drainage through and off the Main Tailings Pile. Residual Mine features that are contributing mercury loading to the Marsh Creek watershed are the subject of the actions proposed in this Remediation Plan as depicted on Figure 2-9.

The Middle Pond is not a historic Mine feature but was created by the property owner, Jack Wessman, as part of stormwater management controls for the Mine conducted under the direction of the CVRWQCB. The Middle Pond contains stormwater and flanks the Lower Pond SI to the north and, based on characterization data, is not currently considered a source of significant mercury loading to Marsh Creek.

2.5.2 Potential Future Land and Resources Uses

The Mine has reportedly been closed since around 1969. The Wessmans have owned the property since 1972 and it has been primarily used for residential purposes, supporting multiple families that include home rentals. No residences are located in the remedial action area (former Mine work area). Occasionally in the past, the property has been leased for recreational activities such as paint ball. The property also supports a small herd of cattle owned and managed by Jack Wessman. These cattle are not raised for commercial sale but are used for vegetation control and considered family pets. Future land use is expected to remain the same.

2.5.3 Potential Exposure Pathways and Receptors of Concern

This section provides a scientifically defensible basis for the selection of potentially exposed hypothetical receptors and the most likely ways they might be exposed to chemicals at the Site. To develop a conceptual understanding of the Site, information regarding potential chemical source, chemical release and transport mechanisms, locations of potentially exposed receptors, and potential exposure routes were assessed. This information is outlined schematically in a CSM shown on Figure 2-10. The CSM associates source of chemicals with potentially exposed receptors and associated complete exposure pathways. In this way, the CSM assists in quantifying potential impacts to human and ecological health.

As defined by USEPA (1989), all of the following four components are necessary for a chemical exposure pathway to be considered complete and for chemical exposure to occur:

- A chemical source and a mechanism of chemical release to the environment;
- An environmental transport medium (e.g., soil) for the released chemical;
- A point of contact between the contaminated medium and the receptor (i.e., the exposure point); and
- An exposure route (e.g., dermal contact with chemically-impacted soils) at the exposure point.

The following sections describe these components and provide a basis for the CSM.

2.5.3.1 Chemical Release Mechanisms and Identification of Transport Media

In this section, the first two components necessary for a complete exposure pathway are addressed. Chemical properties of the detected chemicals and the physical characteristics of the Site were reviewed to identify factors that might allow the release and transport of a chemical in the environment. Other than the on-site residential properties, which are outside the remedial action area, the Site remains undeveloped. The Site is on the lower flanks of the northeastern environs of Mount Diablo and is generally unpaved. The Site landscape is not expected to change in the future except as described in remedial actions proposed in this Remediation Plan.

The chemicals of potential concern (COPCs) at the Site are mercury and arsenic. Release of COPCs can potentially occur through wind and/or mechanical erosion (i.e., during construction), infiltration of chemicals into the groundwater, or lateral migration of chemicals in groundwater.

These types of releases may result in dust (with sorbed chemicals) emissions in air, or the movement of chemicals downward into groundwater with infiltrating rain water or stormwater run-off into surface water. The COPCs are not particularly mobile in soil; therefore, soil to groundwater is not considered a likely transfer mechanism. However, groundwater that flows from the underground Mine workings does contain COPCs. The groundwater is interpreted to daylight via springs or seeps on the face of the Main Tailings Pile.

2.5.3.2 Potential Exposure Points

The third component necessary for an exposure pathway to be complete is a point of contact between the contaminated medium and the receptor (i.e., the exposure point). For soil, the exposure point for potential receptors is defined as the remedial action area (former Mine work area).

As mentioned previously, other than the two groundwater monitoring wells installed into the Mine workings by SGI, only one additional groundwater well is located at the Site. This well is referred to as the "*Wessman Well*". The groundwater from the Wessman Well is used for domestic purposes by the residents located at the top of the hill well above the historic Mine workings. This well is located outside the remedial action area (former Mine work area). As such, the water from this well is not expected to be impacted by the Mine workings or actions proposed in this Remediation Plan. According to Jack Wessman, groundwater from the Wessman Well has been tested in the past and has been deemed potable. Residents located on the lower portions of the Site are connected to a public water supply system. Groundwater from the remedial action area (Figure 2-9) is not being used for domestic purposes and groundwater use is not expected to change in the future.

Although it is possible that a hypothetical outdoor construction worker receptor could contact shallow groundwater during excavation, this contact is expected to be very infrequent and involve only minor contact, if any, with contaminated groundwater. In general, any hypothetical construction worker receptor will be performing activities consistent with a site health and safety plan (HASP). This HASP and BMPs would require control measures to limit and preclude any direct contact with groundwater for workers at the Site.

Additionally, surface run-off and near-surface groundwater is assumed to discharge via ephermeral streams, springs, or seeps into surface waters adjacent to the Site (i.e., Dunn Creek). Dunn Creek is seasonal and intermittent adjacent to the Site and not used for recreational purposes in the stretch adjacent to the Mine. Intermittent presence of water is considered unlikely to support fish suitable for human consumption. Dunn Creek flows south from the Mine Site to join Marsh Creek 0.5 miles downstream, then flows approximately 11 miles to discharge into the Marsh Creek Reservoir, and then into the western San Joaquin Delta at Big Break. Metals (e.g., mercury) may move from the Site to adjacent waterways in dissolved and particulate form. As mentioned previously in Section 2.3.3, 95 percent of the total input of mercury to the upper watershed has been estimated to come from Dunn Creek, with 88 percent traceable to exposed tailings piles of the Mount Diablo Mercury Mine (Slotton, 1996, 1997, 1998). However, 95 percent of the watershed's suspended sediment load is from non-Mine, low mercury source regions. Although Site-related contaminants may flow to potential drinking water sources further downstream from the Site, concentrations are expected to be significantly diluted.

2.5.3.3 Potential Receptors

In addition to exposure points, potential receptors at the Site are necessary for an exposure pathway to be complete. Hypothetical receptors identified for evaluation in this assessment were identified on the basis of proximity to the remedial action area of the Site, proposed activities that could possibly result in direct or indirect contact with chemicals. On the basis of current and potential future uses of the Site, the following hypothetical receptors were evaluated in this risk assessment:

On-Site

- Hypothetical Future Construction Worker Receptor; and
- Hypothetical Current/Future Recreational Visitor Receptor.

Off-Site

- Hypothetical Current/Future Recreational Angler Receptor; and
- Hypothetical Current/Future Aquatic Biota.

2.5.3.4 Exposure Pathways Considered Potentially Complete and Significant

The fourth and final component, a complete exposure pathway (i.e., route of exposure) is discussed in combination with the third component (i.e., presence of receptors) to define those exposure pathways considered to be complete and significant. As indicated in the CSM (Figure 2-10), contact with COPCs at the Site could occur via exposure to soil, groundwater, and surface water. The following sections separately summarize those pathways considered complete and significant for each receptor.

2.5.3.4.1. Hypothetical On-Site Construction Worker Receptor

The hypothetical construction worker receptor is included in this CSM due to planned future construction at the Site. Future construction may occur during installation, monitoring, and maintenance of remedial actions implemented at the Site as proposed and detailed in this Remediation Plan. Therefore, future hypothetical construction worker receptors are expected to perform soil invasive activities. This receptor is expected to be a short-term outdoor worker (i.e., 2 weeks to 7 years [USEPA, 1989]) for a single construction or development project at the Site. This receptor spends the workday outdoors performing construction-related tasks. The exposure pathways assumed to be complete and significant for the hypothetical outdoor construction worker receptor include:

- Incidental ingestion of soil;
- Dermal contact with soil; and

- Inhalation of dust in outdoor air generated from the subsurface.

2.5.3.4.2. Hypothetical On-Site Recreational Visitor Receptor

The hypothetical recreational visitor receptor is included in this CSM in the event any recreational activities occur at the Site. The Site is accessible through privately owned lands and is blocked from public access by fencing and locked gates. Due to access restrictions in place at the Site, the number of visitors is anticipated to be minimal and infrequent and of short duration. This receptor may also include an unauthorized visitor (or trespasser). Conservatively, this receptor is expected to be a long-term recreational receptor that includes exposures as both a child and adult recreational visitor. Exposure to surface water is not expected due to the intermittent presence of surface water and the infrequent and limited time spent at the Site by the recreational visitor. The exposure pathways assumed to be complete and significant for the hypothetical recreational visitor receptor include:

- Incidental ingestion of soil;
- Dermal contact with soil; and
- Inhalation of dust in outdoor air generated from the subsurface.

Areas of the Site outside of the remedial action area are currently used for residential purposes, but these areas are not expected to be impacted by Site-related contaminants from the remedial action area. However, as residents on the property, they may walk or hike on the property. This on-site recreational visitor receptor will address any potential exposures to a potential resident receptor conducting recreational activities in the remedial action areas.

2.5.3.4.3. Hypothetical Off-Site Recreational Angler Receptor

The hypothetical recreational angler receptor is included in this CSM in the event recreational angling is conducted in downgradient waterways that support fish. This hypothetical recreational angler receptor includes both a child and adult. Conservatively, this receptor is expected to be a long-term recreational receptor. The exposure pathways assumed to be complete and significant for the hypothetical recreational angler receptor include:

- Ingestion of fish.

2.5.3.4.4. Hypothetical Off-Site Aquatic Biota

Due to the ecological concerns associated with mercury and formation of methyl mercury in aquatic systems and the presence of surface water that receives run-off from the Site, aquatic biota are included in this CSM. The exposure pathways assumed to be complete and significant for the hypothetical aquatic biota include:

- Uptake of surface water by aquatic biota (i.e., aquatic plants, water-column invertebrates, fishes); and
- Uptake of sediments by sediment dwelling invertebrates.

2.5.4 Summary of Potential Human Health Risks

For the hypothetical on-site human receptors, potential exposure to COPCs in Mine-related materials is possible through direct contact (i.e., incidental ingestion or dermal contact) with contaminated material and inhalation of airborne dust particulates. The Site-related contaminants may pose a risk to human health as a result of work performed at the Site (i.e., construction worker exposure scenario) or recreational activities conducted at or near the Site (i.e., hiking, biking, and other outdoor activities). In general, any hypothetical construction worker receptor will be performing activities consistent with a site HASP and BMPs, which would require proper personal protective equipment to limit direct contact with soil for workers at the Site. In the current exposure scenario, recreational visitor receptor exposures are expected to be infrequent and of short duration; therefore, reducing actual exposure to the Site. In the future exposure scenario, the Mine waste will be capped. As a result, future recreational visitor receptors will not be exposed to Mine waste at the Site.

For the hypothetical off-site recreational angler receptor, water quality criteria for human health (i.e., consumption of water and organisms and consumption of organism only) were lower than the analytical detection limit for surface water samples. Surface water sample location SW-07 (Figure 2-8) in Dunn Creek is the natural point of compliance sampling location for monitoring run-off impacts from the Site. In sample location SW-07, arsenic was not detected above the analytical detection limit and mercury (total and dissolved) were detected below or slightly above the analytical detection limit. Because analytical detection limits are above the water quality criteria, arsenic impacts cannot be evaluated. Site-related contaminant concentrations are expected to be diluted significantly by the time they reach the Marsh Creek Reservoir. Mitigation of sourcing of Site-related contaminants into Dunn Creek and its tributaries and subsequently the Marsh Creek watershed with remedial actions at the Site coupled with ongoing dilution will reduce any potential risks to hypothetical off-site recreational angler receptors from Site-related contaminants.

2.5.5 Summary of Potential Ecological Risks

As mentioned previously, water from the Site eventually flows into Dunn Creek and its tributaries. Although chemistry results fluctuate based on seasonal nature of precipitation events which result in more or less dilution of the waters flowing from the Site, no mercury (total or dissolved) or arsenic have been detected at concentrations that have exceeded the water quality criteria (SGI, 2011). Water quality criteria that have been exceeded at sample location SW-07 include methyl mercury, alkalinity, total dissolved solids, chloride, iron, and nickel. With the exception of methyl mercury, all of these compounds exceed the water quality criteria in the State Park Spring sample location (SW-04), which has no known connection to the Mine and likely reflects natural chemistry of waters that would flow from background areas around the Site. Therefore, these exceedances would occur independent of the any impacts caused by former Mine operations in the remedial action area of the Site. In Dunn Creek (SW-07), methyl mercury concentrations ranged from 0.68 to 6.56 ng/l. However, background concentrations for methyl mercury ranged from 0.077 to 0.980 ng/l. Due to the endemic presence of trace levels of mercury in the environment at some trace level, in aquatic systems with any oxic-anoxic interface (i.e., subsurface in sediments), some small fraction of mercury will inevitably be methylated.

Potential aquatic receptors in surface waters downstream of the Site may be impacted by exposure to methyl mercury, which also has the potential to bioaccumulate in biota. However, remedial actions for the Site are designed to mitigate sourcing of Site-related contaminants into Dunn Creek and its tributaries and subsequently the Marsh Creek watershed.

3.0 REMEDY APPROACH AND SCOPE OF WORK

This section describes the planned remediation activities of Mine-related material at the Site, including permitting, Site preparation and control, Mine-related material removal and in-place management, waste management, removal confirmation, and Site restoration.

