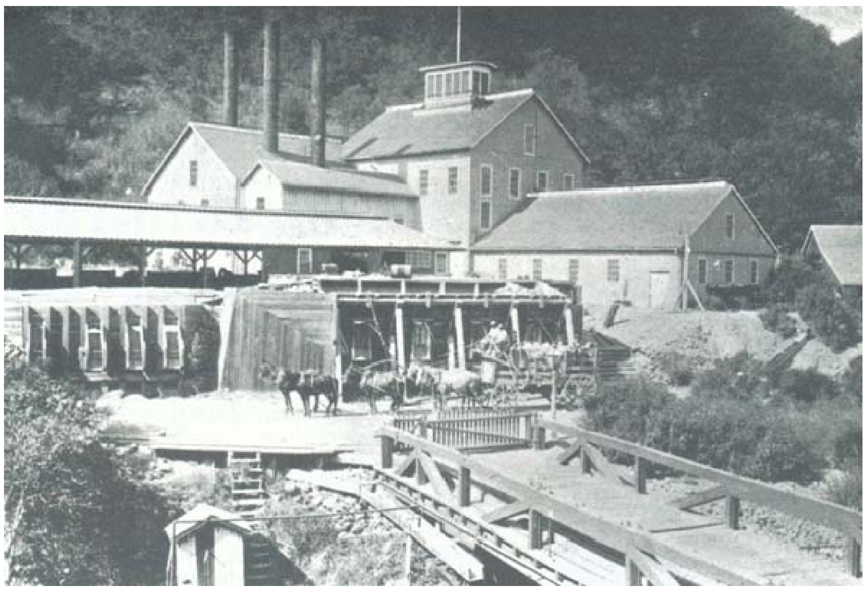
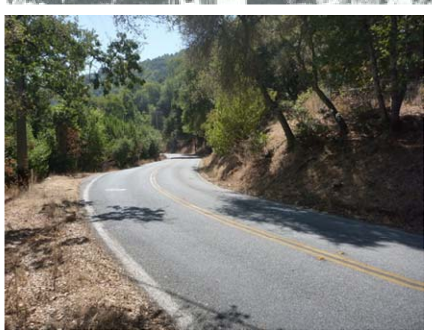
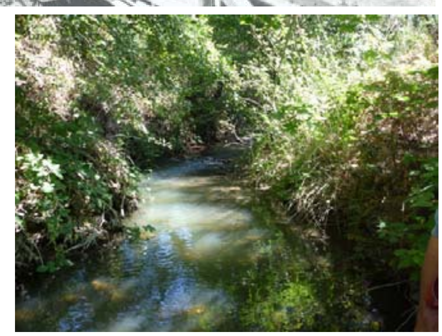
MERCURY MINE WASTE EROSION INVENTORY:
RANCHO DE GUADALUPE AREA
SIERRA AZUL OPEN SPACE PRESERVE

April 13, 2011
(Revised)







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Job No: MPEN-SARTI-483

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TABLE OF CONTENTS

1.0 INTRODUCTION

This study was prepared at the request of the Midpeninsula Regional Open Space District (District) to conform to the first phase requirements of the Guadalupe River Watershed Mercury Total Maximum Daily Load (TMDL) as outlined in California Regional Water Quality Control Board (RWQCB) Water Code Section 13267 Technical Report Requirement letter dated June 18, 2009 (RWQCB, 2009). This report concludes an intensive inventory of potential mercury mine sites and roads on portions of the Sierra Azul Open Space Preserve in the vicinity of the New Almaden Mining District and Guadalupe Mercury Mine, Santa Clara County, CA (Figures 1 and 3). Parcels of land owned by the District that are of particular interest in this study are located within the Rancho de Guadalupe Area of this Preserve (Figure 3).

The District's Rancho de Guadalupe Area is located immediately adjacent to the greater Guadalupe Mine and includes mine features associated with the Guadalupe Mine (Figure 3). The Guadalupe Mine and the numerous mines of the New Almaden Mining District, were once the largest producer of mercury (quicksilver) in North America. The Guadalupe River Watershed Mercury TMDL Project found many of the waters in the Guadalupe River watershed to be polluted and/or impaired by mercury (Tetra Tech, 2005b). As part of the first phase of the TMDL, the California Regional Water Quality Control Board (RWQCB) requires landowners to prepare a technical report identifying the locations of possible mining wastes that are eroding, or potentially eroding into surface waters.

1.1 PROJECT GOALS AND OBJECTIVES

The objectives of this study are to:

- Systematically inventory the location of possible mercury mine waste sites within Sierra Azul OSP from review of available documents, Federal mining records included in the MAS/MILS database, historic aerial photographs and field reconnaissance. This review excludes Hicks Flat where mine waste has been previously identified.
- Qualitatively characterize the mine waste and preliminary testing of select soils for total mercury following EPA method 7471A
- Evaluate the potential for erosion and discharge of mercury laden mine wastes into surface waters
- Develop preliminary treatment alternatives, as necessary, to address eroding mercury mine waste, where reasonable and feasible per TMDL Staff Report guidelines (RWQCB, 2008)(pg 9-11).
- Prioritize implementation treatments to assure biological, physical, and economic effectiveness.

2.0 BACKGROUND

The Rancho de Guadalupe Area of the Sierra Azul Open Space Preserve is located in the upper Guadalupe River watershed on the north side of the Santa Cruz Mountains (Figures 1 and 3).

The northern portion of the preserve lies within and adjacent to the New Almaden Mining District and Guadalupe Mine, the highest mercury producing mining district in the California Coast Range Mercury Belt. Hicks Road generally bounds the northern portion of the study area (Figure 3).

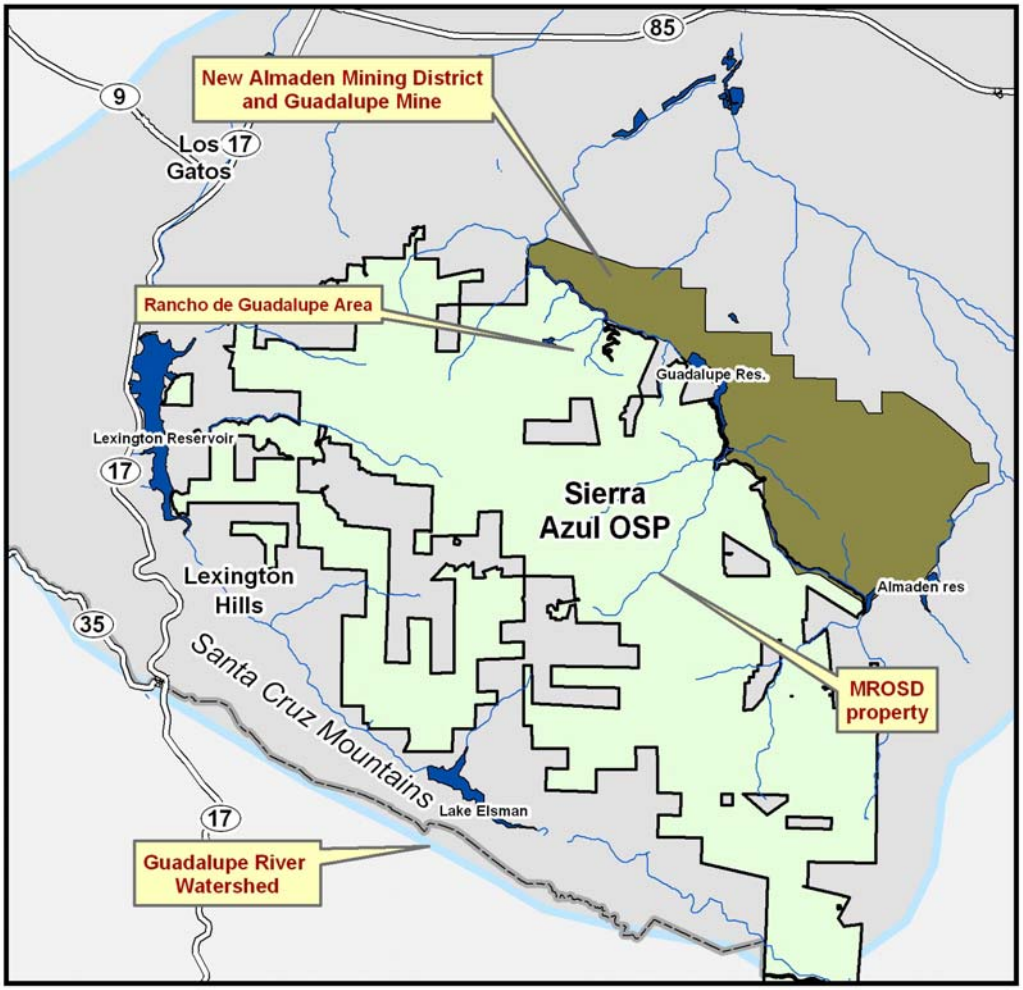

Figure 1: Location Map

2.1 GEOLOGIC SETTING

McLaughlin and others (2001) and Bailey and Everhart (1964) map the region as underlain by Central Belt Franciscan Complex, a Cretaceous and Jurassic Age accumulation of folded and faulted continental margin deposits (Figure 2).

Mercury deposits are chiefly associated with serpentine intrusions into the Franciscan Formation, where the serpentine has been hydrothermally-altered to silica carbonate (Bailey and Everhart, 1964). The naturally occurring mercury is principally in the form of the mineral cinnabar (mercury sulfide) in the silica carbonate. Silica carbonate rocks are mapped primarily on the north side of Guadalupe Creek in and around the historic Guadalupe Mine and New

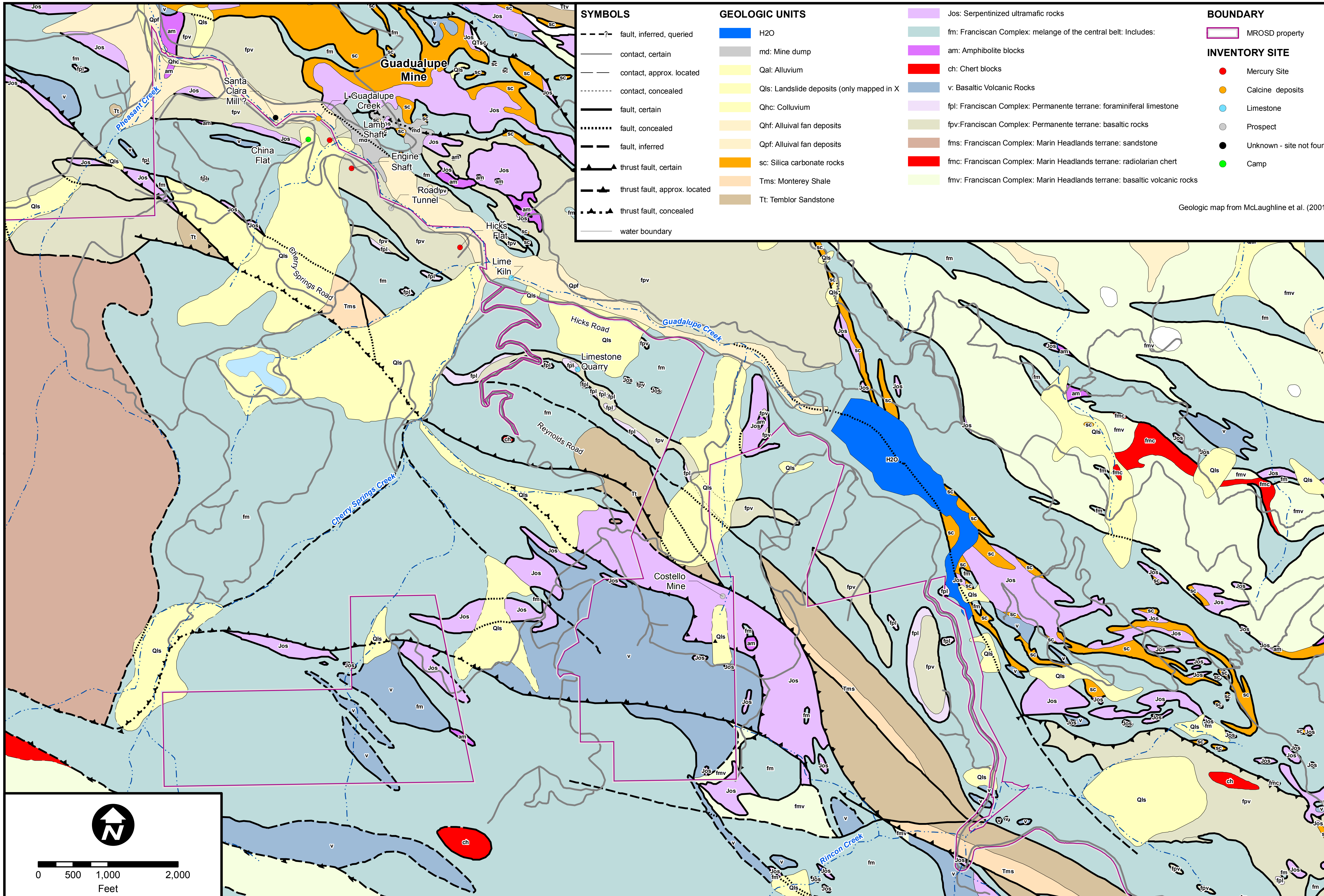

FIGURE 2A
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GEOLOGIC MAP
Rancho de Guadalupe area: Sierra Azul OSP
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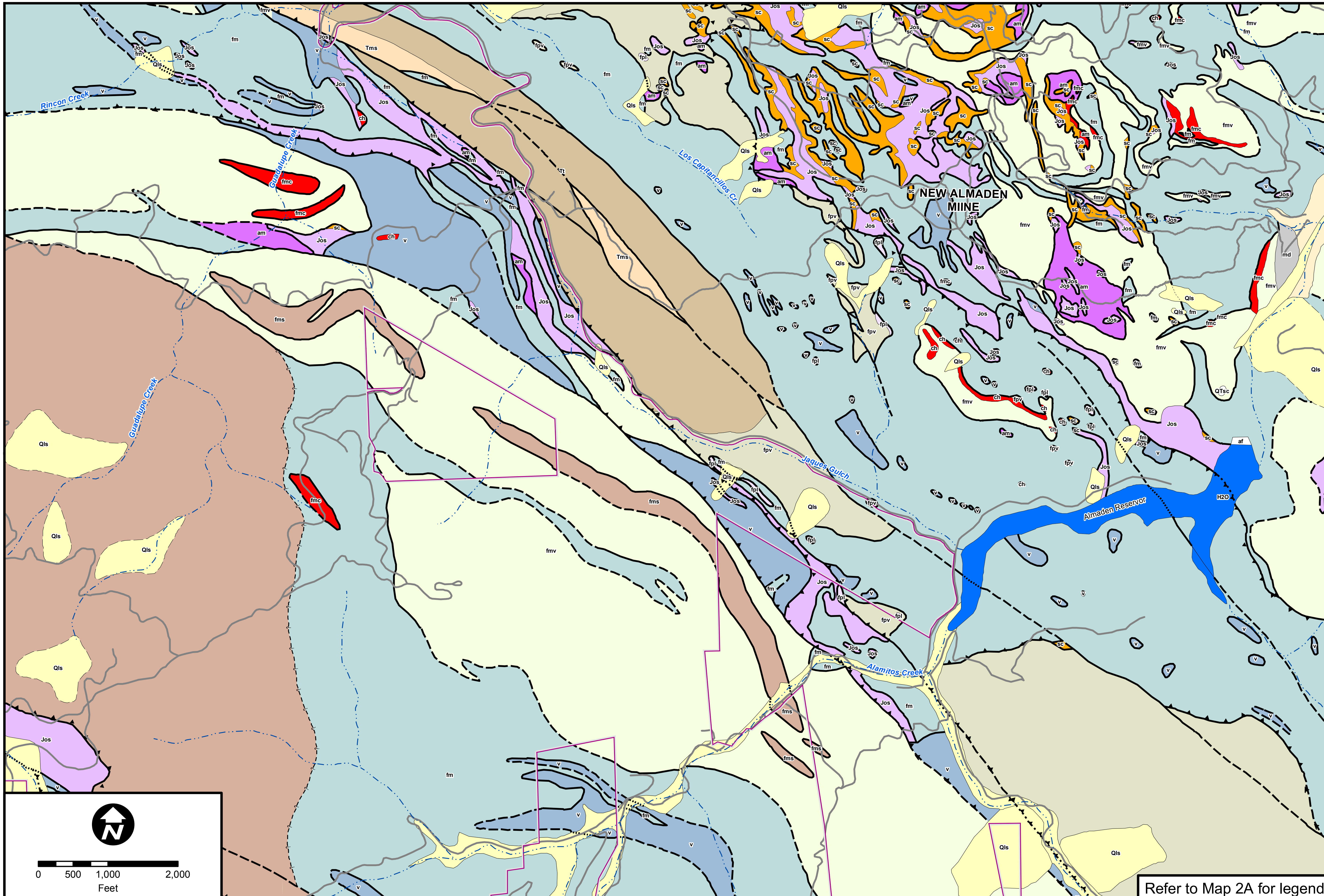

FIGURE 2B

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GEOLOGIC MAP

Rancho de Guadalupe area: Sierra Azul OSP

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Almaden Mines (Figures 2A, 2B). With the exception of a small outcrop of silica-carbonate rock mapped by McLaughlin et al. (2001) in upper Guadalupe Creek, these rocks are not mapped on District lands. Silica-carbonate are found at depth in the immediate vicinity of the "Engine Shaft" site as described later in this report.