3.1 Remedial Action Overview and Approach

Mining waste targeted for remedial action was identified via characterization activities that have essentially been ongoing over the last 50 years (Section 2.3). Recent characterization activities were conducted by SGI on behalf of Sunoco to expand and refine historic characterization activities as detailed in SGI's Additional Characterization Report of December 7, 2011 (Summarized in Section 2.3.4). The focus of characterization activities has been to identify Mining waste based on its demonstrated contribution of sediment and COCs to Dunn Creek and the Marsh Creek watershed. Characterization activities have all indicated that the continuing source of mercury impact to lower Dunn Creek and Marsh Creek and its environs emanates from the Lower Pond that is filled via spring discharge and surface run-off that flows over the Main Tailings and waste rock pile (Bradleys' eastern tailings piles) at the Mine. As a result, the focus of this Remediation Plan is to effectively remediate this condition and reduce discharges into Dunn Creek from the Mine Site to be consistent with natural background specific to the Mine Site. Since the Mine Site and the adjacent State Park contain highly mineralized natural springs that pre-date mining activities, restoration of natural background surface water discharges is focused on activities that reduce and eliminate contribution of Mine derived additional COCs and mineral content to the natural highly mineralized background water quality.

Characterization has identified three main categories of solid Mine waste material that are the focus of this Remediation Plan. The primary focus is concerned with the Main Tailings Pile that has been demonstrated to be providing the bulk of COC loading to Dunn creek via storm flow, seepage and movement of recharge through the pile, and the discharge and movement through and on the pile of the Travertine/Adit Spring. The secondary focus is the presence of sediments in the Mine surface impoundment located below the Main Tailings Pile. A third and minor item is the calcines located north of the Main Tailings Pile. The locations and extent of the materials targeted for remedial action are depicted on Figure 3-1. Volumes of these materials are summarized in Table 2-2.

The Main Tailings Pile is made up of both capped and uncapped Mine-related wastes as indicated on Figure 3-1. Surface water sampling has indicated that COC sourcing is occurring on the lower, uncapped portion of the Main Tailings Pile. The remedial approach for the Main Tailings Pile is to remove the portion of these tailings that are uncapped and consolidate them within the area of the former Mine workings as shown on Figure 3-1. The former Mine workings area is located directly west of the Main Tailings Pile and consists of a flat base made up of compacted fill placed over the collapsed Mine workings by the current property owner. The Mine workings area is bounded on the north, south and west sides by the steep slopes of the mountainside as a result of historic Mine-related excavations in the Mine workings area. The Mine workings area thus forms an ideal location for the consolidation and capping of Mine wastes away from the Dunn Creek environs. Figure 3-2 presents a cross section demonstrating the nature of the disposition of Mine wastes and the selected area for consolidation and capping.

The sediments and berm materials of the Lower Pond SI will also be excavated and consolidated with materials from the Main Tailings Pile in the Mine workings area. Additionally, a smaller volume of processed ore (calcines), located north of the Main Tailings Pile will be excavated and consolidated with the other material (Figure 3-1). These consolidated materials will then be capped and appropriate surface water drainage controls implemented.

Excavation and removal of these Mine waste materials will expose the portal of the 165 level Adit and any associated Mine water discharge as well as the pre-mining emanation point of the former Travertine spring. The relationship of these discharge locations to Mine waste and remedial actions is shown on the cross section of Figure 3-2 and on Figure 3-3. Discharge waters encountered from these sources will be sampled and analyzed as detailed in section 4.1. The short-term solutions implemented as part of this Remediation Plan will include the capture and routing of these groundwater discharges away from and around all contact with Mine waste materials prior to discharge into Dunn Creek below the Lower Pond SI. Based on characterization data, it is anticipated that elimination of contact of these waters with Bradley Mine wastes will likely reduce COCs to natural background conditions. Regardless, these groundwater discharges will be evaluated to determine if additional remedial action concerning them is warranted.

The general approach described above for Mine-related material remediation is consistent with previous federal and state recommendations for similar settings in California. In the case of the Sulfur Creek Mercury Mining District, the United States Geological Survey (USGS, 2004) and Churchill and Clinkenbeard (2003) reports concluded that effective Mine Site remediation should be based on general Site erosion control and Mine-related material isolation measures. Similarly, a CalFED Bay-Delta Program (CalFED) Report regarding the Sulfur Creek Mercury Mining District also recommended that Mine-related wastes with elevated mercury levels be excavated and removed off-site and/or consolidated and stabilized on-site, with the implementation of institutional and surface water run-on/run-off controls to reduce the potential for erosion into nearby surface water (CalFed, 2003).

3.2 Permitting

All necessary approvals must be obtained prior to initiating the remediation activities described in this Remediation Plan to ensure the project is completed in compliance with applicable regulatory requirements. Mine and mill wastes are specifically excluded from regulation as hazardous wastes under the Bevill Amendment and as such, RCRA Subtitle C regulations do not apply. The general approach to the permitting process will be to:

- Identify potentially applicable approvals required from regulatory agencies and private parties;
- Meet with key regulatory agencies for pre-application meetings to confirm the potential requirements, and establish early communication with agencies and adjust data needs as required; and
- Facilitate the approval process from pre-application to submittal and approval.

Tracking of the approval status and compliance with the potential requirements will be conducted including:

- Use of a permit-tracking matrix to manage submittal of materials and status of approvals. A master permit list with more detailed information on permit requirements and planned dates will be prepared and will be updated throughout the project for use as a tracking and management tool as part of pre-implementation.
- Development of specific oversight plans and documentation as required for permit compliance.
- Implementation of field monitoring requirements, as needed. Work monitoring and inspection activities (e.g., monitoring of BMPs) required by applicable permits during field work/construction will be implemented into the bid specifications.

3.3 Site Preparation and Control

This section describes the Site preparation and control activities to be completed prior to and during remediation and restoration work at the Site, including Site access agreements, mobilization and demobilization, material and equipment staging, road construction and improvements, and transportation.

3.3.1 Site Access Agreements

Updated Site access agreements will be required with the current property owners at the Site by all parties involved in implementation of the remedy. In addition, a Site access agreement will be required with the Mount Diablo State Park to allow removal of waste material that overlaps the property border to the south (Figure 3-1 illustrates the State Park boundary overlap).

3.3.2 Mobilization and Demobilization

Mobilization and demobilization will include all work necessary to manage operations for the duration of the project. Mobilization will be an ongoing task as new resources are needed for specific operations. The project-specific HASP will be completed as part of the mobilization phase. A draft HASP will be finalized prior to beginning field activities, with input from the selected remediation contractor during the pre-mobilization phase of work. During mobilization, equipment will be cleaned to limit noxious weed transport to the Site. A stormwater pollution prevention plan (SWPPP) will be prepared prior to the initiation of any soil disturbing activities at the Site.

Demobilization will include the removal of all equipment and personnel mobilized to the Site and waste generated during the duration of the project. Final demobilization will include cleanup and restoration of all staging areas to pre-existing conditions. At the conclusion of the construction season, work areas will be secured and appropriate stormwater BMPs will be implemented to reduce the potential for Site activities to impact stormwater run-off.

3.3.3 Erosion Control

Remediation of the Mine-related materials will require establishing equipment access and the excavation, loading, and haulage of the materials. The disturbance associated with these activities will need to be mitigated to prevent erosion. A notice of intent (NOI) and storm water pollution prevention plan (SWPPP) will be prepared and certified through the CVRWQCB. This mitigation will involve the re-grading and reclamation of the natural ground surface and the temporary placement of erosion control BMPs.

BMPs will be selected based on the planned reclamation activities and include categories related to erosion control, sediment control, tracking control, wind erosion, non-stormwater controls, and waste management and materials control. These BMPs can include, but are not limited to:

- Grading;
- Silt Fences;
- Straw Bales;
- Biodegradable Fiber Rolls;
- Loose Straw, Mulch;
- Grass Filters;
- Sand/Gravel Bags;
- Dust Control Moderation;
- Good Housekeeping Practices;
- Site Entrances and Exit Maintenance; and
- Management of Construction-Related Wastes.

The combination of the above-listed BMPs will protect the stormwater quality during reclamation activities. Procedures to ensure proper implementation of erosion control BMPs during remediation will be identified and described in the SWPPP. The SWPPP will be established prior to starting any soil disturbing activities associated with construction work at the Site, and will be included as necessary in permitting documentation. Specific construction activities likely to require erosion control measures are addressed in the task descriptions in the following sections. Erosion control materials will be on standby for use if rainfall events occur during construction activities.

3.3.4 Material and Equipment Staging

All materials and equipment will be staged on the Mine Site. Each work area will have a temporary staging area for equipment and personnel. These areas will be determined and approved by the current property owners and the Site engineer prior to mobilization.

3.3.5 Road Improvements and Construction

Mine access road construction and improvement will be required throughout the project. Proposed locations of access routes and roads are preliminary and will be revised as necessary pending final approvals by the property owners and the Site Engineer. Access improvements will be located to minimize disturbance.

In the event that any roads cross a drainage channel, existing culvert, or small tributary, a replacement culvert will be installed or temporary steel plating will be placed across to keep drainage areas open.

3.3.6 Transportation Plan

A Site transportation plan will be prepared during pre-mobilization activities and will cover on-site transport of Mine-related material and other material generated during Site removal and restoration activities. The transportation plan establishes procedures to minimize the environmental and health and safety risks associated with material transportation conducted for the project.

3.3.7 Dust Control

Reclamation activities anticipated to generate dust during the project include construction vehicle traffic and ground disturbance activities associated with material removal, consolidation and re-contouring. Routine dust control measures will consist of water spray to moisten disturbed areas, on-site haul roads and other areas, as needed (e.g., unpaved construction roads are commonly watered three or more times per day during the dry season). If dust emissions are visible, dust control practices will be modified or other corrective measures will be implemented immediately.

3.4 Mining-Related Material Remediation

This section describes in greater detail the remediation (e.g., removal and management-in-place) of Mine-related materials including waste rock and tailings, calcines, spring water discharge and Lower Pond SI sediments.

3.4.1 Main Tailings Pile and Calcines

The Main Tailings Pile is generally laid at a slope of 3:1 (18 degrees) from the Lower Pond SI up to the beginning of the capped area near the top of the slope (Figure 3-1). The waste is covered in places with boulders up to 6 feet in diameter. The internal character of the waste in the Main Tailings Pile has not been investigated by intrusive activities. The thickness of the material in the Main Tailings Pile has been determined via comparison of historic topography with the current surveyed Site topography as demonstrated on Figures 3-2 and 3-3. The average thickness of the western portion of the Main Tailings Pile targeted for removal is 24 feet. The eastern portion of waste extending from the lower reaches of Main Tailings Pile to the Lower Pond SI is estimated to be as little as three feet thick or less. Along the east-west edge of the upper portion of the Main Tailings Pile, the slope is very steep - on the order of 1:1. The waste area extends into the adjacent State Park to the south.

The top surface of the Main Tailings Pile is essentially level with a grade to the west for the capture of surface water as designed by the landowner. The tailings have been capped with 10 to 20 feet of fill as estimated by the landowner (Figure 3-2). The capping material extends down the face of the Tailings a significant distance. The cap material is reported to be from a local pool contractor who has stored excess soils on the Site for many years. The leading downhill slope of the stockpile is quite steep and likely is on the order of 2:1 (26.5 degrees) or steeper. The estimated volume of wastes proposed for removal from the Main Tailings Pile, as depicted on Figure 3-1, is 102,245 cubic yards.

A small area of calcines is located to the north of the Bradley wastes (Figure 3-1). The gravel-size material was roasted to drive off the mercury as a vapor. The calcines are distinctive and their extent is readily discernable on the ground. The estimated volume of these materials is 7,500 cubic yards based on topographic analysis.

The remedy proposed is the removal and transport of these uncapped exposed Mine waste materials as depicted on Figure 3-1 to the former Mine workings area for consolidation and capping. Figure 3-4 depicts cross sections of the expected configuration of the Mine waste after all waste has been consolidated in the former Mine workings area. The cross sections depict Mine waste extending to an elevation of 930 feet. The planned footprint of consolidated waste in the former Mine workings area extends from the base of the floor at approximately 875 feet to the 930-foot contour interval as shown on Figure 3-1. The volume capacity of this consolidation area is calculated to be approximately 150,000 cubic yards.

Removal of the waste footprint from the Main Tailings Pile as depicted on Figures 3-1 and 3-2 will result in the exposure of the toe of the capped waste that lies above. During the pre-implementation planning phase of the proposed project, an approach for the stabilization and capping of the exposed toe of the capped waste material will be developed by the Site engineer in consultation with an appropriate geotechnical expert. Currently, insufficient data combined with the unknown condition of the base rock under the tailings preclude the development of a detailed plan. The capping and grading plan developed will be based on appropriate field sampling and investigation conducted during the pre-implementation phase of the project and will be submitted to the CVRWQCB for review and approval.

3.4.2 Lower Pond Surface Impoundment

A surface impoundment at the location of the Lower Pond SI has been present at the Mount Diablo Mine since at least the late 1930s. Division of Water Resources (1952) reports the results of a chemical analysis of "*final*" pond outflow from 1939. It is believed that this final pond occupies the same approximate footprint as the present day surface impoundment. The current condition of the Lower Pond SI at the Mine is a result of upgrade and modifications conducted by the current property owner. The Lower Pond SI was re-built in 1978/1979 by Jack Wessman as one of the requirements of the Waste Discharge Requirements and the Cleanup and Abatement Order issued in 1978. Jack Wessman has stated that the Lower Pond SI levee material was derived from local soils that were not in contact with the Mine tailings with the bulk of the material derived on-site from an area north and east of the Lower Pond SI. The lower pond was designed to have an effective storage capacity of 3.0 acre-feet.

A small secondary pond (herein referred to as the Middle Pond) was also constructed by Jack Wessman, immediately north of the Lower Pond SI. This Middle Pond was built by Jack Wessman to capture the stormwater drainage as part of his work to manage stormwater flow away from exposed Mine waste as discussed in Section 2.1.7. Removal of the Middle Pond is not part of this Remediation Plan.

Removal of the Lower Pond SI and berm materials is estimated to generate approximately 14,189 cubic yards of solid waste material form the area depicted on Figure 3-1. Of this total, approximately 9,400 cubic yards are estimated to be sediment contained within the impoundment. Additionally, approximately 2,400 cubic yards of waste material that is observable below the southern levee of the surface impoundment is included in the total.

In its current configuration, the Lower Pond SI drains directly into Dunn Creek. De-watering of the Lower Pond SI will be conducted via pumping and on-site treatment to remove sediment load and reduce total metals loading to Dunn creek. Estimated water volume in the pond at the time of project implementation will be dependent on the time of year and the total winter rainfall preceding the project start. Water volume is estimated to be on the order of 2 to 3 million gallons. Based on the requirements determined during the permitting stage of the Remediation Plan implementation process, a de-watering plan for the impoundment will be developed and submitted to the CVRWQCB for review and approval.

The Lower Pond SI is bounded on the west by a large area of open ground with a gentle slope that is already covered and impacted with Mine waste materials. During sediment excavation, staging and amendment of sediments will be conducted in this area such that run-off from the staging and processing area will naturally be contained within the catchment of the Lower Pond SI.

Lower Pond SI sediments will be excavated and amended via the addition of cement and/or other satisfactory pozzolonic material to stabilize them and allow transport to the consolidation area. Initial estimates indicate the need for 1200 tons of dry cement for application to the pond sediments in order to stabilize and condition the sediments.

The footprint of the excavated Lower Pond SI will be restored via implementation of a re-vegetation plan as discussed in Sections 3.7 and 4.4.

3.4.3 Mine Adits and Shafts

Based on review of Site mining history information and interviews with the current property owners, no mineshafts are known to exist in the area of planned tailings removal. Removal of the Main Tailings Pile is expected to uncover the former 165 level Adit as shown on Figure 3-2. The condition of the adit opening is unknown. Historic information indicates that this adit may be the source of some or all of the spring water currently exiting the Main Tailings Pile and called the Travertine/Adit Spring. Based on the condition of the adit when uncovered, a plan will be developed to; 1) remove Mine waste in the adit mouth that could contribute mercury loading to spring water, 2) stabilize and plug the adit opening, and 3) construct a catchment to capture any water drainage effectively and route it away from all Mine waste as detailed in following Section 3.4.4.

3.4.4 Travertine Spring /Adit Discharge

Removal of the Main Tailings Pile will allow access to the historic emanation location of the Travertine Spring and the possible groundwater discharge from the portal of the 165 level Adit (Figure 3-2 and 3-3). Through access to these areas, the sources of current groundwater discharge that emerges as the spring and seeps will be determined. Based on the determination of the source of the spring water, appropriate catchment/s will be designed. The catchment/s will be designed to allow complete capture of these groundwater discharges allowing competent routing of the flow away from contact with Mine waste. During project implementation, a temporary catchment will be designed by the Site engineer to route the groundwater discharge away from the on-going work areas. This flow will be diverted to Dunn Creek and bypass any further contact with existing Mine waste. Due to the planned removal actions that will be occurring in the vicinity of these groundwater discharges, the likely routing direction for this flow is to the south in the vicinity of the State Park Spring. As a result of this planned re-routing, it is expected that the groundwater discharge water quality will be significantly improved in comparison to the current discharge of these waters to Dunn Creek.

A spring water catchment and routing plan will be developed and submitted to CVRWQCB for review and approval. During the intervening time, a temporary catchment and routing plan will be developed and immediately implemented by the Site engineer in consultation with CVRWQCB staff. Maintenance of this temporary discharge routing will be conducted throughout the implementation process. Construction of permanent catchment and routing structures will be conducted following approval of the developed plan by the CVRWQCB and the effective completion of removal and stabilization activities in the area.

3.5 Material Management Plan

This section describes the material management plan for Site Mine-related material, including structures and equipment, waste rock, tailings, calcines, and mercury-enriched sediments.

3.5.1 Recycling and Disposal of Structures and Equipment

The Remediation Plan does not include the removal of Mine-related equipment. However, it is possible that during the process of excavation and consolidation of Mine waste, Mine-related equipment will be encountered.

Mine-related equipment that is encountered, such as pipes and retort remnants, will be consolidated within the consolidation area if feasible. Where inclusion of Mine-related equipment encountered is considered by the Site engineer to be infeasible, the Mine-related equipment will be further evaluated to determine if removal is necessary. If equipment or structures encountered cannot be included in the consolidation area, then the procedures that would be followed are described below.

Where possible, based on the available material characterization data, remnants of former Mine-related structures and equipment will be recycled. Only those materials demonstrated to contain concentrations of mercury below applicable regulatory limits will be considered for recycling. Materials will be sorted by type (i.e., brick/concrete, dimension stone, wood, and metal) in the staging area as they are removed. Brick, dimension stone, and concrete debris will be transferred to a recycling facility or disposed as construction waste, depending on condition. Wood will either be recycled or disposed of as construction waste depending on condition. Steel will be transferred to a recycling facility as general scrap metal.

3.5.2 On-Site Stabilization and Capping

Mine waste consolidation and stabilization will be completed so that the consolidated and capped materials will not be actively eroding material directly to Dunn creek or its minor tributaries. In general, materials that are moved for consolidation will be placed in lifts, keyed into existing slopes and compacted between lifts. Water trucks will provide water that will be used for dust control as well as to enhance soil compactability. Lifts will be keyed in for stability and erosion control. Once final grading is complete, the materials will be capped with soil. The source of the borrow soil will be determined prior to contractor selection and detailed in a capping plan. The cap material will be keyed into the surrounding native material and proof rolled for compaction.

A licensed geotechnical engineer under the direction of the Site engineer will perform a geotechnical investigation. The investigation will include slope stability, seismic stability, and design of the capping area. Furthermore, the licensed geotechnical engineer will provide drainage recommendations to be installed within the consolidated waste material. Based on this pre-implementation design, a general Capping Plan will be prepared by the Site engineer and submitted to the CVRWQCB for review and approval.

3.5.3 Hazardous Waste

Mine-related waste that is the subject of this Remediation Plan is by its nature considered to fall under the Bevill exclusion. In October, 1980, Resource Conservation and Recovery Act (RCRA) was amended by adding section 3001(b)(3)(A)(ii), known as the Bevill exclusion, to exclude "*solid waste from the extraction, beneficiation, and processing of ores and minerals*" from regulation as hazardous waste under Subtitle C of RCRA.

No waste is planned for off-site disposal as a result of the actions described in the Remediation Plan. Although not anticipated, if hazardous wastes are generated during the project and they do not meet the Bevill exclusion requirements, these wastes will be transported to an appropriate hazardous waste landfill facility for disposal. In this event, a transportation plan will be developed. The transportation plan will include, if required, trucking routes and manifest required for the hazardous waste facility. The final hazardous waste disposal facility will be determined based on the waste characteristics, waste profile, and the acceptance criteria for the available disposal facilities.

3.6 Removal Confirmation

The extent of excavation of Mine-related waste rock, and tailings at the Site will be determined in the field using qualitative (visual) techniques before and during excavation activities. Samples for laboratory analysis will not be collected to confirm removal and/or stabilization limits or boundaries.

The horizontal and vertical limits of the waste rock, and tailings piles will be identified and confirmed using the following guidelines:

- Topographical expression (many material piles have well-defined topographic profiles);
- Color change (calcine tailings have a distinctive reddish color);
- Presence of buried soil horizons, as evidenced by the presence of organic material, roots, and developed soil horizons;
- Presence of in-place bedrock;
- Presence of laminated or bedded fine-grained material indicative of natural overbank deposits; and
- Presence of an abundance of rounded gravel and cobbles indicative of former streambed or stream terrace deposits.

Delineation of the horizontal and vertical limits of the waste rock, ore, and tailings piles will be conducted by or under the direction of registered Professional Geologists with relevant expertise in accordance with California Business and Professions Code sections 6735, 7835, and 7835.1. The delineation tasks will also be documented and reported to the CVRWQCB.

In order to distinguish Mine-related materials from natural soils and rock materials, the following guides will be used; the soil classification guidelines published in American Society for Testing and Materials Standard D-2487 and the standard practice for classification of soils for engineering purposes (Unified Soil Classification System). The available guidelines will be applied in a manner that allows for the removal or stabilization of all targeted Mine-related materials while minimizing the removal or disruption of in-place naturally occurring materials.

3.7 Site Restoration Approach

This section describes the Site restoration approach, including temporary road removal; re-grading, slope stabilization and bank stabilization; and re-vegetation that will be conducted in accordance with the NOI storm water discharge permit.

3.7.1 Temporary Road Removal

All Mine access roads or constructed temporary roads, bridges, or steel plates used during construction will be removed and the area restored upon the completion of work in that area as described in Sections 3.7.2 and 3.7.3. Unless required for future access or requested by the property owner, culverts placed or repaired during the construction of the roads will be removed and disposed of in accordance the recycling plan described in Section 3.5.1.

3.7.2 Re-grading, Slope Stabilization, and Bank Stabilization

Disturbed areas and temporary roads will be restored upon completion of all removal and/or on-site stabilization activities. Slopes and roads will be graded to a natural line that limits run-off and drainage. Fill material will be borrowed from on-site as need for grading and stabilization. Positive drainage will be achieved to minimize ponding of water. Slopes will be stabilized by eliminating run-off from the top of the slope, or cutting the slope back to slow stormwater run-off. Grading around on-site stabilized materials will be used to divert stormwater away from the stabilized material. Grading near creeks will be completed to limit streambed disturbance and maintain the natural flow. The grading of Site areas will remain above the Dunn Creek elevation to minimize the potential for undercutting.

Temporary bank stabilization measures may be necessary at the Dunn Creek drop adjacent to the southeast corner of the Lower Pond SI to minimize lateral creek migration following removal of the pond and associated berms.

3.7.3 Re-vegetation and Monitoring

A re-vegetation plan will be developed for the project that focuses on the seeding of early succession herbaceous grasses and/or forbs upon completion of the Site removal actions.

Disturbed Site areas will be re-vegetated following the completion of the construction season just prior to the first rain events. Re-vegetation will include hydro seeding, or other techniques where more appropriate, with an appropriate soil stabilization seed mix. Upon completion of re-vegetation activities, a Site inspection with the CVRWQCB will be scheduled. See Section 4.4.5 for additional details of the re-vegetation plan.

4.0 REMOVAL DESIGN, METHODS AND PROCEDURES

This section describes the removal design, methods and procedures, including sample collection and analysis, Site preparation and control, Mine-related material removal, Site restoration design, equipment decontamination, geolocation, and recordkeeping.

4.1 Sample Collection and Analysis

Sample collection during project implementation is anticipated for both soil and water as follows:

1. Geotechnical evaluations discussed in Section 3.5.2 will be required during the removal, consolidation, and capping of Mine waste material. Sample collection and analysis specifications for soil samples will be described in the capping and grading plan developed before and during project implementation.
2. Water sampling will be conducted at the Lower Pond SI to evaluate water treatment and discharge options during planned de-watering.
3. Additionally, water samples will be collected from spring discharge upon uncovering of the former Travertine spring and the portal of the 165 level Adit. These samples will be collected and analyzed to aid in the management of these spring waters during and after completion of the removal actions specified in this Remediation Plan. All water samples will be collected under chain-of-custody protocols and transported to a State-certified laboratory for analysis. Samples will be analyzed for the following constituents using the appropriate test method:

Constituent	Test Method
Total/Dissolved Mercury	EPA 245.1
Methyl Mercury	EPA 1630
pH/Specific Conductivity/Turbidity	SM18 4500H+/2510B/2130B
Alkalinity (Bicarbonate, Carbonate, Total)	SM18 2320B
Total Organic Carbon	SM18 5310C
Total Dissolved Solids	SM18 2540C
Chloride, Bromide, Fluoride, Nitrate	EPA 300/SW846 9056A
Metals (Sb, As, B, Ca, Cr, Cu, Fe, Pb, Mg, Mn, Ni, K, Si, Na, Zn)	SW846 6010B

4.2 Site Preparation and Control

This section outlines the Site preparation and control methods and procedures to be implemented during Site removal and restoration activities, including mobilization and demobilization, materials and equipment staging, and road construction and improvements.