Natural shallow and deep-seated landsliding is an active process within the Santa Cruz Mountains. Regional landslide mapping reveals much of the study area to be underlain by a series of large deep-seated landslide complexes (Wentworth et al., 1997). These slides are characterized by a somewhat cohesive slide mass with a relatively deep failure plane compared to shallow debris slides and debris flows. Shallow-seated landslides are also present within the preserve. These include debris slides, debris flows, channel bank failures and road/trail fill failures characterized by rapid, shallow (generally less than 10 feet thick) downslope movement of surficial soil, colluvium, and weathered bedrock. Most of these failures are located on comparatively steep slopes. There are no landslides related to mercury mines or mine waste in the study area.

2.2 HISTORIC MINING

Mining-related operations are known to have occurred on District lands but these were generally adjunct to the larger area of operations along the north side of Guadalupe Creek referred to as the Guadalupe Mine (Figure 3). Mining in the Guadalupe Mine area began in 1846, with peak production occurring in 1879. The mercury that was mined was principally in the form of the mineral cinnabar (mercury sulfide) in the silica carbonate rocks. The majority of the ore that was extracted from the area was from deep underground shafts and tunnels in contrast to open pits (Bailey and Everhart, 1964).

Ore was visually hand sorted at the shaft based on the presence of cinnabar, an obvious bright red mineral. High grade material was transported to the processing site, mapped on the north side of Guadalupe Creek. Overburden that lacked cinnabar or was of low economic value was typically dumped as mine tailings.

Common to many mercury mine sites, ore was processed close to the extraction shaft locations. The processing of the raw ore was done by heating in large furnaces to over 700 degrees (F) which vaporized the mercury, which was then recondensed by cooling into its liquid form. The resulting mine wastes are termed calcines. These processing areas are shown on the historic 1874 and 1887 maps as retorts, furnaces, reduction works, or mills, and are located on the north and east side of Guadalupe Creek, off of District lands (Appendix 2)(Becker, 1887; Herrmann, 1874). Typical of the early mining period practices, roasted ores (called calcines) were dumped into creeks to wash downstream. These extensive waste dumps are also evident on the 1874 and 1887 maps, shown adjacent to the processing areas off District lands.

DeGraff et al. (2007) reports that "Rather than the actual mine workings, it is the associated mill facility that is often responsible for the highest and most mobile concentrations of mercury at the mine site." Calcines can contain residual cinnabar but also elemental mercury, metacinnabar, and various sulfate, chloride and oxychloride compounds of mercury. Because of this, one of the main sources of mercury contamination and exposure present at a mercury mine site is the calcines. In the context of the Guadalupe Mercury TMDL greater importance is placed on the mitigation of calcines (RWQCB, 2008, 2009).

2.2.1 Mining on District Lands

The principal mercury mining operations on District lands occurred at the Engine Shaft (Figure 3). The Engine Shaft is a 600 foot deep vertical shaft located on the south side of Guadalupe Creek accessing a group of underground workings known as the Old Mine (Bailey and Everhart, 1964). The site was mainly used for ore production (extraction of raw ore) through the first decade of 1900, until the "New" or Guadalupe Inclined shaft was established on the north side of the creek and became the main mine working shaft. Through 1922 the Engine Shaft was used principally for dewatering the New mine (Bailey and Everhart, 1964). In 1969, spoils were excavated to reopen the Engine Shaft by the New Idria Mining and Chemical Company and were placed at Hicks Flat now owned by the District. These spoils are known to be contaminated with mercury, though all processing of ore was done offsite at the New Almaden mine or at the New Idria mine in San Benito County (Cox, 1995). The Hicks Flat site has already been evaluated, with remediation pending, and therefore is not included in this inventory.

In addition to the Engine Shaft and Hicks Flat sites, the MAS/MILS mineral location database (Causey, 1998) identifies several smaller mines and/or prospects on District lands. These include the Lamb Shaft, Road Tunnel, Brainard Prospect, Costello Mine, and the Bowie site. Mine waste and calcine deposits are also found locally along Guadalupe Creek (Tetra Tech, 2003). There is no known record of processing of ore on District lands.

Mining of other ore including limestone, chromite, copper, and stone also took place in the area. These sites are briefly discussed by Nolan (2001). Several limestone quarrying and lime processing sites were encountered and reviewed during the course of this study. These sites were found to be insignificant in the context of this mercury mine waste study.

2.3 GUADALUPE RIVER WATERSHED MERCURY TMDL

The Guadalupe River Watershed Mercury TMDL Project (Tetra Tech, 2005b) found many of the waters in the Guadalupe River watershed to be polluted and/or impaired by mercury. These waters are found largely off of District lands to the south. With the exception of samples taken at Hicks Creek immediately below a known dumpsite, Tetra Tech (2005a; 2005b) found low levels of mercury in the tributaries draining District lands. This is consistent with the mapped geology of the Districts' portion of the watershed which lacks the silica carbonate host rock for cinnabar, the primary source of mercury. Elevated mercury in Hicks Creek is attributed to erosion of the mine waste at Hicks Flat.

Erosion of residual mine wastes and the transport of sediment into streams have been found to have the potential to impact water quality. RWQCB (2008) finds that actions are required to control mercury mining waste sources. In the mercury mine areas, the stated goal of the TMDL is to prevent excessive erosion of mercury mining waste by stabilizing and vegetating slopes. In depositional areas the goal is to prevent further erosion of mercury mining waste and resuspension of mercury-laden sediments accumulated in creek beds, banks, and floodplains, and in shallow impoundments. As previously discussed, the TMDL lays greater emphasis on controlling erosion of processed ores (calcines) than of unprocessed ores (overburden and mine tailings)

The first phase of the TMDL is designed to identify and stabilize mercury sources. To conform to the TMDL the California Regional Water Quality Control Board requires the District to submit a report on erosion of mercury mining wastes to surface waters in the Guadalupe River Watershed. This technical report was prepared to conform to the first phase requirements of the Guadalupe River Watershed Mercury TMDL (RWQCB, 2009).

3.0 METHODOLOGY

An intensive field inventory of potential mercury mine waste sites was completed for the portions of Sierra Azul OSP that are within or adjacent to the New Almaden Mining District and Guadalupe Mercury Mine (Figure 3). This inventory was undertaken to identify and characterize mine related sites including: processed ores (calcines), contaminated soils, overburden soils (open waste cuts, mine rock tailings, and dump rock used as road base), and mine seeps. As mentioned earlier, the project area excludes the Hicks Flat area that has already been addressed. The inventory also excludes soils that may have accumulated mercury from natural ore body weathering or undisturbed soils that may be enriched in mercury attributed to airborne fallout. Potential mercury mine waste sites were identified from the following:

- MAS/MILS mineral location database (Causey, 1998)
- 1874 historic maps of the Guadalupe Mine (Herrmann, 1874)(Appendix 2)
- Review of published literature including Bradley (1918) and Irelan (1888) that describe past mining activities
- Review of District files
- Geologic maps prepared by McLaughlin and others (2001) and Bailey and Everhart (1964) that identify mine sites and exposures of silica carbonate rock, host rock for the majority of mercury. These rocks tend to be in the northern portion of the preserve.
- Environmental audits of Rancho de Guadalupe prepared by Geologica (2004), SECOR (1995), and SRK (1989; 1992)and Geologic Resource Assessment of Sierra Azul prepared by Nolan Associates (2001)
- Mine history review of recently acquired parcels prepared by Michael Cox (1995; 2002; 2004)
- Guadalupe River Watershed Mercury TMDL and supporting documents (Tetra Tech, 2003, 2005b)
- Field reconnaissance made in the course of inventorying erosion issues along 14 miles of roads and trails within the Rancho de Guadalupe area of Sierra Azul Open Space preserve

(Best, 2010).
- Review of historic aerial photographs dating back to 1938 (on file at UCSC Map Library)
- Field reconnaissance of the project area made in the course of this study

Several factors need to be considered when evaluating the risk of mercury discharge from mine wastes into surface waters and the priority for treatment. This includes:

- Mine waste characteristics and bioavailability (processed ore vs. overburden)
- Effects of seeps (potential to erode mining wastes)
- Erosion potential (risk for future erosion)
- Sediment yield (size of site and rate of sediment discharge)
- Feasibility of treatment

These factors were evaluated for each of the mercury mine sites identified during the course of this study, and are included in the discussions of the individual sites. Additionally, these factors are summarized in Table 4.

Mitigation should focus on those sites with elevated mercury with greater emphasis placed on sites with processed ores (calcines). Mitigation should also focus on those sites found to have high or extreme rate of erosion and have the potential to deliver large quantities of material to surface waters. In comparison, sites with low mercury concentrations, low rates of erosion, small size, and/ or with low potential to deliver sediment to surface waters are comparatively of lower concern.

3.1 MINE WASTE CHARACTERISTICS AND BIOAVAILABILITY

Mine waste are characterized as either 1) overburden (material and rock overlying the silca-carbonate ore bodies, 2) tailings (unprocessed and discarded rocks of low quality silica carbonate ore, 3) processed silica carbonate ore (i.e. calcine), or 4) native soil, local fill material, or non-mercury mine waste (e.g. limestone tailings).

3.1.1 Sampling and mercury testing

A total of 34 samples were collected from five sites and tested for total mercury per EPA method 7471A (mg/kg wet weight). The purpose of the sampling was to provide an initial screening of mercury concentration to confirm and characterize the potential mine waste observed. Results from the lab testing are found in Appendix 1.

The initial testing was done on 17 samples, six of which yielded high mercury concentrations of between 68 and 8400 mg/kg. These six samples were subsequently retested. Two of the retested samples (S8 and S9) were found to have significantly different measured concentrations from their initial measurements. Sample S8 initially measured 4700 mg/kg and was retested at 810 mg/kg, and Sample S9 retested at 0.5 mg/kg compared to the initial measurement of 8400 mg/kg.

Because of the high readings and varied test results in the two samples, an additional 20 new samples were collected and tested and all 34 samples were retested again. This effort confirmed that mercury concentrations can vary and in some cases significantly even within the same sample. We are not certain as to why the concentrations can vary significantly within the same sample but believe a possible explanation is the often heterogeneous nature of the mine waste. For the purpose of this study results from each individual test and the median for each sample are presented.

3.1.2 Bioavailability

Bioavailability of mining wastes was ranked per criteria outlined by RWQCB (2009) as outlined below:

BIOAVAILABILITY	
• **High**	Heat-processed wastes including calcines and elemental mercury, and heat contaminated soils in processing areas
• **Low**	Overburden and rocks

3.2 SEEPS

RWQCB (2009) requires that the effect of seeps (whether from tunnel seeps or natural springs) shall be evaluated for the potential to erode mining wastes. No seeps were identified at or adjacent to any mercury mine waste site on District land, therefore this is not a significant concern within the study area.

3.3 EROSION POTENTIAL

Erosion potential is a qualitative measure of the likelihood of mercury mine waste to erode. It is based on criteria following criteria outlined by RWQCB (2009). It is important to understand that this criteria does not take into consideration the rate of erosion or volume of material that might be delivered to surface waters (sediment yield).

EROSION POTENTIAL	
• **High**	Currently eroding into surface waters
• **Medium - High**	Susceptible to mass wasting from gullies, slumps and landslides
• **Medium-Low**	Susceptible to surface erosion
• **Low**	Located greater than 300 feet from surface waters, stable slopes and little evidence of surface erosion

3.4 SEDIMENT YIELD

Sediment yield is a measure of the amount and rate of material that can erode from the land surface and be delivered to surface waters. It is a function of the erosional processes and the size of the deposit that is eroding. For the purpose of this study the rate of sediment yield was qualitatively assessed as Low, Medium, High, or Extreme based on field observations of geomorphic conditions and evidence of past erosion.

RATE OF SEDIMENT YIELD

• **Extreme**	Has the potential for greater than 100 cubic yards of erosion and sediment delivery within the next 25 years. Active and on-going erosion is present.
• **High**	Has the potential for greater than 50 cubic yards of erosion and sediment delivery within the next 25 years. Some erosion is expected during average large winter storms.
• **Medium**	Has the potential for 10 to 50 cy of erosion over the next 25 years. These sites are expected to erode during less frequent storm events.
• **Low**	Unlikely to erode more than 10 cy of sediment within the next 25 years and/or have low potential of sediment delivery. Generally no visible signs of past erosion.

3.5 TREATMENT PRIORITY

Not all sites that display a potential for future erosion have the same need or priority for treatment. Treatment priorities are based upon a number of factors, including 1) material characteristics and bioavailability (e.g. overburden and tailings vs. processed ore), 2) erosion potential, 3) sediment yield, and 4) feasibility and effectiveness of the proposed treatment. Treatment priority for each site was qualitatively classified as LOW, MODERATE or HIGH based on how it evaluated against these factors.

4.0 FINDINGS

The following is a description of each inventory site. A summary of these sites is found in Table 4. Site map is found in Figure 3 below.

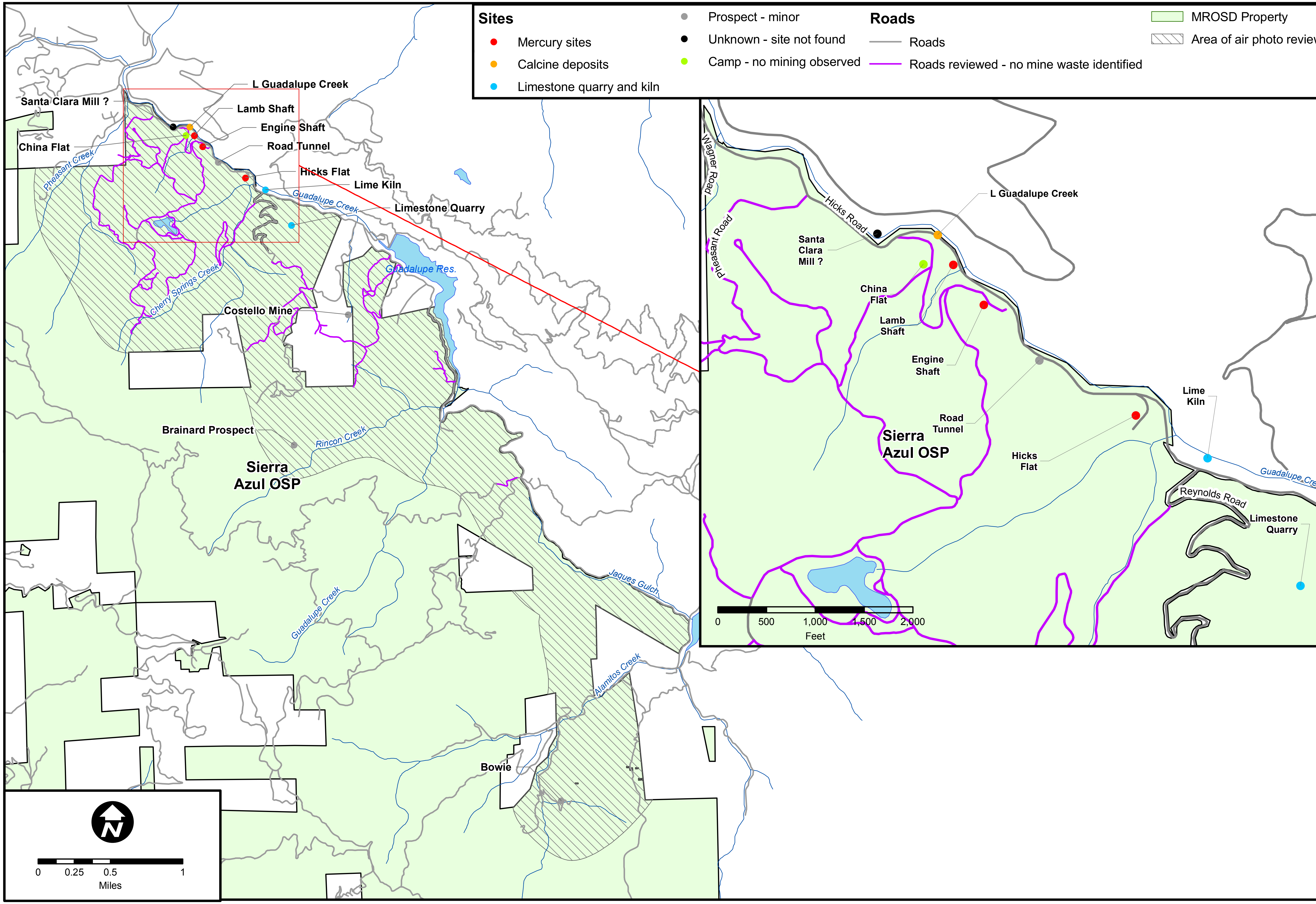

FIGURE 3

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SITE MAP

Rancho de Guadalupe area: Sierra Azul OSP

Midpeninsula Regional Open Space District

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4.1 ENGINE SHAFT

The Engine Shaft site occupies a 0.5 acre graded pad above Hicks Road on the south side of the Guadalupe River (Figure 4). The pad was constructed on a gently sloping fluvial terrace by cutting into the hillside at the western end and pushing spoils to the outside edge of the bench and into Guadalupe Creek. Fill generated from the construction was augmented with tailings and overburden from the excavation of the mine shaft. The site is accessed by two short roads, one of which is blocked by an earthen berm. There are two old sheds and scattered debris on the pad. The old mine shaft is covered by a 10 foot by 20 foot concrete slab. The site is fenced off and is posted as off limits for public access.

District property extends downslope to Guadalupe Creek. Hicks Road, a County road, and portions of the adjacent embankments are located within the Hicks Road right-of-way. A land survey would be required to determine the District and right-of-way boundaries. A map of the Engine Shaft site is found in Figure 4 and a photograph of the old site in Photo 1.

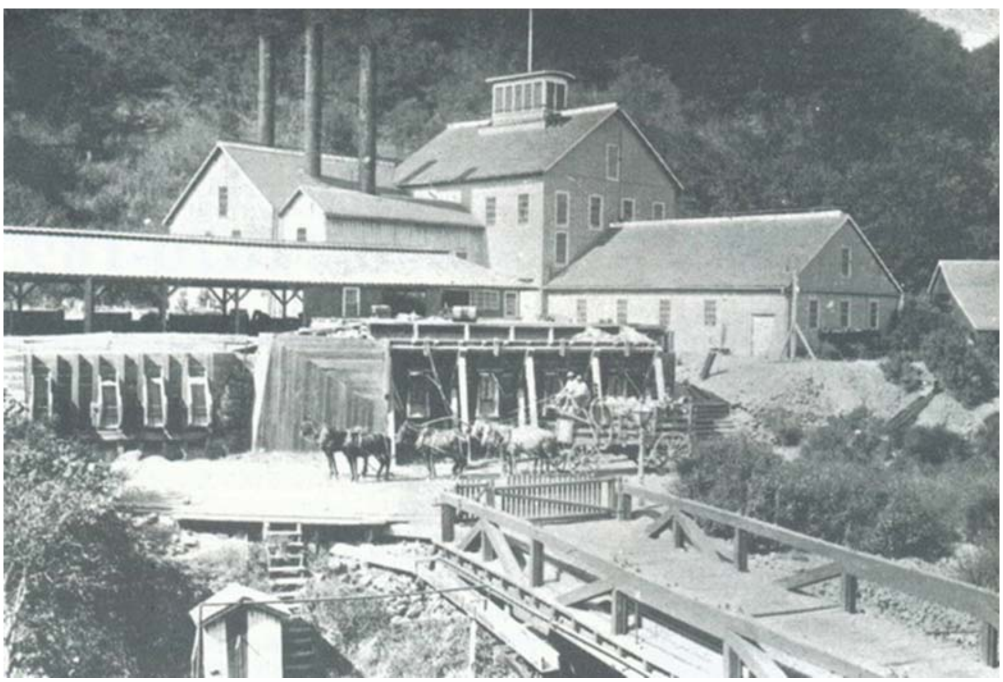


Photo 1: Historic photo of the old Engine Shaft workings. Note waste or chutes below the bench and overburden/tailings pushed over the edge.

4.1.1 Background and History

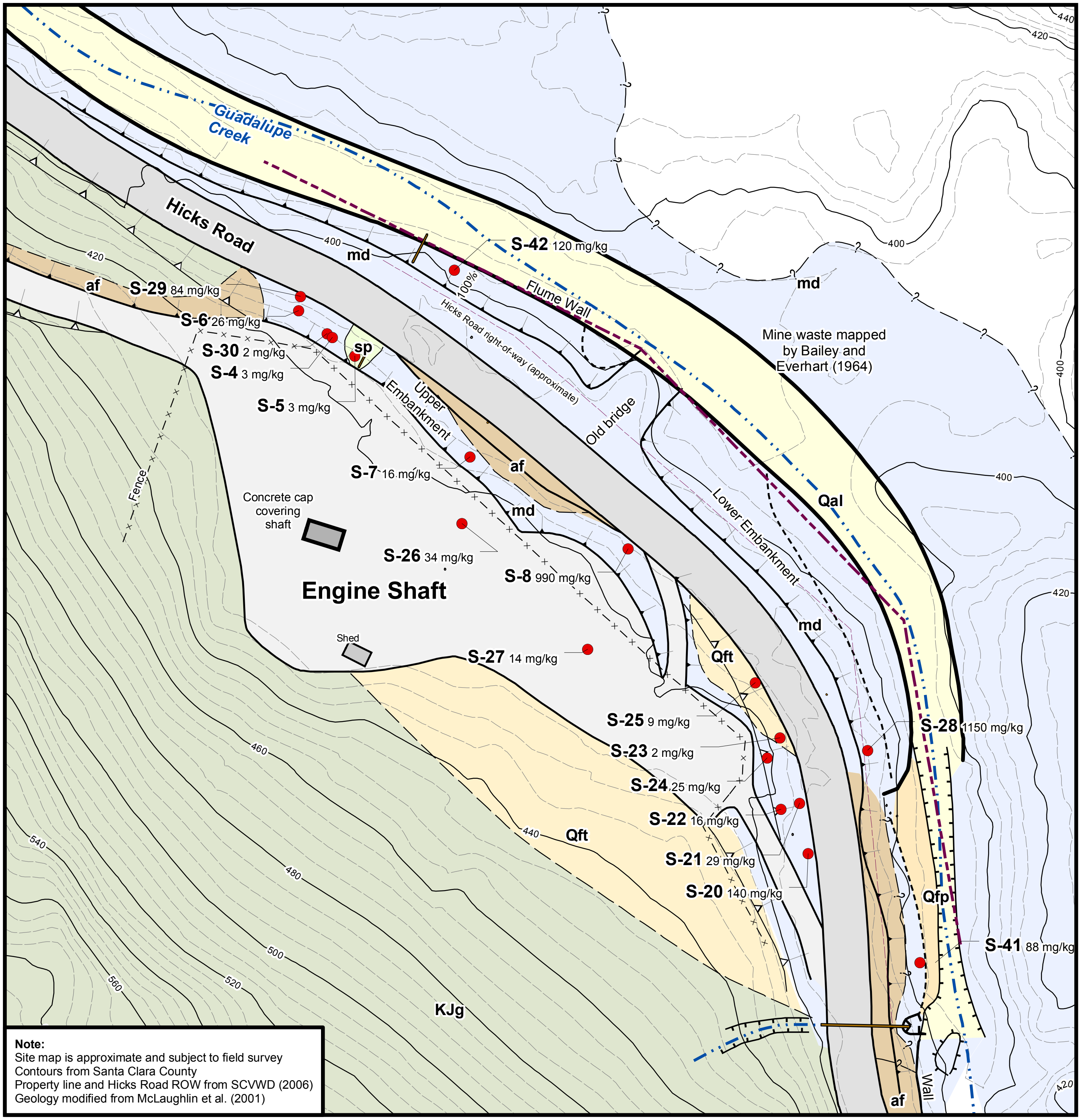
The Engine Shaft is part of the Guadalupe Mine and is the largest of 5 vertical and 1 inclined shafts that accessed a group of underground workings known as the Old Mine (Bailey and Everhart, 1964). The Engine Shaft and the much smaller Lamb Shaft are the only two shafts located on the south side of Guadalupe Creek and on District lands. The site was mainly used for ore production and dewatering of the mine; there is no known record of processing of ore at the Engine Shaft.

The Engine Shaft is a 620 foot deep, 3-compartment vertical shaft constructed to access cinnabar ore before the mine was idled in the late 1880's (Bailey and Everhart, 1964). The shaft and hoisting works are shown on the 1874 map of the Guadalupe Mining Company (Herrmann, 1874) and on the 1877 Geologic map of the New Almaden Mining District (Becker, 1887) with the reduction works (furnaces) located on the north side of Guadalupe Creek (Appendix 2). Ore was transported from the Engine shaft to the reduction works via a horse drawn tram. An old photograph of the site shows the building housing the hoisting works, plainer shed (for sorting ore) and waste ore chutes for low quality discarded ore. The photo also shows overburden and/or tailings pushed to the outside edge of the bench. This is consistent with Bailey and Everhart (1964) who mapped mine tailings and/or overburden (labeled as "dump") along the outer edge of the Engine Shaft and along 1,000 feet of the south bank of Guadalupe Creek below Hicks Road. The 1874 map also shows Guadalupe Creek to be channelized in a "flume".

The Old Mine was reactivated in the early 1900's with the Engine Shaft used to dewater the old mine and for moderate mining operations. Work proceeded slowly due to copious seepage (Bailey and Everhart, 1964). In 1917 Guadalupe Creek was lined with a 740 foot long 55 foot wide concrete flume to limit seepage into the mines. It is unknown if the 1917 flume was a new structure or a reconstruction of the earlier 1874 flume. Regardless, the concrete flume was only marginally successful and in 1922 mining operations on the south side of Guadalupe Creek were abandoned. As a side benefit the flume structure has protected the channel banks of Guadalupe Creek from erosion and appears to have retained some mine tailings.

In 1969 the New Idria Mining and Chemical Company (New Idria) cleaned out the mine shaft relocating the overburden and tailings removed to Hicks Flat. Cox (1995) believed that the entire 620 foot shaft was reentered with the property producing 60 tons of ore per month, although Cox did not know if this came through the Engine Shaft. This ore was trucked offsite to the New Almaden Mine and the New Idria Mine in San Benito County for processing (Cox 1995). In 1981, Dick Beltram Excavating was contracted by New Idria to remove three buildings, remove approximately 500 cubic yards of timbers, wood and debris dumped at Hicks Flat, and level out approximately 2000 cubic yards of waste rock that had previously been dumped at Hicks Flat by New Idria when the Engine Shaft was cleaned out (Beltram, 1991).

The District purchased the property that includes the Engine Shaft in 1995 (property also contains the Road Tunnel, Lamb Shaft and Lower Guadalupe Creek sites discussed later). The property known as Rancho de Guadalupe when purchased now makes up a substantial portion of the Rancho de Guadalupe Area of the Sierra Azul Open Space Preserve. The property is not currently open to the general public.



Note:
Site map is approximate and subject to field survey
Contours from Santa Clara County
Property line and Hicks Road ROW from SCVWD (2006)
Geology modified from McLaughlin et al. (2001)

N

0 10 20 30 40 50
Feet

EARTH MATERIALS

- **af** Artificial fill
- **md** Undifferentiated mine dump and fill
- **sp** Serpentine (in mine waste)
- **Qal** Alluvium
- **Qfp** Flood plain deposits
- **Qft** Fluvial terrace deposits
- **TJg** Franciscan greenstone

SYMBOLS

- Geologic contract dashed where approximate querried where uncertain
- Cutslope
- Fillslope
- Channel bank
- Erosional scarp
- Fence
- Pipe
- Flume wall
- Property Line (approx)
- Hicks Road ROW (approx)
- **S-26** 33 mg/kg Soil Sample — Sample ID and median concentration

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SITE MAP: ENGINE SHAFT
Sierra Azul Open Space Preserve
Midpeninsula Regional Open Space Preserve

FIGURE 4
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Date: 12/13/2010

4.1.1.1 Aerial Photo Observations

The 1938 aerial photographs show a small building covering the main shaft. To the northwest of this building is a white area absent of vegetation and which extends down to Hicks Road. This white area appears in the aerial photographs to be mine waste and is consistent with Bailey and Everhart (1964) who mapped the location as mine "dump". West of location is a narrow bridge, pipe or conveyor belt that spans Hicks Road and Guadalupe Creek. East of the building is a vegetated bench with several trails.

The 1948 aerial photographs show the building and a portion of the bridge spanning Guadalupe Creek had been taken down. The ground is revegetating and the site generally appears abandoned.

The 1963 photos show the majority of the site abandoned and overgrown. There are several pits dug into the eastern portion of the bench. It is unknown why these pits were dug but a possible explanation is for prospecting of the old mine tailings.

The 1980 photos show the mine waste and building area had been reworked with a road extending off the pad to the east and onto Hicks Road. This work appears associated with the cleaning out of the mine shaft by New Idria Mining and Chemical Company.

4.1.2 Observations

The Engine Shaft is located on a graded bench measuring about 300 feet long and 50 to 75 feet wide. The graded bench, was constructed on a gently sloping fluvial terrace by cutting into the hillside at the western end. Fill generated from the construction of the bench and augmented with mine tailings and overburden from the mine shaft was pushed to the outside edge of the bench and into the Guadalupe Creek channel, as mapped by Bailey and Everhart (1964) . Below the bench is a 3 to 15 foot high "upper" embankment that extends down to Hicks Road. Guadalupe Creek is located immediately below Hicks Road with the stream flowing within the 1917 concrete flume. The "lower" embankment refers to the slope extending below Hicks Road to either the concrete flume or Guadalupe Creek.

Native rock surrounding the Engine Shaft is mapped by Bailey and Everhart (1964) and McLaughlin et al. (2001) as Franciscan greenstone. Silica-carbonate rock, host rock for most of the quicksilver ore, was encountered at depth in the mine shaft.

4.1.2.1 Graded bench and upper embankment

The graded bench is about 0.5 acres in size, nearly flat and vegetated with light grass. Overburden and mine tailings from the shaft comprise portions of the graded pad, embankment, and slope below Hicks Road. The depth and extent of these deposits are not readily apparent in the field.