4.2.1 Mobilization and Demobilization

Mobilization and demobilization includes all work necessary to manage operations for the duration of the project. Mobilization tasks will include, but are not limited to:

- Project management of all construction operations;
- Completion and maintenance of the HASP;
- Delivery of all equipment and materials to support work and health and safety requirements;
- General Site preparation, including fencing, and signage, to support operations for the duration of the project; and
- Installation and maintenance of all stormwater BMPs.

Demobilization tasks will include, but are not limited to:

- Removal of temporary Site controls and facilities established by the subcontractor;
- Removal of any damage caused by temporary Site controls and/or removal work;
- Verification that post-construction SWPPP BMPs are in place at the conclusion of the project;
- Decontamination of all equipment leaving the Site; and
- Final inspection by CVRWQCB at the conclusion of the project.

4.2.2 Materials and Equipment Staging

Material and equipment staging areas will be located on the valley floor near the entrance to the Mine property and on the Mine terrace area located as shown on Figure 4-1. The staging areas will house field offices, equipment and material storage, and heavy equipment staging areas.

The valley floor staging area will be located in an area that is not impacted by past mining operations. Only minor or emergency equipment repair or maintenance will be completed in the staging area. Activities will be conducted within the staging areas in a safe manner that is protective of the environment. All generators used for power will have secondary containment for fueling and a spill response kit available at all times. The equipment maintenance area will also have secondary containment as well as stormwater BMPs in place to protect the surrounding area. Note non-emergency maintenance will be conducted off-site.

Storm water BMPs will be in place anytime material is being stored in the stockpile portion of staging areas. Stockpiles will be covered if substantial rain is in the forecast and run-off is possible.

At a minimum, BMPs will consist of straw wattles around the base of the pile and silt fence around the perimeter of the stockpile area.

Both the materials and equipment staging areas will be restored as described in Section 4.4 upon completion of the project.

4.2.3 Road Construction and Improvements

Road construction and improvements will be an ongoing task during the project. Mine access roads will be constructed or existing roads repaired on an as needed basis. Conceptual plans for road construction and improvements are shown in Figure 4-1. Tasks that will be performed for Mine access road construction include the following:

- Grading of existing roads for use by off-road trucks and equipment will be kept to a minimum. Roads will only be scraped to remove ruts, large rocks, or widened for safe passage of the largest piece of equipment using the road. These roads will be constructed by using a dozer to create a road and berm the spoils along the outer edge of the road for use later. The maximum road width will be 14 feet except in turn out areas. Roads will be re-contoured to minimize the disturbance of existing slopes.
- Replacing or extending drainage culverts may be required to accommodate larger vehicles.
- New culverts, steel trench plates, or a combination of the two will be used at locations where existing culverts or drainage channels require additional support.
- New access roads will be constructed only when needed. Each road will be constructed with a dozer just deep enough to remove vegetation and wide enough for the largest piece of equipment to access. Any material removed from the road will be bermed on the side for re-vegetation use when the work is complete. Roads will be constructed along contour as much as possible while providing safe passage of trucks and equipment. Turns will be kept wide so that additional rutting and damage to the area does not occur.

4.3 Mining-Related Material Remediation

This section describes the Mine-related material remediation methods (i.e., removal and managed-in-place) and procedures to be implemented during Site removal and restoration activities, including required equipment; structures and equipment removal and staging; waste rock, tailings, and sediment removal segregation, and staging; on-site management of Mine-related materials; and transportation.

4.3.1 Required Equipment

The removal of Mine-related materials (e.g., rock, tailings, and debris) will require at a minimum the use of heavy equipment, including:

- Excavator with thumb;
- Excavator with straight edge bucket;

- Multiple 10-wheel truck or off-road trucks;
- Water truck, all wheel drive;
- Drop tank for water;
- Loader;
- Dozer, D-6; and
- Dozer, D-6 LGP.

4.3.2 Structures and Equipment Removal and Staging

The removal of Mine-related structures is currently not anticipated as part of this Remediation Plan. If required due to encountered conditions, the removal of former Mine structures will be completed with an excavator with thumb with minor cutting. If hot work is need to dismantle steel structures, a separate job safety analysis form will be completed and included in the project HASP.

4.3.3 Waste Rock, Tailings, and Sediment Removal, Segregation, and Staging

Waste rock, tailings, and sediment will be removed from the Site using a systematic approach. Excavators will be used to excavate the material and load into haul trucks. The material will be removed using a straight edge bucket working from the outside edges of dumps and piles inward. The process will minimize the mixing of native material with the tailings, the over excavation of material, and the spreading of material into adjacent creeks and clean areas. To the extent possible, work will proceed from the furthest location of the Mine back toward the staging area. Material will be directly loaded into trucks and transported to the consolidation area in the former Mine workings for placement.

During sediment excavation, staging and amendment of sediments will be conducted in the area located immediately west of the pond as shown on Figure 4-1. Pond sediments will be excavated and amended via the addition of dry cement to stabilize them and condition the sediments allowing transportation to the consolidation area. Care will be taken to prevent generation of cement dust using a water buffalo during mixing activities. Mixing will also occur during sunny and low wind conditions. If average wind velocities are greater than 25 miles per hour, then lime stabilization activities will cease until conditions stabilize to stabilize them and allow transport to the consolidation area.

4.3.4 On-Site Management of Mine-Related Materials

The Mine-related material will be spread in thin lifts and compacted. The final surface shall be graded to match the surrounding surface, have positive drainage, and seeded with the approved upland seed mix to vegetate the finished surface. The final specifications for the consolidation and capping of waste materials will be detailed in the capping and grading plans developed as discussed in Section 3.4.1.

4.3.5 Transportation Plan

A Site transportation plan will be prepared during pre-mobilization to identify potential health and safety risks resulting from on- and off-site movement of materials, equipment, and debris. The preliminary transportation plan outlines appropriate procedures and precautions that will be taken to minimize potential risks, and will be modified during the project to reflect changing conditions, improved procedures, and expanded scope, as needed, including additional off-site disposal locations, if necessary.

4.4 Site Restoration Design

This section describes the Site restoration design, including required equipment, temporary road removal, re-grading and slope stabilization, sediment controls, and re-vegetation.

4.4.1 Required Equipment

Equipment required for Year 1 Site restoration may include the following:

- Water truck, all wheel drive;
- Dozer, D-6, with rippers; and
- Hydro seeder.

4.4.2 Restoration of Temporary Roads

All temporary roads used or constructed as part of this project will be removed when all construction is completed. Using excavating equipment and starting at the furthest extent of the access road, the roadway shall be graded to match existing grade and contour as the equipment "*backs out*" of the access road alignment. Road areas shall be graded such that no ponding of stormwater will occur and seeded with the approved seed mix to re-establish the vegetative cover. Restoration activities will include:

- Removal of culverts installed for creek crossings;
- Removal of signs or markers installed during mobilization;
- Removal of new temporary bridges, anchor blocks, and support blocks in creek;
- Rip the soil compacted during road construction to facilitate re-vegetation;
- Re-grade the road location to minimize visual evidence of the road;
- Re-grade to minimize run-off and erosion, per Sections 4.4.3 and 4.4.4; and
- Re-vegetate area per Section 4.4.5.

4.4.3 Regrading and Slope Stabilization

The restoration of disturbed areas and temporary roads will be completed by grading the area to blend with the surrounding grades and natural slopes to the extent practicable. Areas that have been compacted and abandoned will be graded and/or ripped to facilitate vegetation growth. All slopes and graded areas will minimize channeled stormwater run-off and erosion.

Slopes will be stabilized by track rolling with the dozer, will comply with stormwater BMPs, and will be finished with hydro seeding per the re-vegetation plan. For areas requiring fill along slopes, the material will be keyed in and compacted.

Where appropriate, grass filters may be employed to facilitate stabilization and mitigate sediment run-off to the creek. A grass filter is essentially a vegetated buffer zone lying on the flat to gently sloping terrace surface between the toe of the slope and the top of the main channel bank. The vegetation slows the velocity of sediment laden run-off causing the sediment to deposit on the surface within the limits of the vegetation coverage before reaching the edge of the stream bank. It relies on a high cover density of grass or grass-like vegetation (a dense cover of weeds will also be effective). The grass filter can be formed either by preserving an existing stand of dense vegetative cover (i.e., leaving a buffer zone) or by re-establishing a dense vegetative cover on a newly disturbed surface.

4.4.4 Potential Channel Sediment Controls at Dunn Creek

Dunn Creek flows on the eastern portion of the Site, and flow is toward the south. Dunn Creek's drainage on the northern portion of the Site is relatively topographically flat and near the northern portion of the Lower Pond SI, Dunn Creek is funneled into a narrow channel, which increases stream velocity and erosive energy. Near the southern end of the Lower Pond SI, Dunn Creek topographically drops approximately 4 feet, which has resulted in moderate to severe erosion at this location. At the request of Sunoco, SGI concreted with shotcrete the western portion of Dunn Creek as it bounds the Lower Pond SI to prevent erosion from damaging the southeast corner of the surface impoundment (SGI, 2009). The eastern portion of Dunn Creek at this location has since experienced moderate erosion and BMPs will be deployed to reduce the velocity of the channelized water before and after falling over the topographically higher ledge. BMPs will include inert rip-rap, energy dissipaters, and splash preventers. All BMPs will be selected and designed by a Professional Geologist/Professional Engineer prior to deployment.

4.4.5 Re-vegetation

A re-vegetation plan will be developed during the implementation phase of the project. The goal will be to introduce early succession stage vegetation that will (a) control soil erosion and (b) promote future succession of plant communities at the Mine. As underlying substrate and slope of areas following remediation cannot be accurately determined at this time, the re-vegetation plan will be developed during project implementation following completion of excavation and removal activities.

4.4.6 Maintenance and Monitoring Plan

Due to the unknown nature of the final design of some of the specific remedial actions described herein, development of a maintenance and monitoring plan will be conducted following completion of removal and consolidation activities. The maintenance and monitoring plan will be developed as appropriate based on the final known and/or designed disposition of implemented remedial actions concerning capped areas, re-vegetated areas, and water discharge controls. The maintenance and monitoring plan will be submitted to the CVRWQCB for review and approval consistent with the approach for the multiple implementation plans specified for development in this Remediation Plan.

4.5 Equipment Decontamination

Equipment decontamination will occur anytime a piece of equipment or truck that was in contact with contaminated material leaves the Mine area (boundaries to be determined in the field) or the Site. Mine area and staging area decontamination will be conducted in accordance with the following procedures:

- Contaminated material with be knocked off all equipment tracks and/or tires prior to leaving work area;
- Bulk transporters or on-site trucks will load in a single area outside of the contaminated zone to prevent material from being tracked out;
- Bulk transporters and on-site trucks will keep loads below the rail and will clean rails prior to proceeding on haul road; and
- Support vehicles will not enter contaminated zones.

Equipment and or trucks leaving the project Site will adhere to the following procedures:

- Equipment will be decontaminated in the staging area prior to leaving the Site. The bid specifications will include specific demobilization decontamination procedures.
- Bulk transport trucks will verify that rails and fenders of trucks are clear of soil and that tires are clean prior to leaving staging area. Knock-off pads will be constructed if necessary.
- Pickup trucks leaving the Site will have clean tires prior to leaving the Site on the access road.
- All vehicles leaving the property will have clean tires prior to entering Morgan Territory Road. Knock-off pads will be constructed if needed.

4.6 Geolocation

The limits of removal actions at the Mine will be photo-documented in the field and will be geolocated using a portable global positioning system (GPS) unit. The GPS data will be used to develop as-built maps of the construction effort using the existing project base maps, and will be augmented by a series of before-and-after photographs of all of the working areas.

4.7 Recordkeeping

This section describes recordkeeping procedures that will be followed during the removal and restoration activities at the Site, including daily field notes, the project permit book, and field and laboratory material characterization activities.

4.7.1 Daily Field Notes

Daily field notes, consisting of the following forms, will be produced during Site removal and restoration activities:

- Site visitor form – All site visitors will be required to sign in and out of the Site.
- Daily tailgate form - The daily tailgate form will document the days planned activities and health and safety discussions. This form will be signed by all Site visitors (form included in Site HASP).
- Field log - The field log will document Site activities, which includes, but not limited to, work completed, volumes excavated, materials leaving the Site, phone log, and decisions made in the field.
- Air monitoring log - Real time air monitoring and dust monitoring will be recorded daily (log included in the Site HASP).
- Off-site truck log - Off-site truck logs will contain the date, time, truck, material leaving the Site and the manifest for the load, if appropriate. It will be paired with a receiving log for materials imported to the Site, such as cap fill material.
- Photo log - Photo logs will be digital images of the progress of work throughout the day. Site photos as well as detailed photos will be organized chronologically and maintained electronically.

All of the Site daily field logs will be kept by the construction manager during Site construction activities, and will be provided to the project manager following completion of construction, for placement into the project file.