At one location on the flat bench a small area of pinkish fine grained material was observed. This material may include some processed mine wastes (i.e. calcines), though it tested relatively low for total mercury (15 and 33 mg/kg). There was no erosion evident from the top of the bench at any location.

The western end of the upper embankment exposes mixed angular clasts of dark grey greenstone, sandstone and serpentinite in a sand matrix. This portion of the embankment is lightly vegetated with grass. The slope is oversteepened with shallow instability noted along the lower portion of the embankment. Failed debris is deposited on the road surface where it is either eroded away by ditch flow or removed by county maintenance crews.

The central portion of the embankment is well vegetated with grass and oaks. A portion of the embankment is covered with more recent piles of dirt that appear to have been trucked to the site and dumped along the back edge of an old turn out on Hicks Road. A small exposure of native fluvial terrace deposits (sand and rounded cobbles) is exposed just east of the gravel entrance road. Active erosion was not observed.

The eastern most end of the embankment exposes rust orange brown sand and angular gravel. Based on configuration of the site the material is likely fill or tailings but appears similar in composition to native soils. The embankment is vegetated with grass. The rate of erosion appears low.

Hicks Road and portions of the adjacent embankments are located within a County road right-of-way. A land survey would be necessary to determine the Districts and right-of-way boundaries if additional work on the embankments is undertaken.

4.1.2.2 <u>Lower Embankment of Hicks Road</u>

The “lower” embankment extends downslope of Hicks Road to Guadalupe Creek and the top of the concrete flume. About 60% of this wall is on District property. The remainder is on Guadalupe Rubbish Disposal Company, Inc land. A second shorter concrete wall is located upstream. The two walls act to protect the embankment from stream bank erosion. Between the two walls is 130 foot long section of rocky embankment fronted by a low flood plain. This section of the lower embankment is referred to as “unretained” since it is not retained by a concrete wall. The lower embankment, including the unretained segment, is located on District land and is well vegetated without signs of recent erosion.

Most of the lower embankment appears to be comprised of fill that includes coarse mine tailings and overburden. Bailey and Everhart (1964) map the material as mine dump. Tailings and overburden are exposed along the 130 foot long segment of unretained embankment between the concrete flume and upstream concrete wall. In this area the base of the embankment consists of clast supported angular cobble size rock consistent with mine tailings. Capping the rock is a finer grained soil that incorporates recent trash and debris that were dumped off of Hicks Road at a much later time. The lower embankment is well vegetated as evident in the photo’s below.

Photo 2: Graded bench at Engine Shaft

Photo 3: Western end of upper embankment below Engine Shaft. Pipe extends to shaft. Serpentinite and fill exposed in embankment

Photo 4: Eastern end of upper embankment below road leading to Engine Shaft site

Photo 5: Eastern end of upper embankment below Engine Shaft site to right, and top of lower embankment to left.

Photo 6: Lower unretained embankment below Hicks Road, densely vegetated.

Photo 7: Concrete flume below Hicks Road, lower retained embankment.

4.1.3 Sampling and mercury testing

To further evaluate mercury concentrations two (2) soil samples were collected from the surface of the graded pad, thirteen (13) samples taken from the embankment below the pad, and three (3) from the fill embankment below Hicks Road. Grab samples were collected at depths of 2 to 6 inches below ground surface and analyzed for total mercury by EPA method 7471A. As discussed in Section 3.1.1 Sampling and mercury testing (page 8), measured mercury concentrations can be highly varied even within the same sample. Results from each individual test and the median for each sample are presented in Table 1. Sample locations are shown on Figure 4.Median total mercury concentrations were highly variable ranging from 2 to 1150 mg/kg. Unprocessed mine tailings that were cleared from the Engine Shaft and dumped at Hicks Flat also have elevated total mercury concentrations that range between 2.2 to 330 mg/kg (SECOR, 1995).

Elevated concentrations of mercury are most likely from native cinnabar that would have been encountered at depth within the mine shaft and placed on the bench as mine tailings and overburden. Some pinkish fine-grained material was observed on a portion of the flat bench at the site which may be processed mine wastes (i.e. calcines) though this material tested relatively low for total mercury (34 and 14 mg/kg). This material is capped by 2-3 inches of darker soil and no erosion of this material was observed.

High concentrations of mercury were measured at two locations (S8 and S28). Median total mercury concentration at S8, collected in the fill embankment below the graded pad, measured 990 mg/kg but results were highly variable between subsequent tests on the same sample. At S28, collected in the fill prism below Hicks Road, median mercury concentration measured 1500 mg/kg and was also highly variable between tests. This later area was recently disturbed and restored to access a creek habitat restoration site completed by the Santa Clara Valley Water District. Both of these concentrations are high. Neither site appeared unique relative to surrounding areas that tested lower.

Median total mercury at S41 sampled along the unretained embankment below Hicks Road was 81 mg/kg. This sample was obtained from the finer grained soil matrix between the larger cobble size material of native overburden rock.

Median total mercury concentration in the native fluvial terrace deposits located near the gravel entrance is 9 mg/kg.

TABLE 1: MERCURY TEST RESULTS
ENGINE SHAFT SITE

Sample	Location	Description	Sample date	Test date	Sub-sample Method	Total Hg (mg/kg)	Median (mg/kg)
S4	Engine Shaft: Upper Embankment (west end)	Mixed sidecast	5/21/2010	6/28/2010	Grab approx.2g	1.8	**3**
				12/7/2010	Mortar & Pestle whole sample	4.6	
S5	Engine Shaft: Upper Embankment (west end)	Mixed sidecast	5/21/2010	6/28/2010	Grab approx.2g	2.7	**3**
				12/7/2010	Mortar & Pestle whole sample	2.4	
S6	Engine Shaft: Upper Embankment (west end)	Mixed sidecast with serpentinite	5/21/2010	6/28/2010	Grab 20G, then Mortar & Pestle	26	**26**
				8/24/2010	Grab approx.2g	45	
				12/7/2010	Mortar & Pestle whole sample	6.8	
S7	Engine Shaft: Upper Embankment (middle)	Mixed sidecast	5/21/2010	6/28/2010	Grab approx.2g	15	**16**
				12/7/2010	Mortar & Pestle whole sample	16	
S8	Engine Shaft: Upper Embankment (middle)	Mixed sidecast	5/21/2010	6/28/2010	Grab 20g, then Mortar & Pestle	4600	**990**
				8/24/2010	Grab approx.2g	810	
				12/7/2010	Mortar & Pestle whole sample	1600	
				12/7/2010	Grab approx.2g	990	
				12/7/2010	Grab approx.2g	2100	
				12/7/2010	Grab approx.2g	900	
				12/7/2010	Grab approx.2g	410	
S20	Engine Shaft: Upper Embankment (east end)	Mixed sidecast	9/15/2010	9/24/2010	Grab 20g, then Mortar & Pestle	130	**140**
				12/7/2010	Mortar & Pestle whole sample	150	
S21	Engine Shaft: Upper Embankment (east end)	Mixed sidecast	9/15/2010	9/24/2010	Grab 20g, then Mortar & Pestle	33	**29**
				12/7/2010	Mortar & Pestle whole sample	24	
S22	Engine Shaft: Upper Embankment (east end)	Mixed sidecast	9/15/2010	9/24/2010	Grab 20g, then Mortar & Pestle	17	**16**
				12/7/2010	Mortar & Pestle whole sample	15	
S23	Engine Shaft: Upper Embankment (east end)	Mixed sidecast	9/15/2010	9/24/2010	Grab 20g, then Mortar & Pestle	1.6	**2**
				12/7/2010	Mortar & Pestle whole sample	2.3	
S24	Engine Shaft: Upper Embankment (east end)	Mixed sidecast	9/15/2010	9/24/2010	Grab 20g, then Mortar & Pestle	38	**25**
				12/7/2010	Mortar & Pestle whole sample	12	
S25	Engine Shaft: Upper Embankment (east end)	Native fluvial terrace deposits	9/15/2010	9/24/2010	Grab 20g, then Mortar & Pestle	7.1	**9**
				12/7/2010	Mortar & Pestle whole sample	11	
S26	Engine Shaft: Bench	Surface material on pad	9/15/2010	9/24/2010	Grab 20g, then Mortar & Pestle	33	**34**
				12/7/2010	Mortar & Pestle whole sample	34	
S27	Engine Shaft: Bench	Surface material on pad	9/15/2010	9/24/2010	Grab 20g, then Mortar & Pestle	15	**14**
				12/7/2010	Mortar & Pestle whole sample	13	
S28	Engine Shaft: Lower Embankment of Hicks Rd	Fill material below Hicks Road. Sample taken above top of concrete flume	9/15/2010	9/24/2010	Grab 20g, then Mortar & Pestle	1700	**1150**
				12/7/2010	Mortar & Pestle whole sample	1100	
				12/7/2010	Grab approx.2g	940	
				12/7/2010	Grab approx.2g	1000	
				12/7/2010	Grab approx.2g	1200	
				12/7/2010	Grab approx.2g	4300	
S29	Engine Shaft: Upper Embankment (west end)	Mixed sidecast with serpentinite	9/15/2010	9/24/2010	Grab 20g, then Mortar & Pestle	92	**84**
				12/7/2010	Mortar & Pestle whole sample	75	
S30	Engine Shaft: Upper Embankment (west end)	Mixed sidecast	9/15/2010	9/24/2010	Grab 20g, then Mortar & Pestle	2.6	**2**
				12/7/2010	Mortar & Pestle whole sample	0.96	
S41	Engine Shaft: Lower Embankment of Hicks Rd	Finer grained matrix material infilling voids between coble size material. Sample taken along the unretained embankment below Hicks Road.	10/27/2010	11/30/2010	Grab 20g, then Mortar & Pestle	76	**88**
				12/7/2010	Mortar & Pestle whole sample	100	
S42	Engine Shaft: Lower Embankment of Hicks Rd	Fill material below Hicks Road. Sample taken upslope of concrete flume	10/27/2010	11/30/2010	Grab 20G, then Mortar & Pestle	140	**120**
				12/7/2010	Mortar & Pestle whole sample	100	

4.1.4 Erosion and sediment delivery potential

4.1.4.1 Bench and Upper Embankment

The surface of the graded pad is vegetated with light grass and without evidence of concentrated surface runoff or erosion. No seeps or wet areas were observed. The potential for erosion and the rate of sediment yield is low.

The embankment below the pad and above Hicks Road is vegetated with grass and scattered hardwoods. There is no evidence of concentrated runoff flowing over the embankment face. No seeps or wet areas were apparent. Minor cutbank instability was observed along the western portion of the embankment where the slope tends to be oversteepened. Past failures at this location have been very small, estimated to be less than 3 cy, and the material likely removed by County road maintenance crews. Outside of this location the embankment appears stable without signs of instability or significant erosion.

The toe of the upper embankment could be subject to erosion from ditch flow along Hicks Road or by clearing of the ditch and undercutting of the embankment by road crews. The rate of embankment erosion is very low and is not a significant source of sediment. Based on field observations of the small erosional scars, erosion over the past 20 to 50 years has been less than 10 cy (less than 0.5 cy/year). Overall the erosion potential along the embankment face is ranked as medium-low. The rate of sediment yield is also low.

4.1.4.2 Lower Embankment of Hicks Road

The majority of the embankment below Hicks Road is protected from stream bank erosion by either the 1917 concrete flume or the upstream wall. The ground above the flume and wall are well vegetated and/or have a heavy duff layer without signs of active erosion. About 250 feet of the flume wall extends 2 to 8 feet above the ground surface and in this area there is little chance of erosion or sediment delivery.

A stability analysis of the flume structure and upslope embankment was outside the scope of this study. There is, however, no evidence of past erosion or instability. The erosion potential is medium-low only because it is within 100 meters of Guadalupe Creek (as defined by the RWQCB) even though the flume wall restricts the migration of sediment to the creek. Otherwise the erosion potential would rank low. The rate of sediment yield from the lower embankment appears low.

Between the two walls is an unretained 130 foot long embankment section fronted by a low flood plain (Photo 6). The bottom consists of coarse cobble size material that acts to partially armor the bank. The embankment is well vegetated without signs of significant erosion or instability. Because the site is located along an unretained segment of Guadalupe Creek, the erosion potential is characterized as high. However, because there has been little apparent erosion in the past 50+ years the rate of sediment yield appears low.

4.1.5 Treatment Alternatives

Elevated mercury concentrations were identified in historic mine tailings at the Engine Shaft site and in the embankment below Hicks Road. The deposits are located within 100 meters of Guadalupe Creek but are well vegetated and absent of significant active erosion or instability. Material at the Engine Shaft pad and embankment are separated from Guadalupe Creek by Hicks Road. The majority of the deposits below Hicks Road are protected from erosion by the 10 foot high concrete flume. Past erosion of these deposits has been minimal. Several remedial methods can be employed to mitigate the risk of future erosion and sediment yield:

1) Maintain and augment existing vegetative cover, coordinate maintenance activities with County to minimize disturbance
2) Removal and disposal
3) Retainment

4.1.5.1 *__Stabilize with vegetative cover__*

Maintain existing vegetative ground cover (and augment if necessary) to minimize the exposure of bare ground and the risk for erosion and sediment delivery. Coordination will occur with the County Roads Department to minimize disturbance that could exacerbate erosion at the site such as ditch clearing, roadside vegetation spraying. Future erosion and sediment delivery is expected to be similar to what has occurred in the past, which has been minimal. Visual monitoring of the site will be undertaken by MROSD staff during the winter period. Replant/cover any new bare areas in excess of 200 square feet following storms, as necessary. Utilize “soft” BMP’s such as seeding, mulch, native plantings, brush mattress, brush layering, erosion control rolls and blankets, live staking, and wattles. These BMP’s are already utilized by the District and are included in the District’s Routine Maintenance agreements with the Department of Fish and Game and the Regional Water Quality Control Board. If substantial erosion occurs as a result of a severe winter or fire event, that is not treatable with the noted BMP’s, a Certified Engineering Geologist (CEG) or Certified Professional in Erosion and Sediment Control (CPESC) will be retained to evaluate and recommend solutions. The RWQCB will be notified of the problem and recommendations, and the District will implement the recommendations as soon as possible.

4.1.5.2 *__Removal and disposal__*

In this alternative contaminated soil at risk for erosion and sediment delivery would be removed and placed in either a stable location on site (e.g. the graded pad of the Engine Shaft) or transported offsite and disposed at an approved landfill.

It is unknown how far the contaminated material extends into the upper embankment. If the material occupies only a narrow wedge then it should be feasible to remove all of the material. However, if the contaminated soils extend further back into the hillside then only the outer portion of the material would be removed and the excavated area capped with clean soil and revegetated. Exploratory borings, sampling and testing would be required to determine the limits of excavation.

Along the lower embankment above the flume the upper few feet of overburden and tailings would be removed and the slope capped by clean soil and revegated. Removing contaminated material from the unretained segment of the lower embankment is not feasible without installing retaining structures to support the roadway.

Because of the low rate of erosion and sediment yield the net sediment reduction benefit of this alternative is small while the cost and potential adverse impacts associated with removal and disposal would be very significant. There are several significant disadvantages with this alternative. First, the work would require extensive grading at high costs. Second, work would extend into Hicks Road right-of-way potentially requiring road reconstruction and possible retaining structures. Any work within the right-of-way would need to be coordinated with the county. Third, removing material on the downslope side of the road would result in the removal of most of the established riparian vegetation. Additional geotechnical work would be required to further evaluate the feasibility and costs for this alternative.

4.1.5.3 Retainment

An alternative to removing the waste rock would be to retain the material behind a series of retaining walls and then capping the residual material with clean soil. The disadvantages are similar to the soil removal option above, namely high treatment costs and impacts to Hicks Road. Additional geotechnical and civil engineering work would be required to further evaluate the feasibility and costs for this alternative. Again, because of the low rate of erosion and sediment yield the net benefit of this alternative is small, and the cost and potential adverse impacts would be high.

4.1.6 Discussion and Recommendations

The Engine Shaft occupies a flat bench above Hicks Road. Fill and overburden from the shaft have been pushed to the outside edge of the pad forming an "upper" embankment above Hicks Road and a "lower" embankment between the road and Guadalupe Creek. The 1917 concrete flume is found along the majority of the lower embankment and adequately protects the embankment from stream bank erosion.

The materials at the Engine Shaft flat are mainly overburden and mine tailings with low bioavailability. Processed ores are either absent or if present appear to be limited in area and have tested relatively low for total mercury (15 and 33 Mg/kg), are capped with soil and exhibit no signs of erosion.

Median total mercury concentrations from all samples collected at the Engine Shaft site, including embankments, were highly variable ranging from 2 to 1150 mg/kg with an overall median concentration of 25 mg/kg.

The graded pad at the engine shaft is fenced off, vegetated with grass and absent of erosion. The upper embankment above Hicks Road is vegetated also absent of significant erosion.

Portions of this embankment lie within the Hicks Road right-of-way.

The majority of the “lower” embankment is protected from stream bank erosion by the concrete flume. Significant erosion was not apparent on the embankment slope above the flume. About 130 linear feet of the lower embankment extends down to Guadalupe Creek and is fronted by a low flood plain. The embankment is well vegetated and absent of significant erosion.

The site is found to have a low treatment priority based on 1) low bioavailability and 2) low sediment yield. The preferred alternative is to maintain existing vegetation and visually monitor for future erosion, utilize soft BMP’s to control erosion, and work with County Roads Department to minimize disturbance by maintenance activities. Removing the mine waste or constructing retaining walls to further stabilize it in place does not appear warranted given the minimal net sediment reduction benefit and likely high costs and potential adverse impacts involved with constraints associated with Hicks Road.

4.2 ROAD TUNNEL

4.2.1 Observations

The Road Tunnel is an old sealed adit located in the cut of Hicks Road about 500 feet southeast of the Engine Shaft site. The adit is shown on Bailey and Everhart (1964) as a 400 foot long horizontal shaft extending into Franciscan greenstone rocks absent of silica carbonate rocks. Cox (1995) suggests the adit was driven in the 19th century to explore for the upper continuation of silica-carbonate lenses that are found at depth.

The entrance is sealed with concrete grout. There is no evidence of mine waste and none have been reported in previous studies (Cox, 1995; Geologica, 2004).

Photo 8: Sealed adit at Road Tunnel

4.2.2 Treatment Alternatives

No treatment required

4.3 LAMB SHAFT

The Lamb Shaft is located along a small intermittent watercourse about 30 feet upstream of Hicks Road (Figure 5) The shaft is part of the old mine workings of Guadalupe Mine that includes the nearby Engine Shaft. Bailey and Everhart (1964) show the Lamb Shaft as a 300± foot deep vertical shaft that probably extended into the upper portion of the silica-carbonate rocks. This and the much larger Engine Shaft are the only two shafts on the south side of Guadalupe Creek and on District lands. The age of the shaft is unknown but most likely was constructed prior to the 1880's.

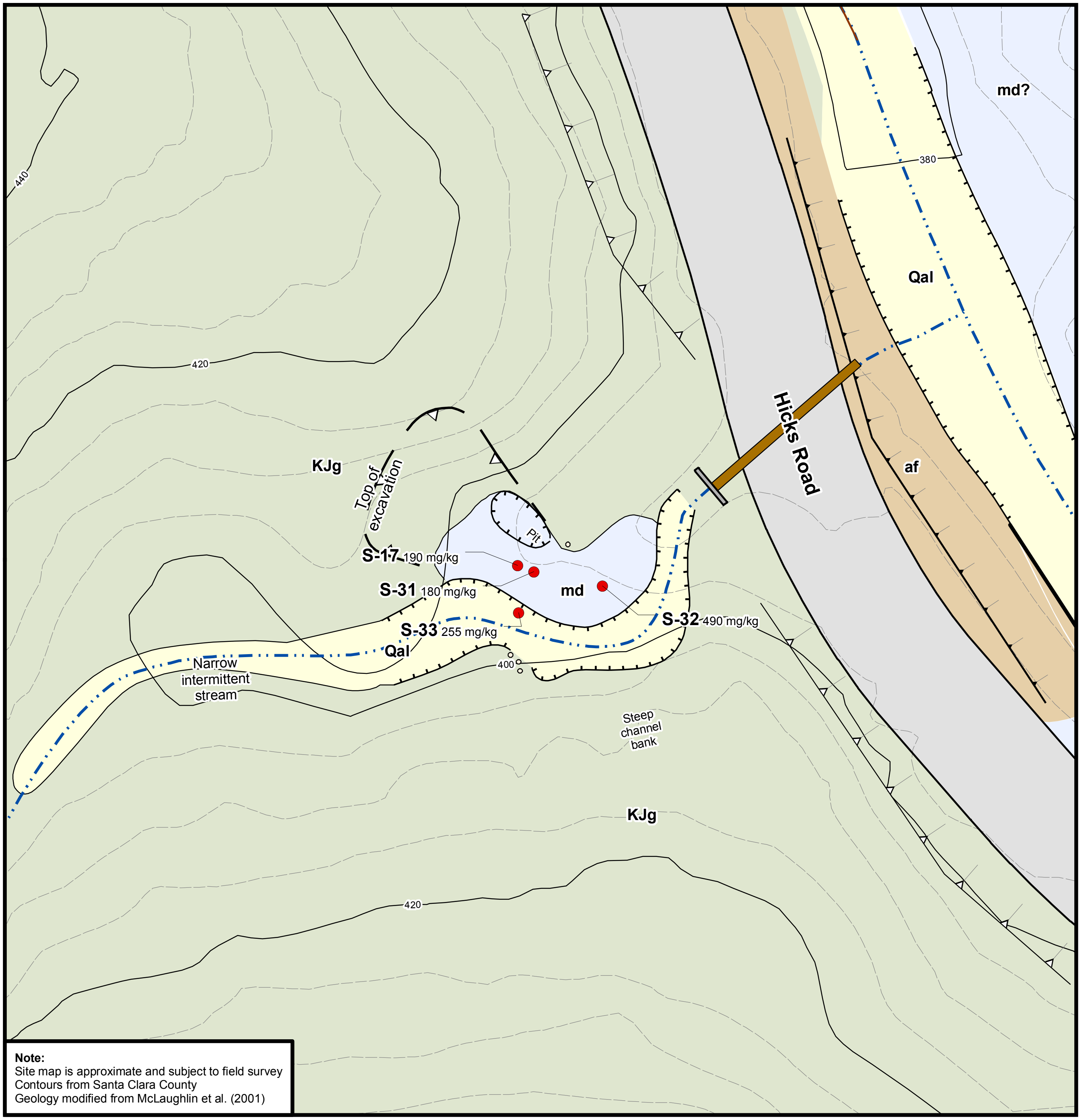
4.3.1 Observations

The shaft occupies a small 750 sf area on the west side of a narrow and steep sided intermittent watercourse. The site consists of a small 8 foot diameter, 3 foot deep pit dug partway into the steep hillside. About 25 cy of fill and mine tailings extends downslope of the pit and protrudes into the narrow valley bottom. The pit and spoils pile have subdued morphology indicating that these features are quite old. Fill material consists of orange brown sands and gravels which are consistent with native soils. Silica carbonate rocks were not readily apparent.

Photo 9: Lamb Shaft. Pit is in background

Photo 10: Intermittent stream channel at Lamb Shaft

The intermittent stream occupies a narrow and steep gradient valley draining a 110 acre watershed. The channel is 2 to 5 feet wide, sand and cobble bedded, and with a moderate channel gradient. Native side slopes leading into the stream exceed 80% gradient. Natural stream sediment transport and load is high based on conditions observed immediately upstream of the site. Spoils from the Lamb Shaft appear to protrude 10+ feet into the narrow valley bottom and this may have pushed the watercourse into the opposite bank. The channel itself does not appear to have been narrowed. The channel bank along the base of the spoils is 2 to 3 feet high and armored with rocky material. Even though the upstream channel is now directed into the spoil pile there appears to have been very little erosion since the time the shaft was abandoned 90+ years ago. For this reason the rate of sediment yield is found to be very low at less than 10 cy over the past 50 years.



0 5 10 15 20 25
Feet

EARTH MATERIALS

- **af** Artificial fill
- **md** Undifferentiated mine dump and fill
- **sp** Serpentine (in mine waste)
- **Qal** Alluvium
- **Qfp** Flood plain deposits
- **Qft** Fluvial terrace deposits
- **TJg** Franciscan greenstone

SYMBOLS

- Geologic contract dashed where approximate querried where uncertain
- Cutslope
- Fillslope
- Channel bank
- Erosional scarp
- Fence
- Pipe
- Flume wall
- Property Line (approx)
- Hicks Road ROW (approx)
- **S-26** 33 mg/kg Soil Sample Sample ID and median concentration

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SITE MAP: LAMB SHAFT
Sierra Azul Open Space Preserve
Midpeninsula Regional Open Space Preserve

FIGURE 5
Job: MPEN-SAMEI-517
Date: 12/13/2010

4.3.2 Sampling and mercury testing

Four (4) soil samples were collected at the site and analyzed for total mercury by EPA method 7471A. Median total mercury concentrations ranged from 190 to 490 mg/kg. Elevated concentrations are most likely from native cinnabar that would have been encountered at depth within the old Mine Workings. There is no evidence of processed mine wastes at this site.

TABLE 2: MERCURY TEST RESULTS
LAMB SHAFT

Sample	Location	Description	Sample date	Test date	Sub-sample Method	Result (mg/kg)	Median (mg/kg)
S17	Lamb Shaft	Sample spoils on outside edge of old pit.	4/29/2010	6/28/2010	Grab 20g, then Mortar & Pestle	480	**190**
				8/24/2010	Grab approx.2g	190	
				12/7/2010	Mortar & Pestle whole sample	153	
S31	Lamb Shaft	West end of spoil pile next to pit	9/15/2010	9/24/2010	Grab 20g, then Mortar & Pestle	170	**180**
				12/7/2010	Mortar & Pestle whole sample	190	
S32	Lamb Shaft	East end of spoil pile next to pit	9/15/2010	9/24/2010	Grab 20g, then Mortar & Pestle	400	**490**
				12/7/2010	Mortar & Pestle whole sample	580	
S33	Lamb Shaft	Left channel bank, 1” above channel bottom.	9/15/2010	9/24/2010	Grab 20g, then Mortar & Pestle	240	**255**
				12/7/2010	Mortar & Pestle whole sample	270	

4.3.3 Erosion and sediment delivery potential

The location of the site along the bank of an intermittent stream places the site at moderate to high risk for continued stream bank erosion. However, the rate of erosion and amount of sediment yield from the site is very low. Total volume of material residing at the site is less than 25 cy. The rate of sediment yield is found to be very low at less than 10 cy over the past 50 years.

4.3.4 Treatment Alternatives and Discussion

Elevated mercury concentrations were identified in mine tailings at the Lamb Shaft site. Processed ores are absent. The deposits are located immediately adjacent to a small ephemeral stream and therefore are at risk for erosion. However, past erosion has been very slow, estimated to be less than 0.25 cy/year.

There are several remedial methods that could be employed to mitigate the risk of future erosion and sediment yield including removing contaminated soils off site and stabilizing material on site with retaining structures. However, these are not warranted due the small size of the site (< 25 cy) and low rate of sediment yield (<0.25 cy/year). The most reasonable approach and the preferred alternative would be to maintain existing vegetation and monitor for future erosion.

4.4 GUADALUPE LIMESTONE QUARRY AND KILN

The Guadalupe Lime Company operated a limestone kiln and several quarries on the south side of Guadalupe Creek about ½ mile southeast of the Guadalupe Quicksilver Mine (Bailey and Everhart, 1964; Becker, 1887; Irelan, 1888). Mining operations focused on limestone within the Franciscan formation. Operations began in 1864 and continued for over 20 years. There is no documentation of mercury mining or processing at the site.

4.4.1 Observations

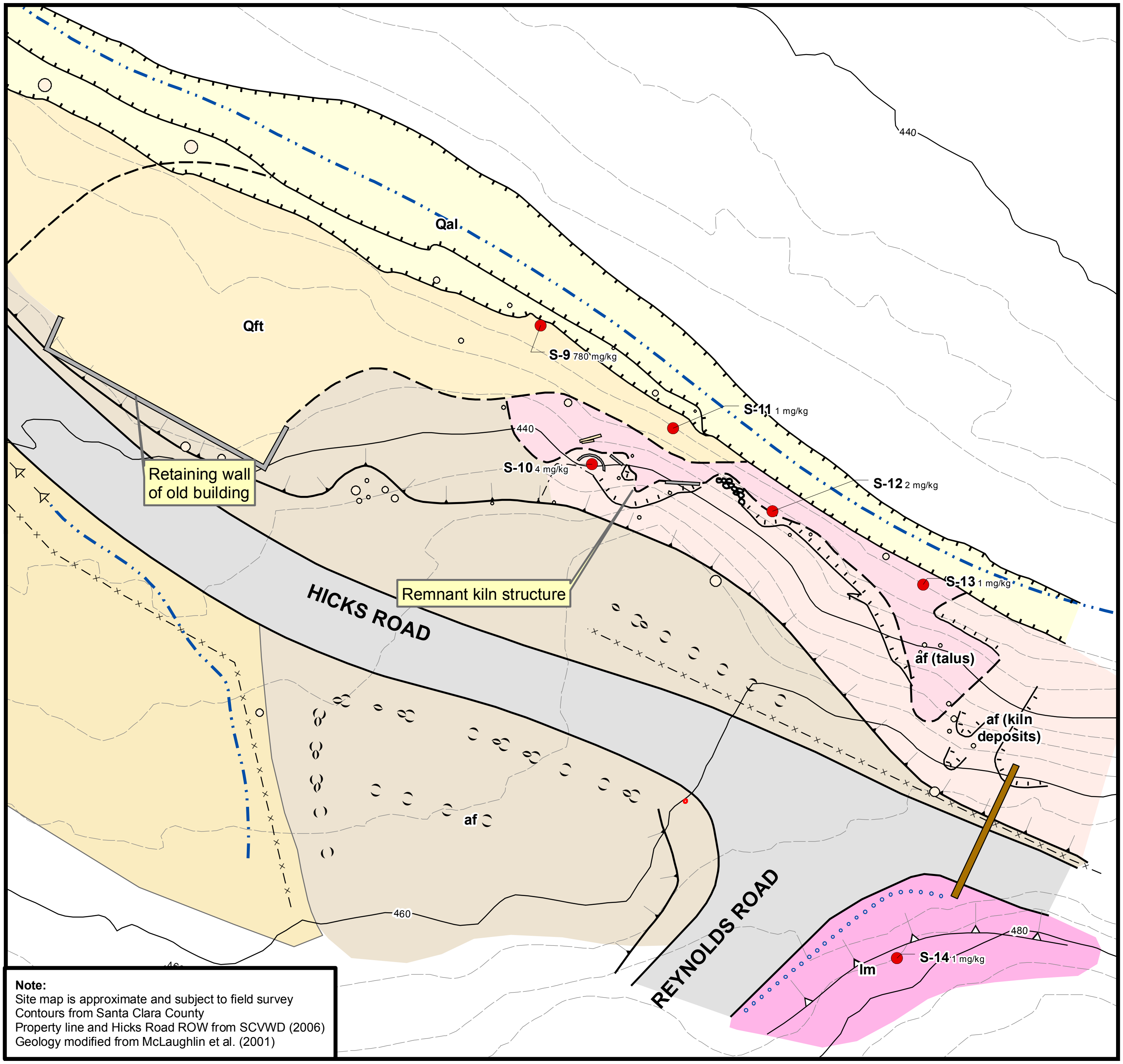
The limestone kiln was located along Guadalupe Creek below the intersection of Hicks and Reynolds Road (Figures 3 and 6). Irelan (1888) reports the kiln to have been an upright circular brick furnace about 33 feet in diameter. Remnants of the brick kiln are exposed in the steep embankment face below Hicks Road immediately adjacent to Guadalupe Creek. Within the old kiln and extending 70 feet east (upstream) is a deposit of partially cemented mine tailings from the processing of the limestone. Mercury mine waste was not observed at the site.