4.7.2 Permit Book

A record of all project approvals and permit conditions will be created as they are obtained and a "*Permit Book*" will be developed that contains all certified and signed permissions and exemptions, and a complete list of conditions and BMPs that are to be adhered to during construction. A hard copy of the Permit Book will remain on Site during construction, and copies will be distributed to appropriate responsible parties and contractor leads.

Following completion of removal and restoration activities, the Permit Book will be incorporated into the project file by the project manager.

4.7.3 Field and Laboratory Material Characterization Data Management

Data generated in the field may include field logbook entries, sample dates, field parameter measurements, observations, and additional information (such as field duplicate number). These data will be manually entered into an electronic format, and then checked by a second person, before final inclusion in the database. Following review and acceptance, analytical data generated by the subcontract laboratories will be obtained as an electronic data deliverable for import into the project database.

5.0 PROJECT SCHEDULE

Due to the nature of the removal actions presented herein, the implementation of the bulk of fieldwork will be limited to the dry construction season months of May through October. Considering these conditions, a conceptual project implementation schedule has been prepared based on potential implementation during the 2013 construction season as the earliest possible implementation time-frame. The project schedule is presented on Figure 5-1.

6.0 LIMITATIONS

This document was prepared for the exclusive use of Sunoco (R&M) Inc. (Sunoco) and the Central Valley Regional Water Quality Control Board (CVRWQCB) for the express purpose of complying with a regulatory directive for environmental investigation and development of a Site Remediation Work Plan. SGI and Sunoco must approve any re-use of this work product in whole or in part for a different purpose or by others in writing. If any such unauthorized use occurs, it shall be at the user's sole risk without liability to SGI or Sunoco. To the extent that this report is based on information provided to SGI by third parties, including Sunoco, their direct contractors, previous workers, and other stakeholders, SGI cannot guarantee the completeness or accuracy of this information, even where efforts were made to verify third-party information. SGI has exercised professional judgment to collect and present findings and opinions of a scientific and technical nature. The opinions expressed are based on the conditions of the Site existing at the time of the field investigation, current regulatory requirements, and any specified assumptions. The presented findings and recommendations in this report are intended to be taken in their entirety to assist Sunoco and the CVRWQCB personnel in applying their own professional judgment in making decisions related to the property. SGI cannot provide conclusions on environmental conditions outside the completed scope of work. SGI cannot guarantee that future conditions will not change and affect the validity of the presented conclusions and recommended work. No warranty or guarantee, whether expressed or implied, is made with respect to the data or the reported findings, observations, conclusions, and recommendations.

7.0 REFERENCES

Bradley, W.W. 1918. Quicksilver resources of California: California State Mining Bureau, Bulletin 78, p. 389.

CalFED. 2003. CalFED-Cache Creek Study, Task 5C2: Final Report. Final Engineering and Cost Analysis for the Sulphur Creek Mining District, Colusa and Lake Counties, California, prepared by Tetra Tech EM, Inc. September 2003.

California Division of Mines. 1956. Interim Report, Docket No. DMEA-2448 (Mercury). March 6.

California Division of Mines. 1958. California Journal of Mines and Geology, Mercury in Contra Costa County, Vol. 54, No. 4. October 1958, pp.530-535.

Central Valley Regional Water Quality Control Board (CVRWQCB). 2007. Sulphur Creek TMDL for Mercury - Final Staff Report. Sacramento, CA.

CVRWQCB. 2008. Central Valley Regional Water Quality Control Board, A Compilation of Water Quality Goals. July.

CVRWQCB. 2009. Revised Order to Sunoco Inc. To Submit Investigative Reports Pursuant to Water Code Section 13267, Mount Diablo Mine, Contra Costa County. December 30.

Churchill, R.K.,and Clinkenbeard, J.P. 2003. Assessment of the Feasibility of Remediation of Mercury Mine Sources in the Cache Creek Watershed, Final Report, September 2003.

Dibblee, W.T. Jr., 1980a, Preliminary geologic map of the Antioch south quadrangle, Contra Costa, County, California; USGS open file report.

Division of Water Resources, 1952, Marsh Creek Investigations report prepared for the Central valley Regional Water Pollution Control Board, 9 pp.

Graymer, R.W., D.L. Jones, and E.E. Brabb, 1994, Preliminary geologic map emphasizing bedrock formations in Contra Costa County, California: A digital database, U.S. Geological Survey Open-File Report 94-622.

Iovenitti, J.L., Weiss Associates, and Wessman, J. 1989. Mount Diablo Mine Surface Impoundment Technical Report. June 30.

Knox, Newton Booth. 1938. University of California Thesis, The Geology of the Mt. Diablo Mine. May.

Pampeyan, E. H. and Sheahan B. H. 1957. Final Report DMEA- 2448, Idm-E544 (Mercury), Mt. Diablo Quicksilver Mine, Contra Costa County, California.

Pampeyan, E. H. 1963. Geology and Mineral Deposits of Mount Diablo, Contra Costa County, California, Unites States Geological Survey, Special Report 80, California Division of Mines and Geology.

Ransome, A.L., and J.L. Kellogg. 1939. Quicksilver resources of California: California Journal of Mines and Geology, V. 35, No. 4, p. 353-486.

Ross C. P. 1940. Quicksilver Deposits of the Mount Diablo District, Contra Costa County, California .U.S. Geo. Survey Bull. 922-B.

Schuette, C. N. 1954. Letter to DMEA dated March 5, 1954.

Sheahan, B. H. 1956. Interim Report DMEA-2448 (Mercury), Mt. Diablo Quicksilver Mine, Contra Costa County, California. March 6.

Slotton, Darell G., Ayers, Shaun M., and Reuter, John E. 1996. Marsh Creek Watershed 1995 Mercury Assessment Project, Final Report, 66 pgs. March.

Slotton, Darell G., Ayers, Shaun M., and Reuter, John E. 1997. Marsh Creek Watershed Mercury Assessment Project – Second Year (1996) Baseline Data Report, 31 pgs. July.

Slotton, Darell G., Ayers, Shaun M., and Reuter, John E. 1998. Marsh Creek Watershed Mercury Assessment Project – Third Year (1997) Baseline Data Report with 3-Year Review of Selected Data, 62 pgs. June.

Smith, Ronnie B. 1951. Letter to Arthur J. Inerfield, Assistant Executive Officer, Central Valley Water Pollution Control Board. December 8.

State Water Pollution Control Board (WPCB). 1955. Activity Report – Mt. Diablo Mine, Arthur J. Inerfield (A.J.I.) and W.D.B. April 8.

The Source Group, Inc. (SGI). 2009. Final Summary Report for Removal Action to Stabilize the Impoundment Berm, January 28.

SGI. 2010a. Site Characterization Report, Mount Diablo Mercury Mine, 2430 Morgan Territory Road, Contra Costa County. August 2.

SGI. 2010b. Additional Characterization Work Plan, Mount Diablo Mercury Mine, 2430 Morgan Territory Road, Contra Costa County. October 18.

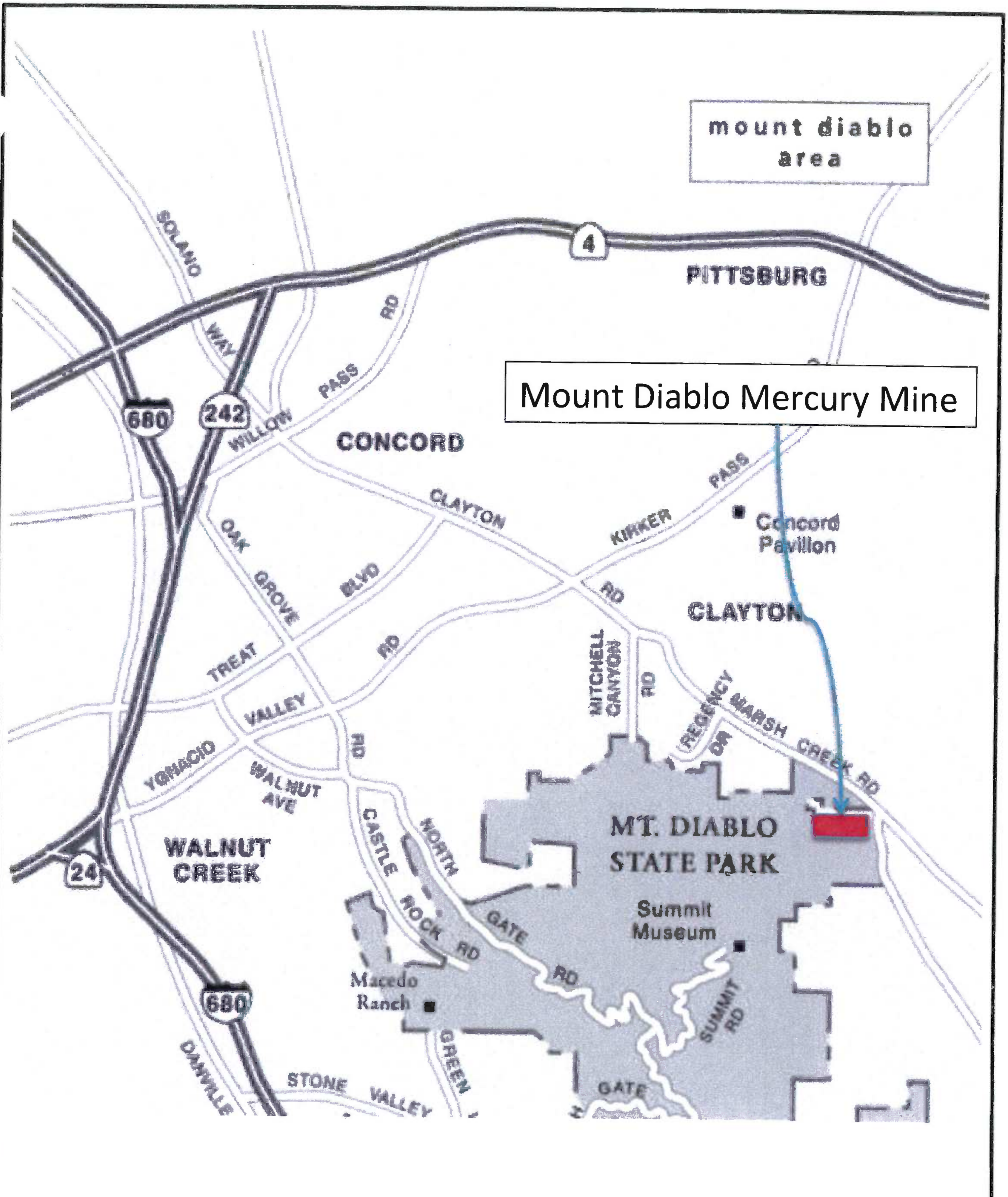
SGI. 2011. Additional Site Characterization Report, Mount Diablo Mercury Mine, 2430 Morgan Territory Road, Contra Costa County. December 7.

U.S. Environmental Protection Agency (USEPA). 2009. National Recommended Water Quality Criteria. Office of Water. Office of Science and Technology.

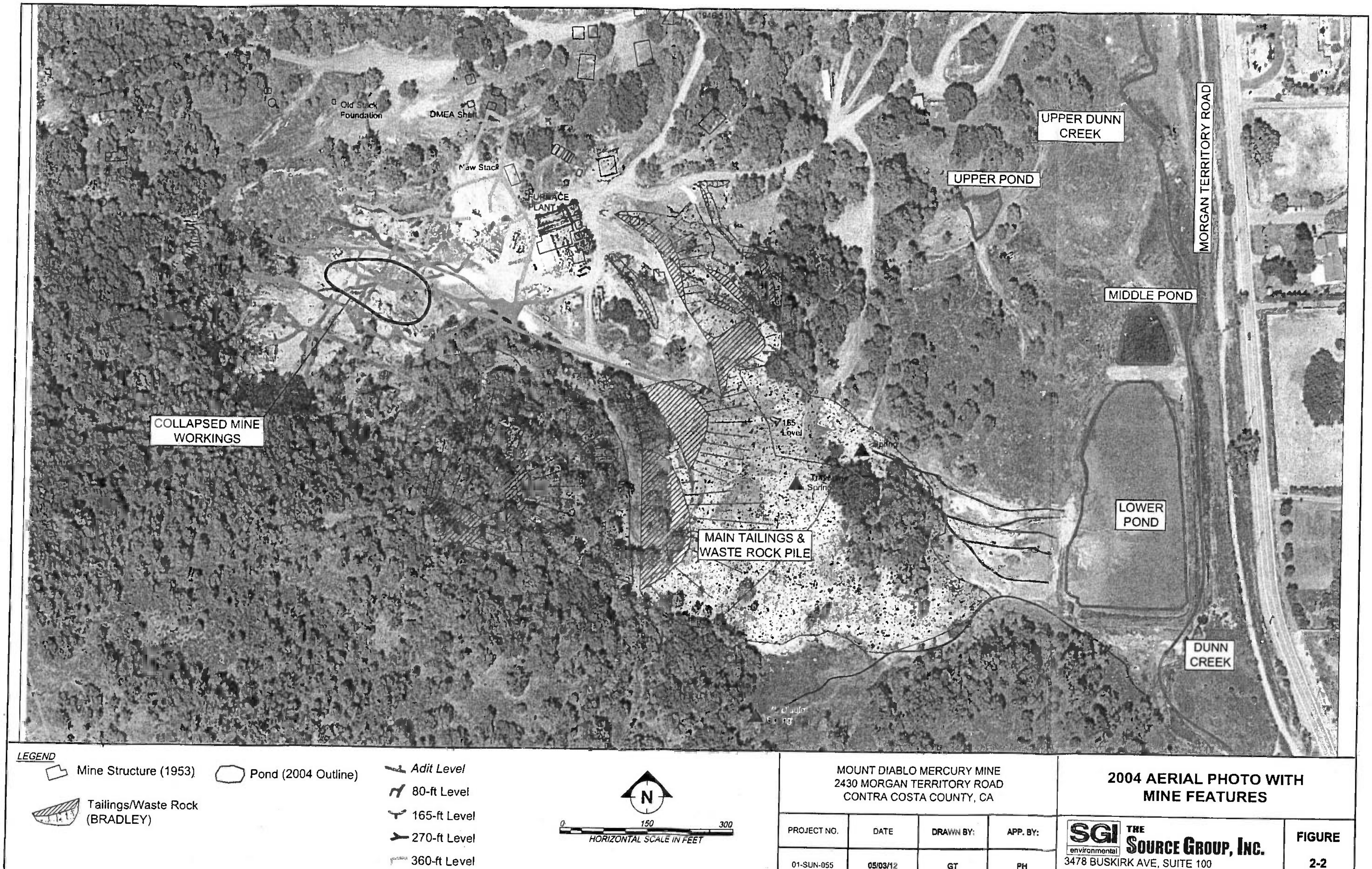
U.S. Geological Survey (USGS). 2004. Summary and Synthesis of Mercury Studies in the Cache Creek Watershed, California, 2000-01: U.S. Geological Survey Water-Resources Investigations Report 03-4335, 30 p.