Photo 11: Old bricks of the Lime Kiln

Photo 12: Photo shows some of the processed limestone within the old kiln.

Photo 13: Cemented processed limestone waste along Guadalupe Creek immediately downslope of the Lime Kiln. Sample S9 was taken from this site

Photo 14: Close up of Sample S9



Note:
Site map is approximate and subject to field survey
Contours from Santa Clara County
Property line and Hicks Road ROW from SCVWD (2006)
Geology modified from McLaughlin et al. (2001)

EARTH MATERIALS

af	Artificial fill - undifferentiated: Primarily associated with road construction
aft (talus)	Talus derived from kiln spoils. May include some alluvial sediments near stream bank.
afk (kiln deposits)	Kiln deposits: Undifferentiated fill, limestone, and processed limestone
lm	Limestone: Limestone deposits from quarry operations
Qal	Alluvium
Qft	Fluvial terrace deposits

SYMBOLS

Geologic contract dashed where approximate querried where uncertain
Cutslope
Fillslope
Channel bank
Erosional scarp
Berm
Ditch
Gaurd rail
Pipe
Remant kiln structure
Tree
Log
S-26 33 mg/kg

0 10 20 30 40 50
Feet

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SITE MAP: LIME KILN
Sierra Azul Open Space Preserve
Midpeninsula Regional Open Space Preserve

FIGURE 6
Job: MPEN-SAMEI-517
Date: 4/4/2011

Downslope of the kiln is a heterogeneous deposit of cemented buff white processed limestone with fragments of darker grey limestone. This deposit extends along the Guadalupe Creek bank for about 50 feet downstream of the kiln. The deposit is visually similar to the in place material within the kiln and interpreted to be waste material from the kiln that was probably pushed into the stream after processing. There is no evidence of processed mine waste and similar deposits were not observed on the opposite (north) side of Guadalupe Creek.

About 100 feet west of the kiln and adjacent to Hicks Road is the cement foundation of an old building that was probably used to store the lime. This building is visible in the 1939 aerial photographs and is shown to have been removed in the 1948 photos.

The principal quarry for the kiln was located about 400 feet upslope on the east side of Reynolds Road. The limestone was hand sorted at the quarry and transported to the kiln by a gravity pulley which is shown on the Geologic Map of the New Almaden Mining District (Becker, 1887). The quarry today consists of two pits and associated tailings on about 2 acres of ground. The 1963 aerial photographs show a newly constructed tractor road cutting across the toe of the quarry and leading to a graded pad about 1800 feet to the east. The quarry area is vegetated without signs of active erosion or sediment discharge to creeks.

On the north east corner of Hicks and Reynolds Roads is a small pile of limestone tailings. Mercury mine waste was not observed. Above the tailings is a wood support that was probably used as part of the pulley system leading up to the quarry.


Photo 15: Old limestone quarry pit


Photo 16: Road cut along Hicks Ranch Road

Several small limestone pits and prospects are also found on District lands along and above Hicks Ranch Road. No evidence of mercury mine waste at these sites was observed. No evidence of calcines were observed in the road base rock. Bailey and Everhart (1964) did not map silica carbonates in the immediate area.

4.4.2 Sampling and mercury testing

4.4.2.1 Lime kiln and quarry

Five (5) grab samples were collected at various locations at the kiln site and analyzed for total mercury by EPA method 7471A. These samples include processed limestone within the kiln (S10), processed limestone waste rock outside the kiln (S9 and S12), talus material below the kiln (S11), and what appears to be unprocessed limestone ore upstream of the kiln (S13) (Table 3). An additional sample (S14) was also collected from unprocessed mine tailings above Reynolds Road and is interpreted to be representative of the material from the upslope quarry.

With the exception of sample S9, total mercury in the five other samples (S10 to S14) was low ranging from less than 1 to 7.8 mg/kg (median 0.4 mg/kg). The low mercury concentrations are consistent with the site being used for limestone quarrying and processing.

Sample S9, however, yielded high and variable mercury concentrations. This sample was obtained from an exposure of cemented bluff white processed limestone with clasts of darker grey limestone along the south channel bank of Guadalupe Creek slightly downstream of the kiln. The material is visually substantially similar to material exposed within the lime kiln and is interpreted to be waste rock from the processing of the limestone ore. The lab tested this sample 7 times and yielded mercury concentrations ranging between 0.5 and 8400 mg/kg (median 780 mg/kg).

We are uncertain as to why there is a high and variable mercury concentration within Sample S9. High levels of mercury would not be expected at the lime kiln since available records indicate mercury rich ore was not being mined or processed. Further elevated mercury was not observed in the other 5 samples taken at and near the site. As discussed in Section 3.1.1 Sampling and mercury testing (page 8), mercury concentration varied in several other samples and could be attributed to the heterogeneous composition of the samples. Based on available information we believe that this sample is an outlier and is not representative of the site as a whole.

4.4.2.2 Hicks Road

Two (2) samples of soils exposed in the cut along Hicks Ranch Road were collected and analyzed for total mercury by EPA method 7471A. Both of these samples yielded low mercury concentrations of less than 1 mg/kg.

4.4.3 Erosion and sediment delivery potential

The lime kiln deposits are located along the south bank of Guadalupe Creek with the lower most deposits inundated during high storm flows.

Because the site is located immediately adjacent to a stream the erosion potential is high per RWQCB ranking criteria. However, field observations reveal the partially cemented limestone deposits to have a low rate of erosion and sediment delivery. This is supported partially vegetated and moss covered nature of the deposits that indicates little erosion within the past 20+ years.

TABLE 3: MERCURY TEST RESULTS
LIME KILN AND QUARRIES

Sample	Location	Description	Sample date	Test date	Sub-sample Method	Result (mg/kg)	Median (mg/kg)
S9	Lime kiln: Processed ore from along Guadalupe Creek bank	Cemented mine tailings located along Guadalupe Creek downstream end of the kiln. Material consists of buff white processed limestone with clasts of dark grey rock.	5/21/2010	6/28/2010	Grab 20g, then Mortar & Pestle	8400	**780**
				8/24/2010	Grab approx.2g	0.5	
				12/7/2010	Mortar & Pestle whole sample	5.4	
				12/7/2010	Grab approx.2g	770	
				12/7/2010	Grab approx.2g	1390	
				12/7/2010	Grab approx.2g	780	
				12/7/2010	Grab approx.2g	970	
S10	Lime kiln: Processed ore from interior of kiln	Sampled from interior of old kiln (brick removed) visually similar to material sampled at S9.	5/21/2010	6/28/2010	Grab 20G, then Mortar & Pestle	7.8	**4**
				12/7/2010	Mortar & Pestle whole sample	0.04	
S11	Lime kiln: talus below kiln	Sample of talus/soil on downstream end of kiln	5/21/2010	6/28/2010	Grab 20g, then Mortar & Pestle	0.45	**<1**
				12/7/2010	Mortar & Pestle whole sample	0.5	
S12	Lime kiln: processed limestone upstream of kiln	Cemented mine tailings sampled upstream of kiln	5/21/2010	6/28/2010	Grab 20g, then Mortar & Pestle	4.2	**2**
				12/7/2010	Mortar & Pestle whole sample	0.12	
S13	Lime kiln: limestone overburden and waste rock	Mixed deposit of fractured limestone in sand matrix at upstream end of kiln	5/21/2010	6/28/2010	Grab 20G, then Mortar & Pestle	0.07	**1**
				12/7/2010	Mortar & Pestle whole sample	2.2	
S14	Quarry Tailings	Sample of limestone quarry tailings above Hicks and Reynolds Road	5/21/2010	6/28/2010	Grab 20G, then Mortar & Pestle	0.15	**<1**
				12/7/2010	Mortar & Pestle whole sample	0.3	
S15	Hicks Ranch Road cutbank	Sample of old quarry spoils (?) exposed in the road cut. Site is located at mouth of old quarry	5/21/2010	6/28/2010	Grab 20g, then Mortar & Pestle	0.06	**<1**
				12/7/2010	Mortar & Pestle whole sample	0.09	
S16	Hicks Ranch Road cutbank	Sample of earth materials exposed road cut.	5/21/2010	6/28/2010	Grab 20g, then Mortar & Pestle	0.1	**<1**

4.4.4 Treatment Alternatives and Discussion

Based on review of available documents and field reconnaissance, the site was used only for the processing of limestone; there are no records or evidence of silica carbonate rocks being mined or processed at the site. Five of the six samples obtained from the lime kiln site (S10 to S14) had low mercury concentrations ranging from less than 1 to 7.8 mg/kg (median 0.4 mg/kg). Low levels of mercury concentration are consistent with the past use of the site.

We do not have a good explanation of why there was high and variable mercury concentration in Sample S9. As previously discussed the material is Sample S9 is visually similar to processed limestone exposed in the kiln and which yielded low mercury concentrations. Because mercury ore is not expected at the lime kiln site and because the results from sample S9 are highly variable, we believe that sample S9 is an outlier and is not representative of the site as a whole.

Based on the foregoing and because the low rate of erosion of the partially cemented deposits the Lime Kiln is not a significant eroding mercury mine site.

4.5 LOWER GUADALUPE CREEK

Guadalupe Creek fronts 0.6 miles of the northern boundary of Sierra Azul Open Space Preserve between Pheasant Creek and the downstream end of the concrete flume (Figures 3 and 7). This portion of Guadalupe Creek is referred to as Lower Guadalupe Creek in this report. Along this reach Guadalupe Creek occupies a 10 to 20+ foot wide sand and cobble bedded channel. Stream banks are generally steep with well-established riparian vegetation. Rocks of the Franciscan Complex and Coast Range Ophilite, alluvial sediments, and mine waste are mapped along the valley bottom (McLaughlin et al., 2001).

The vast majority of the Guadalupe Mine (with the exception of the Engine Shaft and Lamb Shaft) was located on the north side of Guadalupe Creek off of District property. This includes all known thermal processing facilities (retorts, furnaces and reduction works).

Tetra Tech (2003) reports "Calcine deposits appear to be exposed in the channel banks on the opposite side of Guadalupe Creek near the former Guadalupe Mine site and at several upstream locations." The calcine deposits noted by Tetra Tech appear to coincide with the waste dumps shown on the 1874 Herrmann, and the 1964 Bailey and Everhart maps.

4.5.1 Observations

A field reconnaissance of the Lower Guadalupe Creek channel bank was completed in 2010 to identify potential mine waste sites on the portions of District lands adjacent to the stream. The field review identified mine wastes (tailings), calcines and native stream sediments exposed in a 300 foot long segment of the south channel bank downstream of the concrete flume and opposite the old Guadalupe Mine site (Figure 6). These deposits consist of partially cemented sand to cobble-sized material that appears to have been reworked by stream flow. The deposits are exposed in a 2 to 6 foot high steep partially vegetated stream bank. Thicker deposits exist along the north side of the stream which suggests the mine waste was likely pushed into the creek from that side where the known thermal processing occurred and where mapped. Calcines were not identified in the channel but may exist within the alluvial sediments.

At the upper end of the reach, about 120+ linear feet of the calcines is overlain by the steep fill embankment that supports the outer edge of Hicks Road. This significantly constrains and complicates remedial options. The downstream end of the deposits ends at a bedrock outcrop in the left channel bank.

Guadalupe Creek roughly defines the boundary between the District lands to the south and Guadalupe Rubbish Disposal Company, Inc. to the north. This property line has been surveyed along the concrete flume by Santa Clara Valley Water District as part of developing plans to modify the flume for fish passage (SCVWD, 2006), however these plans do not cover the area of concern. Extrapolation of the property line shown on the SCVWD 2006 plans into the project area suggests that portions of the south channel bank are likely located off of District lands. A land survey would be required to more accurately determine the location of the property line as well as the limits of the Hicks Road right-of-way.

Photo 17: Upstream view of Guadalupe Creek

Photo 18: Downstream view of Guadalupe Creek. Elevated mercury levels detected in soils exposed in the escarpment to left of the photo

4.5.2 Sampling and mercury testing

Three (3) grab samples were collected from the calcine deposits exposed in the low channel banks along the segment of channel bank believed to be in or in close proximity to District lands. Samples were analyzed for total mercury by EPA method 7471A. All of the samples had elevated mercury concentrations that ranged from 16 to 180 mg/kg.

TABLE 4: MERCURY TEST RESULTS
LOWER GUADALUPE CREEK

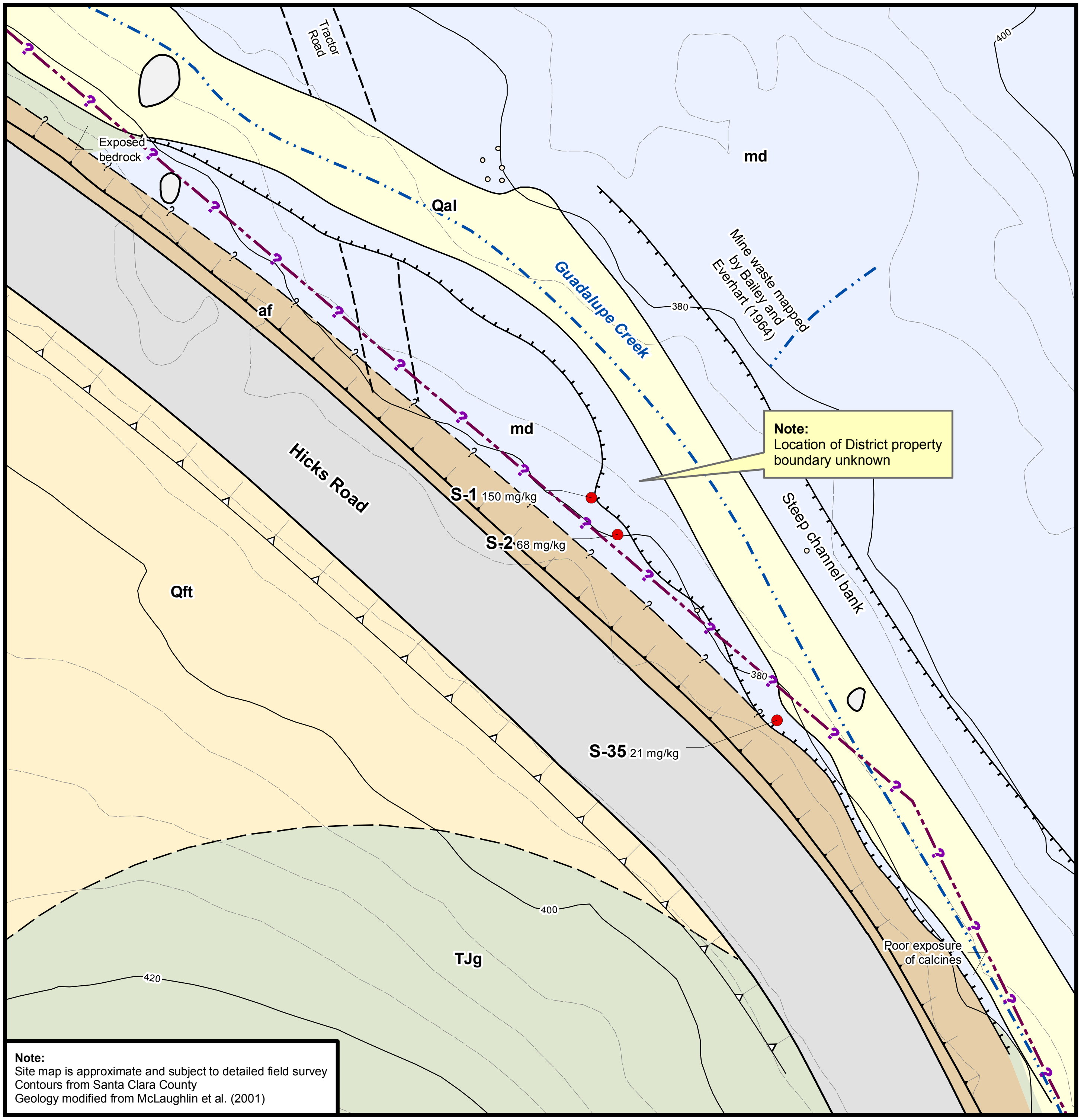
Sample	Location	Description	Sample date	Test date	Sub-sample Method	Total Hg (mg/kg)	Median (mg/kg)
S1	Guadalupe Creek bank	Partially cemented soil/ waste rock in left stream bank	4/29/2010	6/28/2010	Grab 20g, then Mortar & Pestle	180	**150**
				8/24/2010	Grab approx.2g	150	
				12/7/2010	Mortar & Pestle whole sample	100	
S2	Guadalupe Creek bank	Partially cemented soil/ waste rock in left stream bank	5/21/2010	6/28/2010	Grab 20g, then Mortar & Pestle	68	**68**
				8/24/2010	Grab approx.2g	67	
				12/7/2010	Mortar & Pestle whole sample	68	
S35	Guadalupe Creek bank	Partially cemented soil/ waste rock in left stream bank	9/15/2010	9/24/2010	Grab 20G, then Mortar & Pestle	16	**21**
				12/7/2010	Mortar & Pestle whole sample	26	

4.5.3 Erosion and sediment delivery potential

The calcine deposits appear to be largely above the low flow channel, but are at risk for erosion under high flow conditions. The steep channel bank is partially vegetated and locally covered with moss suggesting a low rate of bank erosion. The calcine deposits themselves are partially cemented and in general are not highly prone to erosion. A few small old scour features are evident and these have been significant enough to have undercut the nearby Hicks Road.