FIGURES

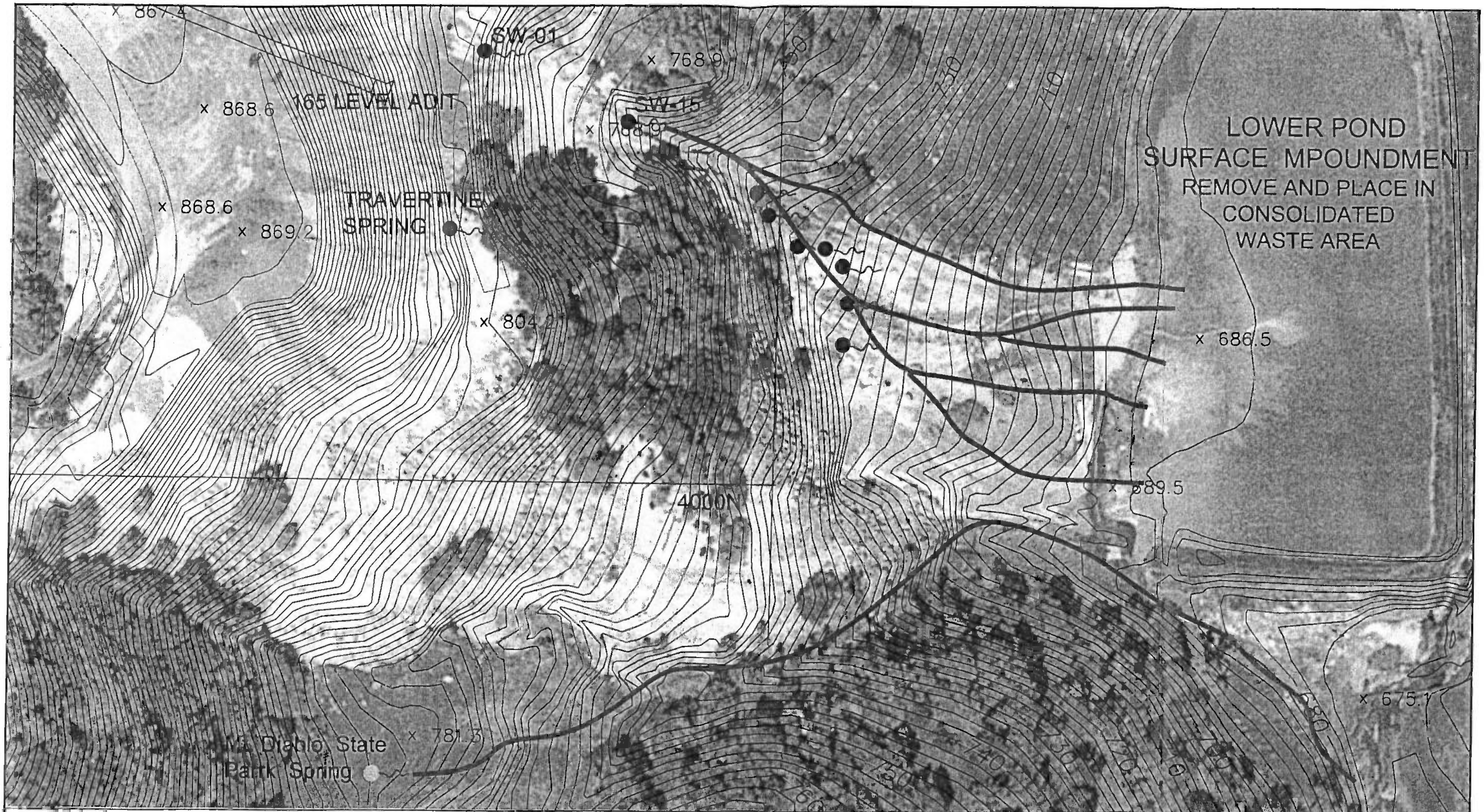
FIGURES



SGI environmental THE SOURCE GROUP, INC. 3478 BUSKIRK AVENUE, SUITE 100 PLEASANT HILL, CA 94523	MOUNT DIABLO MERCURY MINE 2430 Morgan Territory Road Contra Costa County, Calif				SITE LOCATION MAP	
	FILE NAME Diablo RP Figures Landscape.pptx	DATE 05/08/12	DR. BY: PDH	APP..BY: PDH	PROJECT No. 01-SUN-050	FIGURE 2-1



MOUNT DIABLO MERCURY MINE 2430 MORGAN TERRITORY ROAD CONTRA COSTA COUNTY, CA				2004 AERIAL PHOTO WITH MINE FEATURES	
PROJECT NO.	DATE	DRAWN BY:	APP. BY:	SGI environmental THE SOURCE GROUP, INC. 3478 BUSKIRK AVE, SUITE 100 PLEASANT HILL, CA 94523	FIGURE
01-SUN-055	05/03/12	GT	PH		2-2



LEGEND

- SPRING DISCHARGE & SEEPS
- PRE-MINING LOCATION OF TRAVERTINE SPRING
- 165 LEVEL ADIT BURIED PORTAL
- MT. DIABLO STATE PARK SPRING
- SPRING SEEPS FLOW DIRECTION

TOPOGRAPHIC CONTOUR INTERVAL = 2 ft

N

0 60 120
HORIZONTAL SCALE IN FEET

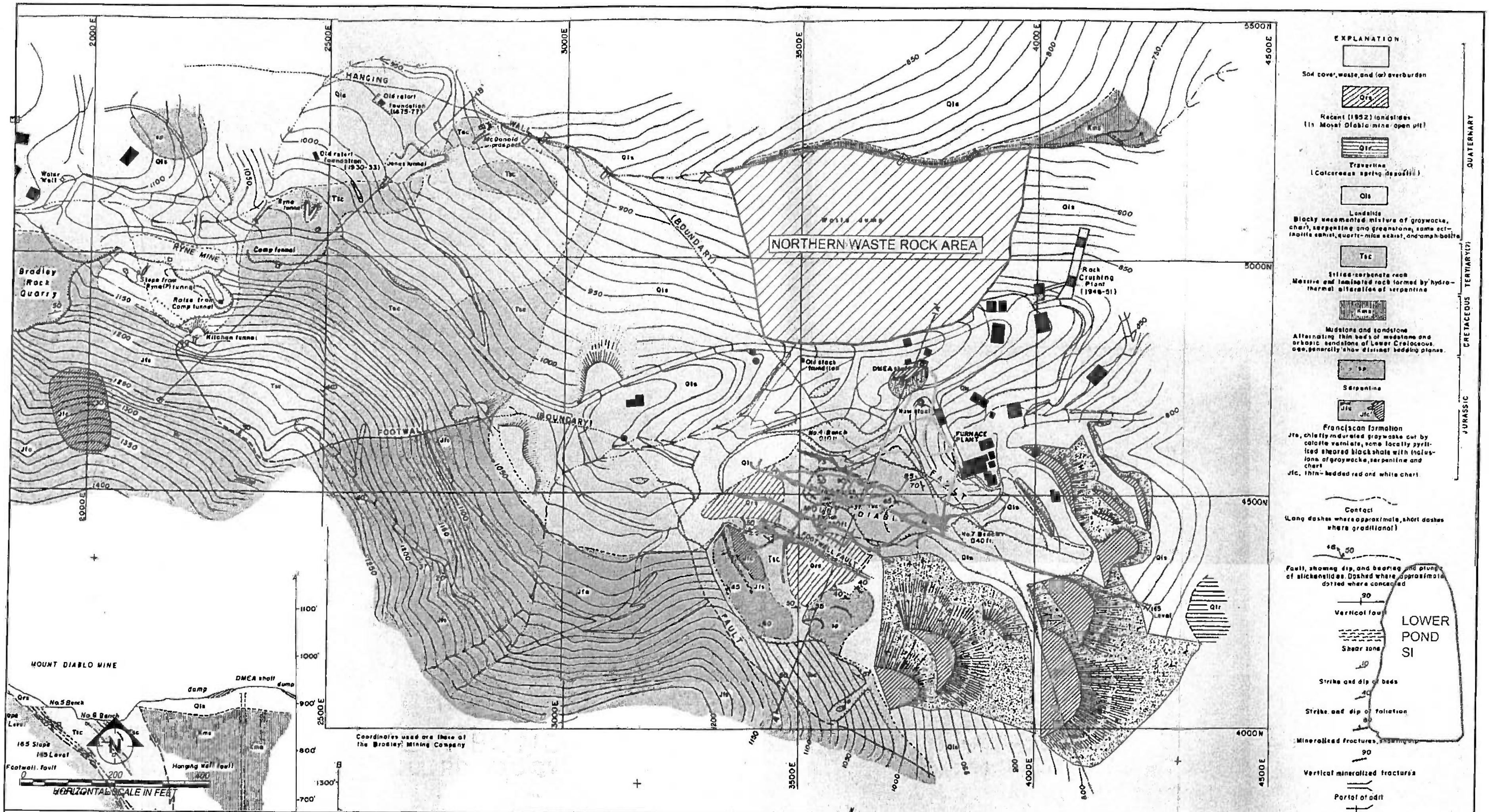
MOUNT DIABLO MERCURY MINE
2430 MORGAN TERRITORY ROAD
CONTRA COSTA COUNTY, CA

PROJECT NO.	DATE	DRAWN BY:	APP. BY:
01-SUN-055	04/24/12	GT	PH

MINE SPRINGS AND SEEPS

SGI environmental THE SOURCE GROUP, INC.
3478 BUSKIRK AVE, SUITE 100
PLEASANT HILL, CA 94523

FIGURE
2-3



LEGEND

- Mine Structure (1953)
- Tailings/Waste Rock (Bradley)
- Tailings/Waste Rock (DMEA/Cordero)
- Adit Level
- 80-ft Level
- 165-ft Level
- 270-ft Level
- 360-ft Level

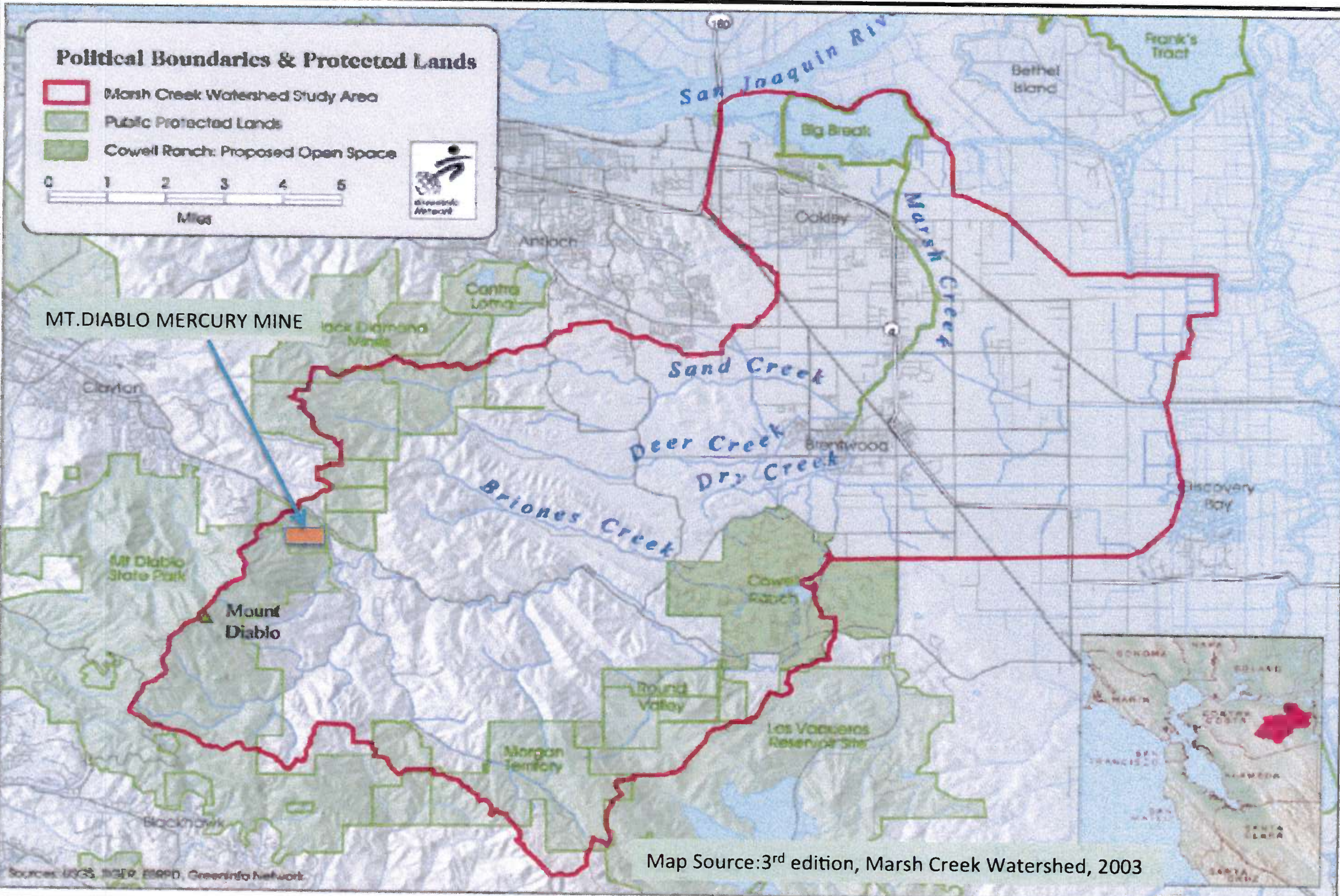
MOUNT DIABLO MERCURY MINE
2430 MORGAN TERRITORY ROAD
CONTRA COSTA COUNTY, CA

SITE GEOLOGY FROM PAMPEYAN

PROJECT NO.	DATE	DRAWN BY:	APP. BY:
01-SUN-055	05/03/12	GT	PH

SGI environmental THE SOURCE GROUP, INC.
3478 BUSKIRK AVE, SUITE 100
PLEASANT HILL, CA 94523

FIGURE
2-4



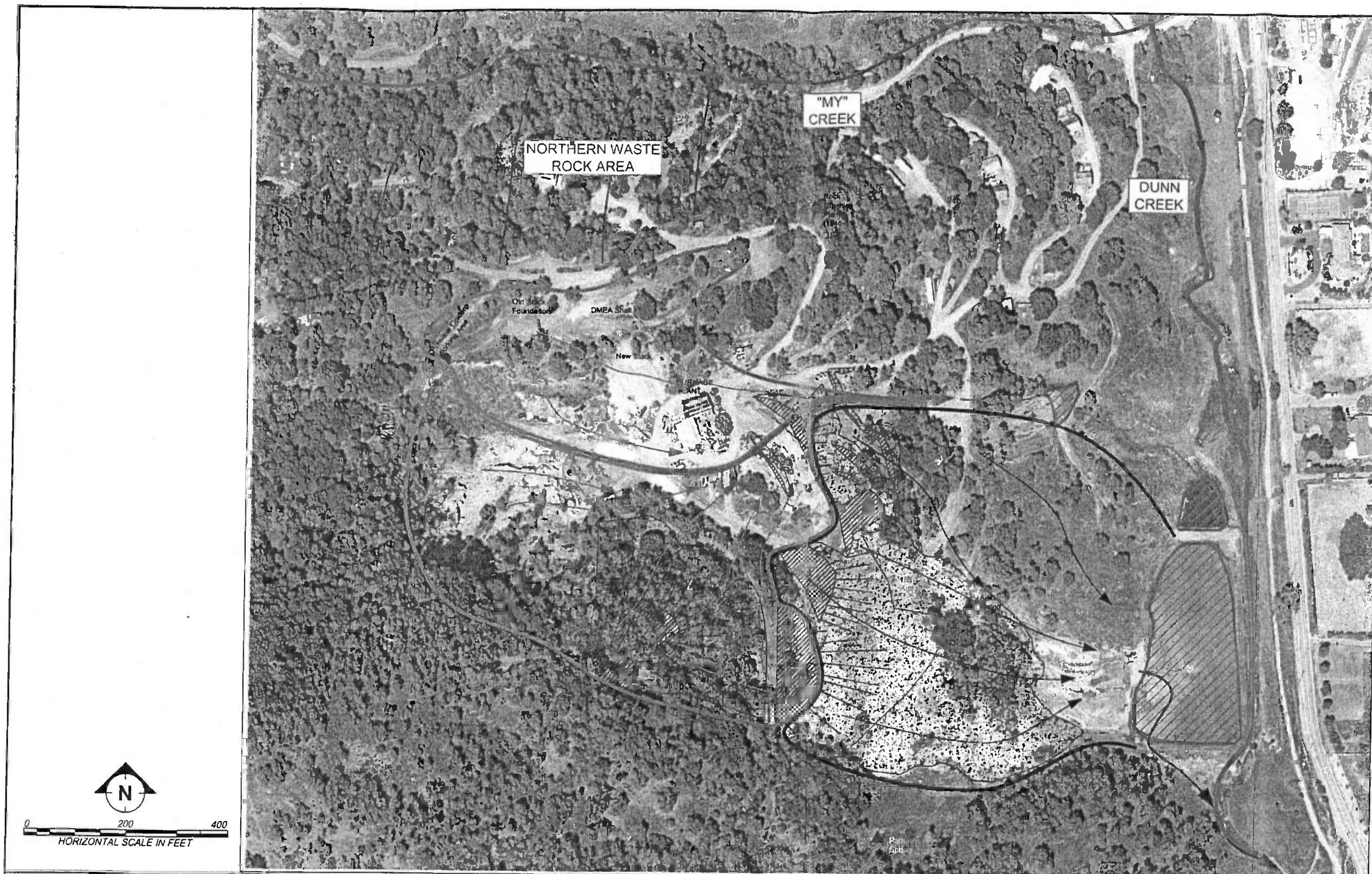
SGI environmental THE SOURCE GROUP, INC.

3478 BUSKIRK AVENUE, SUITE 100
PLEASANT HILL, CA 94523

MOUNT DIABLO MERCURY MINE
2430 Morgan Territory Road
Contra Costa County, California

MARSH CREEK WATERSHED

FILE NAME	DATE	DR. BY:	APP. BY:	PROJECT No.	FIGURE
Diablo RP Figures Landscape.PPTX	05/07/12	PDH	PDH	01-SUN-050	2-5



LEGEND

- Mine Structure
- Spring
- Pond (2004 Configuration)
- Tailings/Waste Rock (Bradley)
- Surface flow
- Surface flow

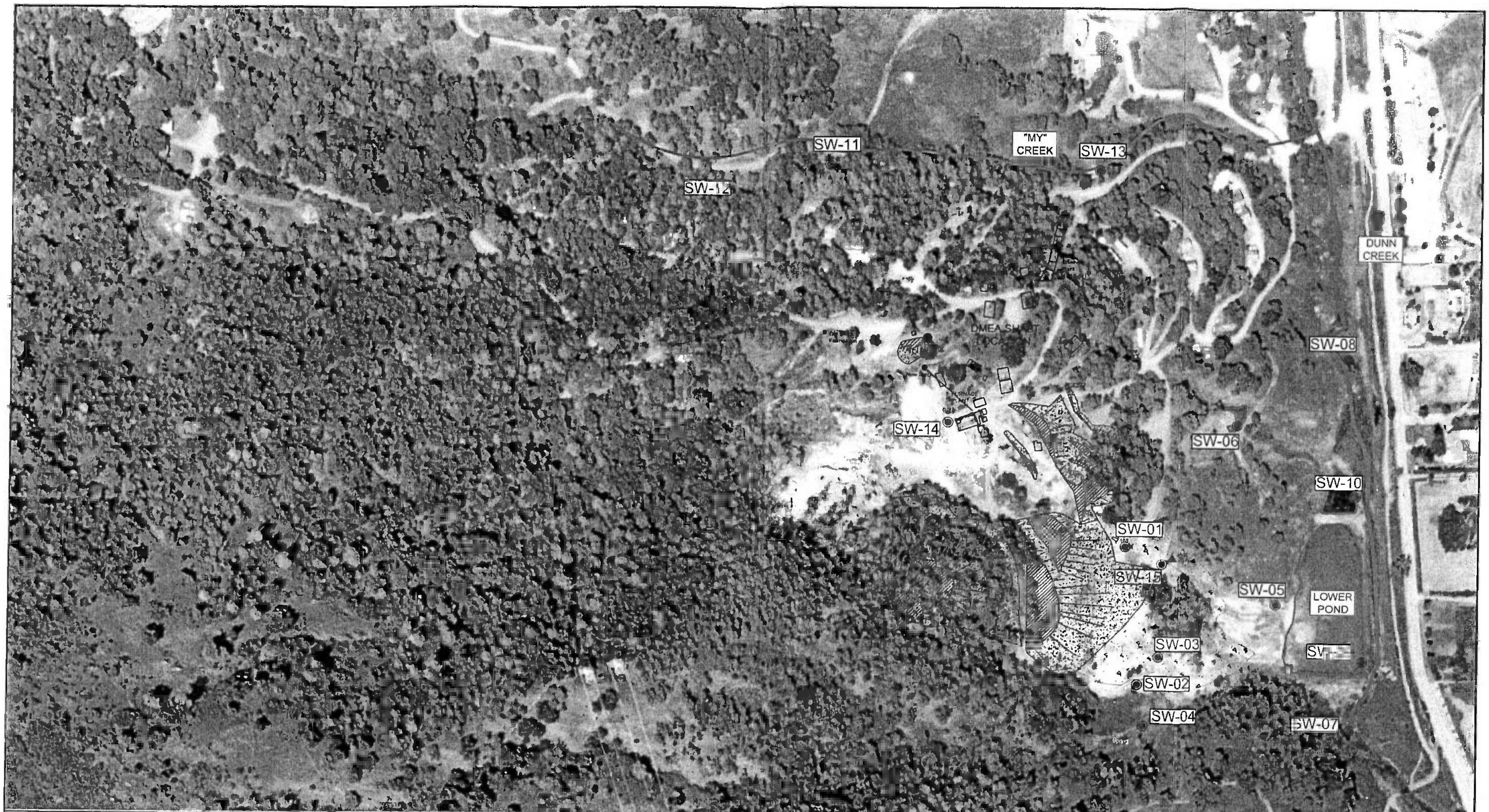
MOUNT DIABLO MERCURY MINE
2430 MORGAN TERRITORY ROAD
CONTRA COSTA COUNTY, CA

PROJECT NO.	DATE	DRAWN BY:	APP. BY:
01-SUN-055	05/03/12	GT	PH

SURFACE WATER DRAINAGE AND FLOW PATTERNS

SGI environmental
THE SOURCE GROUP, INC.
3478 BUSKIRK AVE, SUITE 100
PLEASANT HILL, CA 94523

FIGURE 2-6



LEGEND

Mine Structure (1953)

Tailings/Waste Rock (BRADLEY)