Based on field observations it is estimated that less than 2 feet of bank erosion has occurred within the past 50 to 75 years. Assuming an average mine waste thickness of 4 feet, annual sediment input along this segment of stream is estimated to be less than 1.5 cy per year.

The erosion potential along the embankment face is high per RWQCB ranking criteria. The rate of sediment yield, however, is low to medium.



EARTH MATERIALS

af	Artificial fill
md	Undifferentiated mine dump and fill
sp	Serpentine (in mine waste)
Qal	Alluvium
Qfp	Flood plain deposits
Qft	Fluvial terrace deposits
TJg	Franciscan greenstone

SYMBOLS

Geologic contract
dashed where approximate
querried where uncertain

Cutslope

Fillslope

Channel bank

Erosional scarp

Property Line
(very approximate location)

S-26 33 mg/kg — Soil Sample
Sample ID and median concentration

0 5 10 15 20
Feet

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(831) 425 5832 (831) 425 5830 (fax)

SITE MAP: LOWER GUADALUPE CREEK
Sierra Azul Open Space Preserve
Midpeninsula Regional Open Space Preserve

FIGURE 7
Job: MPEN-SAMEI-517
Date: 12/13/2010

4.5.4 Treatment Alternatives

Treatment of the site is constrained and complicated by Hicks Road located immediately upslope and by the District property line which may bisect the site. Several remedial methods can be employed to mitigate the risk of future erosion and sediment yield:

1) Stabilize with existing vegetative cover
2) Removal and offsite disposal
3) Retainment and onsite stabilization
4) Bank protection

4.5.4.1 <u>Stabilize with vegetative cover</u>

Maintain existing vegetative ground cover to minimize the exposure of bare ground and the risk for erosion and sediment delivery. Future erosion and sediment delivery is expected to be similar to what has occurred in the past, less than 1.5 cy/year. If excessive erosion during large storms is observed, exposed areas can be replanted and/or "soft" BMP's such as brush mattress, brush layering, erosion control rolls, blankets, live staking, and wattles could be utilized.

4.5.4.2 <u>Removal and offsite disposal</u>

Excavate contaminated waste along 300 feet of the channel and endhaul material offsite to an approved landfill. Exposed soils in the channel would then be stabilized with rock armor to minimize the risk of stream bank erosion. The proposed work would require extensive excavation and possible reconstruction of Hicks Road. Cost of treatment would be high.

To remove the material equipment would either need to work from Hicks Road (requiring public traffic control) or from the opposite side of the creek. About 125 feet of Hicks Road is within 30± feet of the channel and excavation of the mine waste could undermine the roadway requiring the County road to be reconstructed, relocated, and/or the outside road prism stabilized with a retaining structure.

4.5.4.3 <u>Retainment and onsite stabilization</u>

An alternative to removing the waste rock would be to retain the material behind a retaining wall constructed along the left bank of Guadalupe Creek. This wall would be similar in concept to the concrete wall along the upstream flume. The disadvantages are similar removing the soils, namely high treatment costs. Additional geotechnical, civil engineering, and hydrology work would be required to further evaluate the feasibility and costs for this alternative. A retaining wall structure would need to be constructed within a floodway with substantial regulatory issues involved. Displacement of flood flows could negatively impact the north (right) bank of the creek where calcine dumps are mapped and were observed during the TMDL process. The north (right) creek bank is also approximately twice as high as the south (left) bank and the calcine waste appears over-steepened and susceptible to potential stream deflection.

4.5.4.4 Bank protection

In this alternative the lower 3 to 4 feet of the stream bank would armored with rock rip rap to minimize bank scour. Some of the bank material would need to be excavated to facilitate stable rock placement, but the majority of the waste would remain. This could be accomplished by working from Hicks Road but would probably better accessed from the opposite (north side) of the creek. Excavated material would need to be endhauled offsite to an approved landfill. Because rock would likely extend into the channel, a detailed hydrologic investigation would be required to evaluate potential changes in channel scour. Cost of this measure would also be high.

4.5.5 Discussion and Recommendations

Mercury mine wastes are evident along a 300± foot long segment of the Lower Guadalupe Creek channel bank near the northern boundary of District lands. Because the location of the District's property line is uncertain in this area, a land survey would be required to determine property boundaries as well as the limits of the Hicks Road right-of-way.

The mine wastes are exposed in a 2 to 6 foot high steep partially vegetated stream bank. The material appears to be mixed unprocessed mine tailings, processed calcines and native stream sediment. The mine waste appears pushed into the creek from the opposite side of the stream where Bailey and Everhart (1964) map extensive mine wastes. Total mercury concentrations ranged from 16 to 180 mg/kg. Additional sampling would be required to more precisely determine the limits and concentrations of the mercury mine wastes. Based on criteria by RWQCB (2009) the material has high bioavailability.

Because the site is located along an unprotected segment of Guadalupe Creek, the erosion potential is high. However, the steep channel bank is partially vegetated and locally covered with moss indicating a low rate of bank erosion. Annual sediment yield from erosion of the mine wastes along the south channel bank over the past 50 to 75 year has been moderate, estimated at less than 1.5 cy. Future erosion is expected at a similar or lower rate.

Guadalupe Creek roughly defines the boundary between the District lands to the south and Guadalupe Rubbish Disposal Company, Inc. to the north. Detailed records of survey for this location were not found during this study. A land survey would be required to determine property boundaries as well as the limits of the Hicks Road right-of-way.

Treatment of the site is constrained and complicated by Hicks Road located within 15 to 40 feet of the channel. The steep fill embankment that supports the edge of Hicks Road overlies about 120+ feet of the calcines. Removing or stabilizing the mine wastes would require extensive excavation that may undermine the road possibly requiring reconstruction or rerouting of a portion of Hicks Road. The cost for these measures would be very high. Because of the high costs to stabilize the deposits and the moderate rate of sediment yield, the treatment priority for this site is low to moderate.

The mine wastes exposed in the south channel bank are also found much more extensively along the north side of Guadalupe Creek as mapped in the TMDL. Given that the property line appears to split the deposit observed on the south bank, from a logistics and treatment standpoint, any remediation on the south bank should be done in concert with Guadalupe Rubbish, particularly if remedial work on the north bank is deemed necessary. The properties share a hydrologic connection, with both opposing stream banks in the floodway. Work on one bank may affect the other. This is a key concern and nexus if remedial work at this location is determined to be a high priority within the watershed.

Additional work would be required to further evaluate the site. A boundary survey is necessary to confirm the property boundary and the Hicks Road right-of-way. Additional sampling is required to determine the limits and depth of the mine waste deposit. Geotechnical investigation is necessary to evaluate the stability of the embankment and to assist the civil engineer in the design of any retaining structures. A hydrologist is required to evaluate stream bank erosion and scour. Biologic studies would be required to obtain necessary permits.

Given the substantial physical constraints at this location involving Hicks Road, the relatively low rate of erosion and small area involved, no treatment is recommended at this time.

4.6 CHINA FLAT

China Flat is located on a 3 acre gently sloping fluvial terrace located just south of Hicks Road (Figure 3). The flat is accessed by a short gravel road. A small ephemeral stream drains across the flat to the west.

The 1874 map of the Guadalupe Mine (Herrmann, 1874) show a "village" with five small buildings at the site with the county road below (Appendix 2). SRK (1989)reports the site is named after Chinese workers who lived in tents on the flat while working at nearby mining operations. The 1938 aerial photographs show possible grading at the site. Subsequent photos show the area vacant except for the roads leading to and from the site. The site is currently used as a staging area for county road maintenance equipment.

4.6.1 Observations

Field and air photo review found no evidence of surface mining or mine waste at the site. Previous studies have similarly found no evidence of mine waste at the site (Cox, 1995; Geologica, 2004; SRK, 1989, 1992). The access road has been rocked with limestone.

Photo 19: China Flat

Photo 20: Road leading to China Flat

4.6.2 Sampling and mercury testing

One (1) composite grab sample was collected from the flat and analyzed for total mercury by EPA method 7471A. Two tests were made of this sample with total mercury concentrations reported at 6.0 and 3.2 mg/kg. SRK (1992) evaluated the potential of remnant metal concentrations per TCPL. Their analysis found mercury levels marginally above detection limits.

4.6.3 Treatment Alternatives and Discussion

No treatment required

4.7 BRAINARD PROSPECT

There is little known about the Brainard prospect (Figure 3). Bradley (1918) reports the prospect to be "an old adit in which it is stated some cinnabar-bearing material was cut, but there has been no work done in recent years." The MAS/MILS mineral location database maps the prospect in Rincon Creek. No evidence of the prospect at this site was observed at this location in air photo review. Cox (1995), however, believed the prospect to be located on the small creek draining Cherry Springs pond but was also unable to find any evidence of mining activities.

4.8 COSTELLO PROSPECT

The Costello Mine (Figure 3) is mapped in MAS/MILS mineral location database as located within a small intermittent watercourse southwest of Guadalupe Reservoir and off District property. Aubury (1908) reports "the works to consist of several shallow cuts and drifts in the debris covering the hillside. One tunnel reaches through the later into serpentine. In a crosscut from this tunnel a sandstone was found having on the fractures planes a thin black coating of iron and carrying some cinnabar." Aubury reports that the character of the ore is entirely different from that in the New Almaden ore bodies and that "No ore deposits in place have yet been found." Bradley (1918) reports this to be a prospect only and no ore was found in place.

Based on available information this site is not located on District lands. No evidence of mining activity was apparent at this site in the historic aerial photographs.

4.9 SANTA CLARA MILL SITE

There is little known about the Santa Clara Mill Site (Figure 3). The MAS/MILS mineral location database maps the site along Guadalupe Creek near China Flat. There is no record of a mill site recorded on the 1874 map of the Guadalupe Mine (Herrmann, 1874) or on the 1887 geologic map (Becker, 1887). The site is not reference by Bailey and Everhart (1964). No evidence of the mill site or of mine waste was observed on District lands in the area identified in the MAS/MILS database. Prior investigations by Nolan (2001) also did not observe any evidence of this site.

4.10 BOWIE PROSPECT

The Bowie prospect is mapped by MAS/MILS within a small tributary to Alamitos Creek above Almaden Reservoir (Figure 3). Bradley (1918) reports this to be a prospect only. McLaughlin et al. (2001) did not map silica-carbonate rocks in the vicinity. I did not attempt to locate the prospect given the mapped geology and that the site is reported as a failed prospect (no ore discovered). No evidence of mining actives was apparent at this site in the historic aerial photographs.

4.11 JACQUES GULCH

Jacques Gulch is a narrow steep gradient intermittent stream that discharges into Almaden Reservoir (Figure 3). The watercourse roughly defines the boundary between Sierra Azul OSP to the south and Santa Clara County property to the north. While mercury mining operations have occurred in the northern portion of the watershed off District lands (Tetra Tech, 2005b) with calcines observed within the Mine Hill tributary and the lower portion of Jacques Gulch, there are no reported mines, prospects or processing areas on District lands (Bailey and Everhart, 1964; Becker, 1887; Causey, 1998; Tetra Tech, 2005b). No evidence of past mining or mine wastes on District lands was observed from review of historic aerial photographs and field reconnaissance of Jacques Gulch. Tetra Tech (2005b) reports total mercury concentrations in Jacques Gulch above the Mine Hill tributary and which drains the majority of the Districts lands to be relatively low at 2.0 ng/L. Based on the foregoing it is unlikely that significant erosion of mercury mine wastes is occurring on the portion of District lands in the Jacques Gulch Watershed.

4.12 PROPERTY INTERIOR

The District manages 9,700± acres of land within the Guadalupe Creek and upper Alamitos Creek watersheds. With the exception of those sites already discussed, there is no record of mercury mining activities, mine wastes or mine seeps on the portion of District lands within the two watersheds, herein referred to as the property interior.

As previously discussed, the host rock for mercury is cinnabar within silica-carbonate rocks which are exposed primarily north Guadalupe Creek and Jacques Gulch. Past mining operations have occurred in close proximity to these deposits. With the exception of a small outcrop in upper Guadalupe Creek, silica-carbonate rock is not mapped on District lands (Bailey and Everhart, 1964; McLaughlin et al., 2001) and for this reason it is unlikely that mercury mine wastes occur.

In the preparation of the Guadalupe River Watershed Mercury TMDL Project, Tetra Tech collected and analyzed water samples from several of the Guadalupe River tributaries draining District lands. This analysis found low mercury levels in Upper Guadalupe Creek and Rincon Creek (Tetra Tech, 2005a) and in Pheasant Creek, Cherry Springs Creek and Jacques Gulch above the Mine Hill tributary (Tetra Tech, 2005b). This is consistent with the mapped geology of the Districts' portion of the watershed which lacks the silica carbonate host rock for cinnabar, the primary source of mercury.

In 2010, a road and trail erosion inventory (RTI) on 14 miles of roads and trails within the Rancho de Guadalupe portion of Sierra Azul Open Space Preserve was completed (Best, 2010). This investigation was undertaken to evaluate the condition of the road network with respect to erosion and sediment delivery, and to assess the suitability of those roads for future use. While this study was not originally intended to identify mine wastes, the RTI was completed concurrently with this study and paid particular attention to road surfacing or possible mining related disturbance where evident. No evidence of historic mercury mining operations outside of the specific locations discussed in this report was observed.

This road and trail inventory also identified the majority of roads in the assessment area to be unsurfaced. Unsurfaced roads are cut into native soil and rock, where the native material forms the road surface. Unsurfaced roads do not have imported road surfacing materials that could include mine waste or calcines. District roads inventoried do not occur within areas with mapped geology containing silica carbonate the host rock for mercury sulfide. Given these circumstances the unsurfaced roads evaluated on District lands are not suspected to be sources of mercury.

Those roads that were paved (Cherry Springs Road) or rocked (Hicks Ranch Road, upper Reynolds Road and China Flat Road) did not show visible signs of any processed ores utilized as road base or road surfacing.

Several additional past studies have addressed mercury and mercury mine operations in the property interior. Coyle (1992) found no evidence for mercury mine wastes or elevated mercury at two proposed building sites located on the Jamison Property near the intersection of Hicks Road and Woods Road. Composite soil samples collected at each of the two proposed building sites contained mercury at concentrations of 0.23 and 0.4 parts per million (ppm) and composite soil samples collected from Woods Road contained mercury at concentrations of 0.14 ppm (Environmental Health Consultants, 1992). Mercury was not detected in groundwater samples from several wells on the property.