Surface Water Sample Locations

N

0 250 500
HORIZONTAL SCALE IN FEET

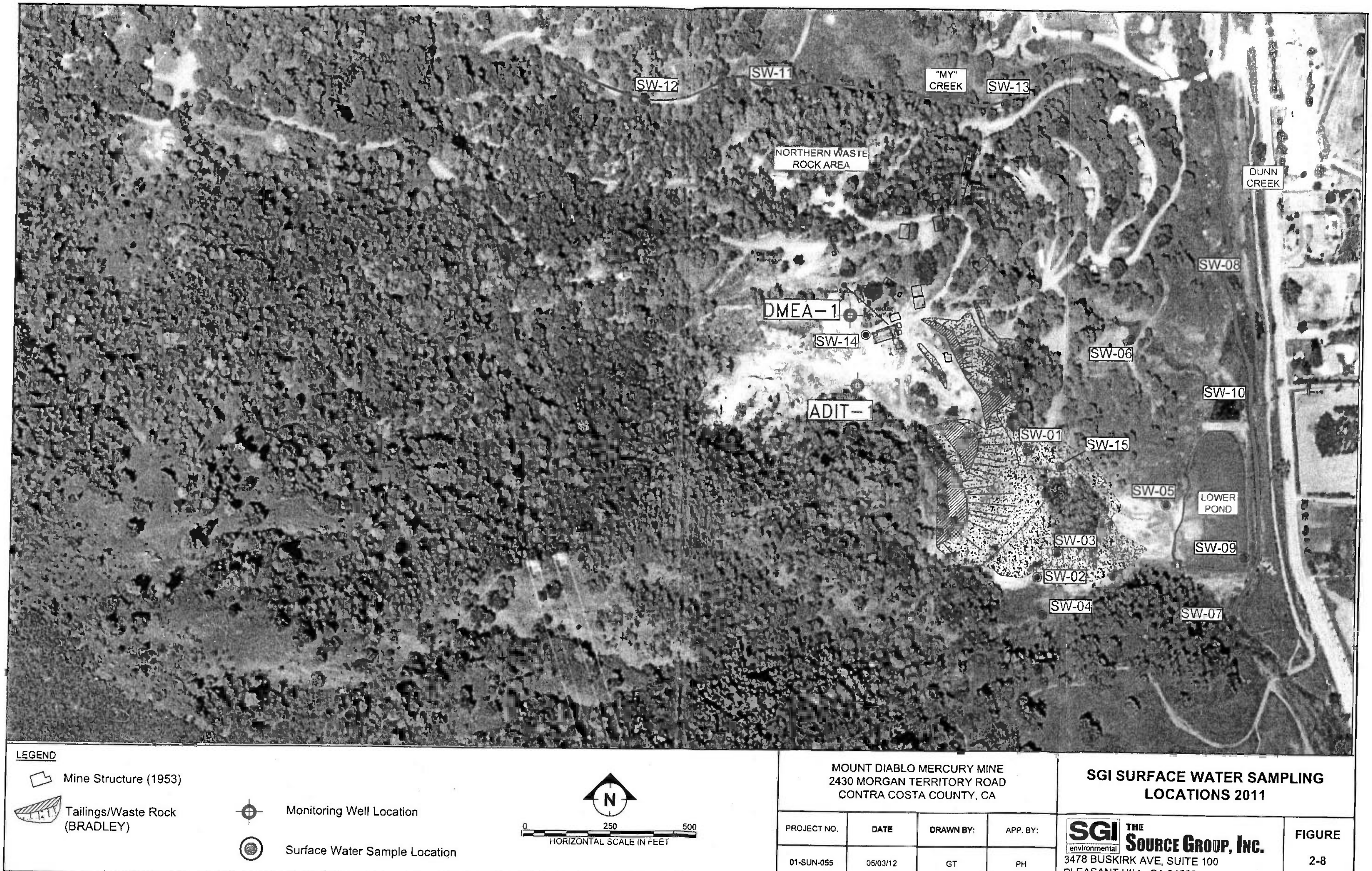
MOUNT DIABLO MERCURY MINE
2430 MORGAN TERRITORY ROAD
CONTRA COSTA COUNTY, CA

PROJECT NO.	DATE	DRAWN BY:	APP. BY:
01-SUN-055	05/03/12	GT	PH

SGI SURFACE WATER SAMPLING LOCATIONS 2010

SGI environmental THE SOURCE GROUP, INC.
3478 BUSKIRK AVE, SUITE 100
PLEASANT HILL, CA 94523

FIGURE 2-7



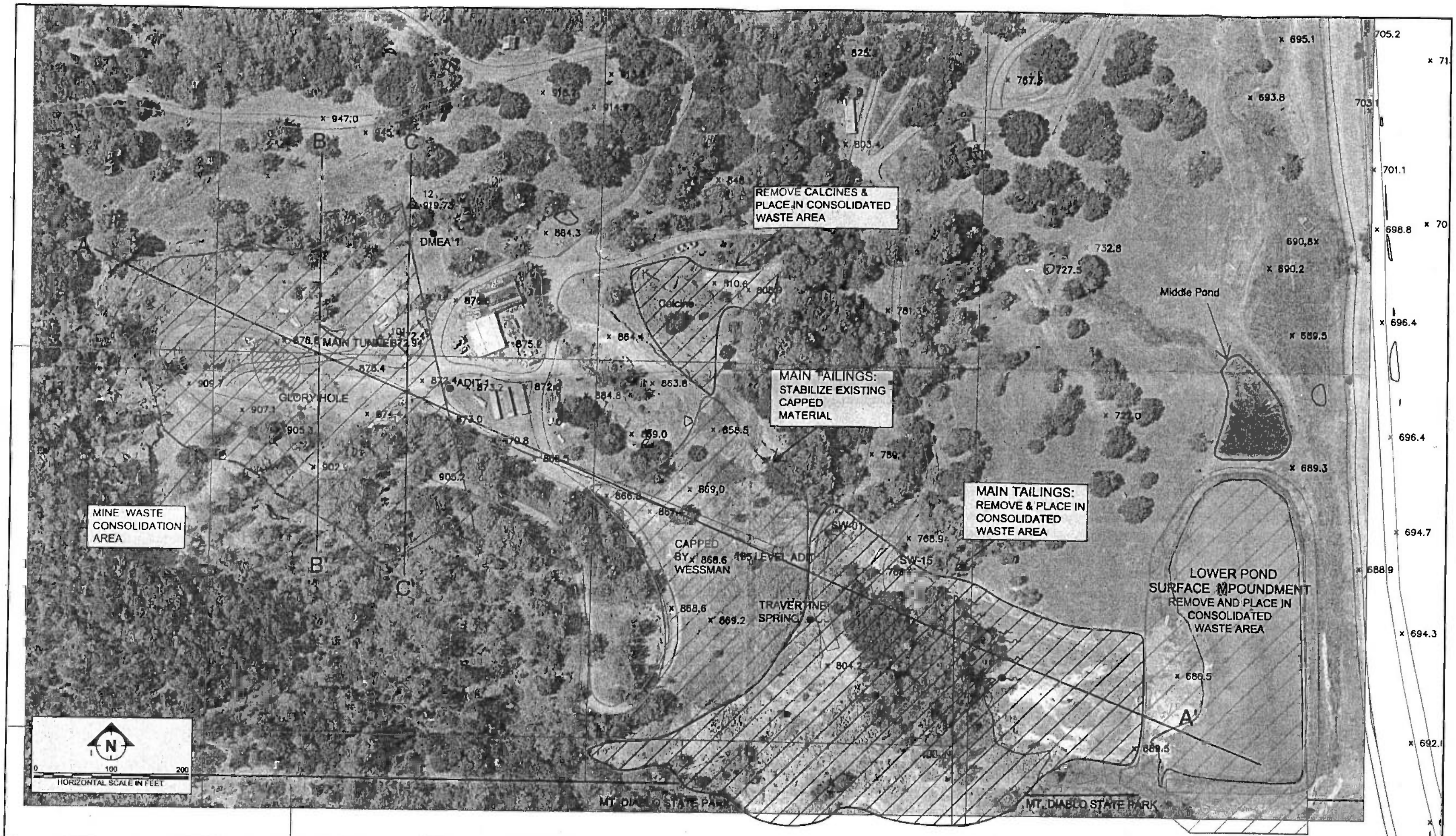
MOUNT DIABLO MERCURY MINE
2430 MORGAN TERRITORY ROAD
CONTRA COSTA COUNTY, CA

PROJECT NO.	DATE	DRAWN BY:	APP. BY:
01-SUN-055	05/03/12	GT	PH

SGI SURFACE WATER SAMPLING LOCATIONS 2011

SGI environmental THE SOURCE GROUP, INC.
3478 BUSKIRK AVE, SUITE 100
PLEASANT HILL, CA 94523

FIGURE 2-8



LEGEND

AREA OF MAIN TAILINGS PROPOSED FOR REMOVAL AND CONSOLIDATION IN MAIN PIT AREA

AREA OF CAPPED TAILINGS

AREA OF LOWER POND FOR REMOVAL

AREA OF CALCINES TO BE REMOVED AND PLACED IN CONSOLIDATED WASTE AREA

MINE WASTE CONSOLIDATION FOOTPRINT

OUTLINE MIDDLE POND

CROSS SECTIONS LOCATIONS

SPRING DISCHARGE & SEEPS

PRE-MINING LOCATION OF TRAVERTINE SPRING

165 LEVEL ADIT BURIED PORTAL

TOPOGRAPHIC CONTOUR INTERVAL = 2 ft

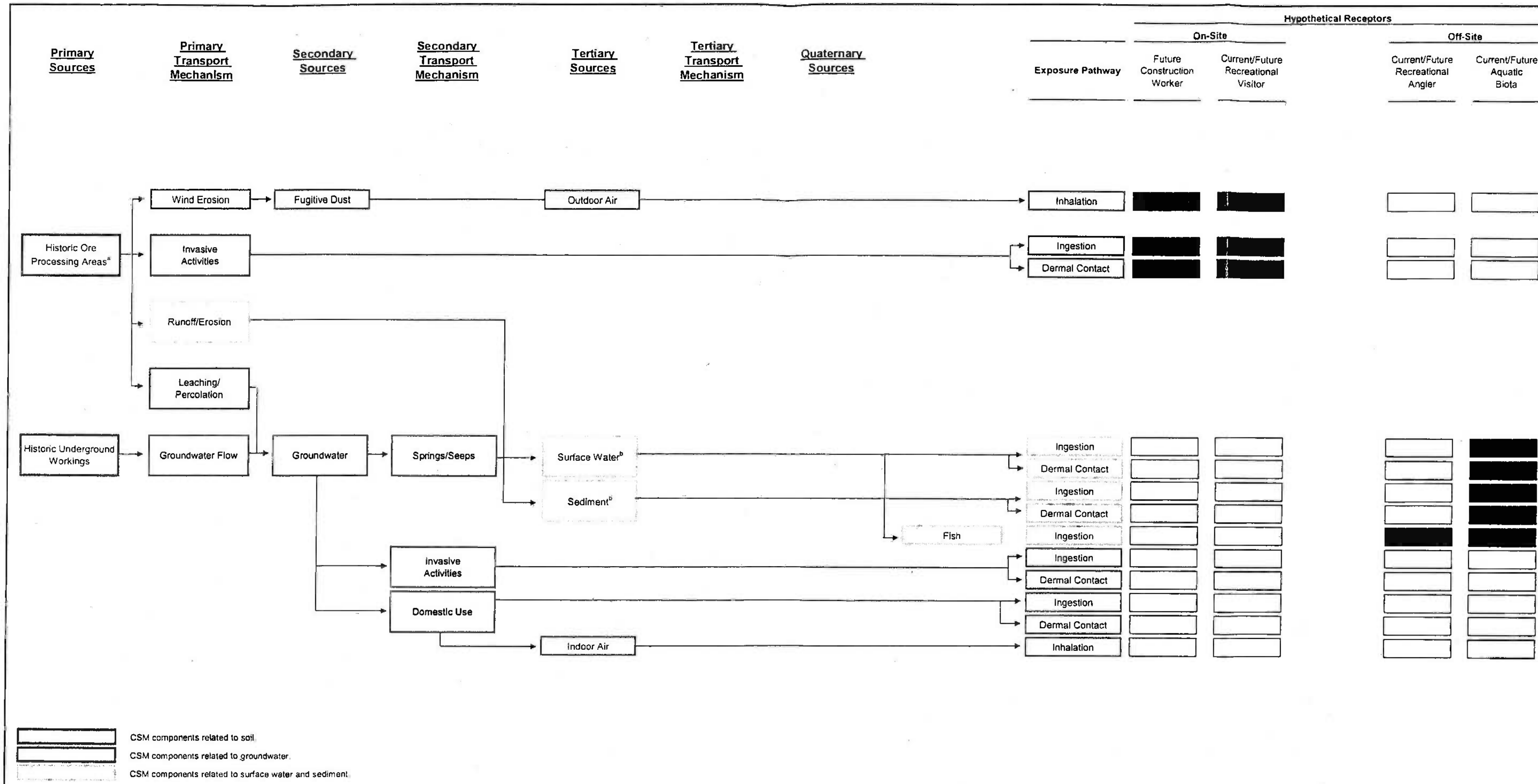
MOUNT DIABLO MERCURY MINE
2430 MORGAN TERRITORY ROAD
CONTRA COSTA COUNTY, CA

PROJECT NO.	DATE	DRAWN BY:	APP. BY:
01-SUN-055	05/07/12	GT	PH

SGI environmental THE SOURCE GROUP, INC.
3478 BUSKIRK AVE, SUITE 100
PLEASANT HILL, CA 94523

REMEDIAL PLAN FEATURES MAP

FIGURE
2-9



[a] Historic ore processing areas include buildings, process tailings, waste rock.

[b] All surface water leaving the Mine is ultimately captured by Dunn Creek. Dunn creek flows south from the Mine Site to join Marsh Creek 0.5 miles downstream. Marsh Creek then flows approximately 11 miles to discharge into the Marsh Creek Reservoir and then into the western San Joaquin Delta at Big Break.

MOUNT DIABLO MERCURY MINE
2430 MORGAN TERRITORY ROAD
CONTRA COSTA COUNTY, CALIFORNIA

PROJECT NO.	DATE	DRAWN BY	APP. BY
01-SUN-050	04/23/12	TC	ll

RISK SCREENING
CONCEPTUAL SITE MODEL

SGI THE SOURCE GROUP, INC.
3478 BUSKIRK AVENUE, SUITE 100
PLEASANT HILL, CA 94523

FIGURE 2-10