A Phase I Environmental Assessment of the Jamison property by Piers Environmental Services (1994) found no obvious evidence of mine waste or mine borehole cuttings, pits, or ponds on those parts of the property which were accessible to the walking surface and binocular reconnaissance. PIERS (1994) further reports that the pervious landowner Joan Jamison is unaware of any mining activities on the property during her family's period of ownership.

In 2002 and 2004, Michael Cox reviewed historic mining operations on the Davidson-Marshall properties (Cox, 2004) and Daloia and Newhagen Meadows properties (Cox, 2002) as part of the District's assessment of the properties prior to their acquisition. Mr. Cox did not identify historic mercury operations on either of these lands.

5.0 SUMMARY OF RESULTS

This investigation was undertaken to identify the locations of mercury mine wastes on District lands that are at risk of significant erosion and discharge into surface waters. Included in this report are preliminary recommendations to mitigate the risk of mercury discharge. This report is intended to conform to first phase requirements of the Guadalupe River Watershed Mercury TMDL (RWQCB, 2009). Inventory sites, site characteristics, and treatment priorities are summarized in Table 4.

This study confirms the findings of the TMDL that outside the previously identified Hicks Flat site, excessive erosion of mercury mine wastes are absent on District property. This study found that mercury mine wastes exist at the Engine Shaft, Lamb Shaft and Lower Guadalupe Creek south channel bank, however these deposits are generally small and/or eroding slowly.

Mine wastes found at the Engine Shaft and Lamb Shaft are mainly mine tailings and unprocessed ore with low bioavailability. Though some of this material is located in close proximity to Guadalupe Creek, the sites are relatively small, generally well vegetated and do not show signs of excessive erosion or sediment yield. The sites are found to have a low treatment priority due to the low rate of sediment yield that is similar to background and low bioavailability. The preferred treatment alternative is to maintain vegetative cover and monitor. Removal of the material at the Engine Shaft is significantly constrained and complicated by Hicks Road that extends though the site.

Mine waste, calcines and native soils were identified along 300 feet of the south Guadalupe Creek channel bank. This material was likely pushed into the creek from the opposite side of the stream where Bailey and Everhart (1964) map extensive mine wastes. Because the location of the District's property line and the Hicks Road right-of-way is uncertain, a land survey would be required to determine exact property and right-of-way boundaries.

Because the site is located along an unretained segment of Guadalupe Creek, the erosion potential is categorized as high. However, the steep channel bank is partially vegetated and locally covered with moss indicating a low rate of bank erosion. Given the substantial constraints at this location involving Hicks Road that is located within 15 to 40 feet of the channel, the relatively low rate of erosion and small area involved, the preferred treatment is to maintain vegetative cover and monitor for any changes.

Elevated but highly variable mercury concentrations were found in one sample taken from the Lime Kiln site. The remaining four samples obtained from the site all had low total mercury concentrations. The Lime Kiln site and adjacent quarry was used for the mining of limestone. Based on our field review there is no physical evidence for the mining and/or processing of silica ore or of the processing of mercury of silica carbonate ore. Based on available information we believe that this sample is an outlier and not representative of the site as a whole. Because of the partially cemented nature of the deposit, sediment yield from the site us low.

Previous studies identified mine wastes at Hicks Flat and remediation of this site is pending.

5.1 MONITORING SITES STABILIZED WITH VEGETATIVE COVER

Maintaining existing vegetative ground cover to minimize the exposure of bare ground and the risk for erosion and sediment delivery is the primary treatment recommendation for the sites identified in this report. Annual monitoring of the identified sites is a critical component of this treatment recommendation to ensure that the vegetative cover continues to provide the necessary erosion control. If excessive erosion is observed, exposed areas can be replanted and/or "soft" BMP's such as brush mattress, brush layering, erosion control rolls, blankets, live staking, and wattles could be utilized.

5.2 RECOMMENDED FIELD REVIEW

To fully understand the sites and findings detailed in this report, it is recommended that a field visit be completed during the report review period by RWQCB staff. District Staff, and the author are available to field review the identified sites and recommendations with RWQCB staff. This will provide valuable context and a visual understanding of the nature of the sites identified.

TABLE 4: SUMMARY OF RESULTS

SITE	DESCRIPTION	MATERIAL	MEDIAN HG (KG/MG)[1]	EROSION POTENTIAL[2]	BIOAVAILABILITY[3]	SEDIMENT YIELD[4]	TREATMENT PRIORITY[5]	SUMMARY OF PREFERRED TREATMENTS	SITE CONSTRAINTS, COMMENTS
Engine Shaft (Pad and upper embankment)	0.5 acre vegetated pad and fill embankment above Hicks Road.	Tailings	16	L	L	L	L	• Maintain existing vegetation and augment as necessary • Notify County Roads Department to minimize disturbance while maintaining Hicks Road • Monitor	• County road right-of-way at base of upper embankment
Engine Shaft (Retained lower fill embankment)	Fill embankment below Hicks Road protected from bank erosion by 10 foot high concrete flume	Tailings	635	ML	L	L	L	• Maintain existing vegetation and augment as necessary • Monitor	• Two samples collected at this location. The median of one sample was 1150 the other 120. • Site constrained by Hicks Road located at top of embankment.
Engine Shaft (Unretained lower fill embankment)	130 foot long unretained but vegetated fill embankment below Hicks Road.	Tailings and recent fill	88	H	L	L	L	• Maintain existing vegetation and augment as necessary • Monitor	• Small unretained area. Well vegetated, no sign of significant erosion. • Site constrained by Hicks Road located at top of embankment
Road Tunnel	Capped horizontal adit	None	-	N	L	N	N	• None	
Lamb Shaft	25 cy tailings pile along small tributary	Tailings	223	H	L	L	L	• None	• Small site with low rate of erosion and sediment yield • Difficult site to access
Lime Kiln and Quarries	Remnants of Guadalupe Lime Company quarry and kiln.	Limestone tailings and processed limestone	1 (excludes one outlying sample with median Hg of 780 mg/kg)	H	L	M	L	• None at present	• Six samples taken at site. One of the samples (S9) had elevated Hg but repeated tests on this sample were highly variable. Based on available information this sample is interpreted to be an outlier and not representative of the site as a whole. • Remaining 5 samples had low Hg concentrations of between 1 and 4 mg/kg. Low Hg is consistent with field observations and past use. • Portions of site are located immediately adjacent to Guadalupe Creek. Portion of the site supports Hicks Road.
Hicks Ranch Road	Samples taken along road where limestone prospecting observed	Limestone	<0	NA	L	LA	N	• None	
L Guadalupe Creek	Calcines exposed along 300± feet of vegetated Guadalupe Creek bank.	Tailings & calcines	68	H	H	M	M	• Reevaluate after property survey if required or if future larger remediation involving the north bank is undertaken	• Property line appears to bisect deposit • About 150 lf of site constrained by Hicks Road located immediately above the deposit

SITE	DESCRIPTION	MATERIAL	MEDIAN HG (KG/MG)[1]	EROSION POTENTIAL[2]	BIOAVAILABILITY[3]	SEDIMENT YIELD[4]	TREATMENT PRIORITY[5]	SUMMARY OF PREFERRED TREATMENTS	SITE CONSTRAINTS, COMMENTS
China Flat	Historic mining camp now used as staging area.	None	5	L	L	L	N	• None	
Brainard Prospect	Reported small adit with "some cinnabar-bearing material". Site not found.	Tailings? Overburden	-	-	-	-	N	• None, small prospect, not located	• Not located by prior investigations
Costello Mine Site	Reported old works without ore deposits. Small site not found.	unknown	-		-	-	N	• None, site off District property	• Not located by prior investigations
Santa Clara Mill Site	Reported mill site but not found.	None	-	-	-	-	N	• None	• Not located by prior investigations
Bowie Prospect	Reported small prospect. Site not found.	Overburden?	-	-	-	-	N	• None, unsuccessful prospect	• Not located by prior investigations
Jacques Gulch	Narrow and steep gradient stream without observed mining operations on District property.	None	-	N	-	N	N	• None	
Property Interior	Interior of Sierra Auzl OSP without observed mine operations.	None	-	N	-	N	N	• None	

Notes

1: Median total Hg concentration mg/kg from samples taken during the course of this investigation. See Appendix 1 for sample results

2: Erosion potential ranking per RWQCB (2009). H: Currently eroding into surface waters; MH: Susceptible to mass wasting from gullies, slumps and landslides; ML: Susceptible to surface erosion; L: Located greater than 300 feet from surface waters, stable slopes and little evidence of surface erosion

3: Bioavailability ranking per RWQCB (2009). H: Heat-processed wastes including calcines and elemental mercury, and heat contaminated soils in processing areas; L: Overburden and rocks

4: Sediment yield: See 3.4 SEDIMENT YIELD (Page 10) for description. E: Has the potential for greater than 100 cubic yards of erosion and sediment delivery within the next 25 years. Active and on-going erosion is present; H: Has the potential for greater than 50 cubic yards of erosion and sediment delivery within the next 25 years. Some erosion is expected during average large winter storms; M: Has the potential for 10 to 50 cy of erosion over the next 25 years. These sites are expected to erode during less frequent storm events; L Unlikely to erode more than 10 cy of sediment within the next 25 years and/or have low potential of sediment delivery. Generally no visible signs of past erosion; N: None; NA: Not applicable

5: Qualitative Ranking: H: High, M: Moderate, L: Low

6.0 REFERENCES

Air Photos

1939 Flight CIV Frames 385-96 to 100; black and white, 1:20,000 nominal scale. On file at UCSC map library, 1939-F
1945 Flight CDF-5 Frames 5-3-39; black and white, 1:10,000 nominal scale. On file at UCSC map library, 1945
1963 Flight CIV Frames 1DD-187; black and white, 1:20,000 nominal scale. On file at UCSC map library, 1963I
1980 Flight USDA Frames 179-128; black and white, 1:40,000 nominal scale. On file at UCSC map library, 1980C

Documents

Aubury, L.E., 1908, Quicksilver Resources of California, second edition, California State Mining Bureau, Bulletin No. 27.

Bailey, E.H., and Everhart, D.L., 1964, Geology and Quicksilver Deposits of the New Almaden District, Santa Clara County, California, U.S. Geological Survey Professional Paper 360.

Becker, G.F., 1887, Geological Map of the New Almaden Mining District: U.S. Geological Survey. Monograph XIII, Atlas Sheet VII.

Beltram, 1991, Proposal and Contract to New Idria Inc. Mine Shaft on Hicks Road and subsequent dump at "Hicks Flat", March 3, 1991. Dick Beltram Excavating, Los Gatos, CA.

Best, T.C., 2010, Road and Trail Inventory: Rancho de Guadalupe portion of the Sierra Azup Open Space Preserve, unpublished report to Midpeninsula Regional Open Space District, Los Altos, CA. Report prepared by Timothy C. Best, CEG, Santa Cruz, CA.

Bradley, W.W., 1918, Quicksilver Resources of California, with a section on metallurgy and ore-dressing, California State Mining Bureau, Bulletin No. 78.

Causey, J.D., 1998, MAS/MILS Arc/Info point coverage for the Western U.S. (excluding Hawaii): U.S. Geological Survey Open-File Report 98-512, U. S. Geological Survey, Spokane, WA.

Cox, 1995, Letter Report to Mr. William Walker, SECOR International Inc. Report dated June 9, 1995. Michael F. Cox, New Almaden, CA, p. 5.

—, 2002, Daloia and Newhagen Meadows Historical Record Review, Unpublished letter report to Michael Williams and Duncan Simmons, Midpeninsula Regional Open Space District. Michael F. Cox, Santa Clara, CA. Letter dated April 29, 2002, p. 9.

—, 2004, Davidson-Marshall Property Mining Historical Review, Unpublished letter report to Duncan Simmons, Midpeninsula Regional Open Space District. Michael F. Cox, Santa Clara, CA. Letter dated December 4, 2004, p. 8.

Coyle, 1992, Geologic letter report, Parcels A and B, Jamison Property, Hicks Road, Santa Clara County, California. Project P102-92, Unpublished letter to Joan Jamison prepared by John Coyle and Associates, Inc. September 10, 1992.

DeGraff, J.V., Rogow, M., and Tainor, P., 2007, Approaches to contamination at mercury mill sites: Examples from California and Idaho, *in* DeGraff, J.V., ed., Understanding and responding to hazardous substances at mine sites in the western united states: Geological Society of America, Reviews in Engineering Geology, Volume 17, p. 115-134.

Environmental Health Consultants, 1992, Letter report to Joan Jamison dated September 9, 1992.

Geologica, 2004, Letter Report: Phase I of Mercury Mine Waste Investigation, Rancho de Guadalupe, Los Gatos, CA. Letter report to Duncan Simons, Midpeninsula Regional Open Space District, dated March 25, 2005. Geologica, San Francisco, Ca, p. 26.

Herrmann, A.T., 1874, Map of the lands of the Guadalupe Mining Company, 1874. On file at University of California, Santa Cruz Map Library.

Irelan, W., 1888, Eighth annual report of the State Mineralogist for the year ending October 1, 1888: California State Mining Board.

McLaughlin, R.J., Clark, J.C., Brabb, E.E., Helley, E.J., and Colon, C.J., 2001, Geologic maps and structure sections of the southwestern Santa Clara Valley and Southern Santa Cruz Mountains, Santa Clara and Santa Cruz Counties, California: U. S. Geological Survey, Miscellaneous Field Studies MF-2373, scale 1:24,000.

Nolan, 2001, Sierra Azul Geologic Resource Assessment, Unpublished report prepared for Midpeninsula Regional Open Space District, report dated April 12, 2001. Nolan Associates.

PIERS, 1994, Phase I Environmental Assessment, Jamison Property, Hicks Ranch Road, Prepared by PIERS Environmental Services, dated November 28, 1994, Project 583-24-003/005.

RWQCB, 2008, Guadalupe River Watershed Mercury Total Maximum Daily Load (TMDL) Project: Staff Report for Proposed Basin Plan Amendment, California Regional Water Quality Control Board, San Francisco Bay Region. September 2008, p. 297.

—, 2009, Water Code Section 13267 Technical Report Requirements on Erosion of Mercury Mine Wastes at the New Almaden Mercury Mining District and Guadalupe Mine, Santa Clara County, Letter to Stephen Abbors, General Manager, Midpeninsula Regional Open Space District dated June 18, 2009 (CIWQA # 717685), California Regional Water Quality Control Board, San Francisco Bay Region, p. 4.

SCVWD, 2006, Map and Construction Plan for Guadalupe Creek Fish Passage Modifications at U-Frame Channel, Santa Clara Valley Water District, Project 26154001, 2-27-06 Preliminary Draft.

SECOR, 1995, Mercury impacts in soil and sediment: Rancho de Guadalupe Property, Sierra Azul Open Space Preserve, Unpublished report submitted to Midpeninsula Regional Open Space District, report dated June 2, 1995, SECOR International Incorporated, Sacramento, CA, p. 26.

SRK, 1989, Phase I Environmental Audit: Rancho de Guadalupe, Unpublished report prepared for Heller, Ehrman, White and McAuliffe, San Francisco. Steffen, Robertson and Kirsten Inc., Lakewood, Co. Report dated September 1989.

—, 1992, Phase II Environmental Audit: Rancho de Guadalupe, Unpublished report prepared for Manufactures Trading Bank, New York. Steffen, Robertson and Kirsten Inc., Redmond Washington. Report dated September 1992.

Tetra Tech, 2003, Technical Memorandum 2.2 Synoptic Survey Report. Guadalupe River Watershed Mercury TMDL Project, Prepared for Santa Clara Valley Water District. September 8, 2003, p. 56.

—, 2005a, Guadalupe River Watershed Mercury TMDL Project Technical Memorandum 5.3.2: Data Collection Report Volume II, Prepared for Santa Clara Valley Water District. Report dated February 8, 2005, p. 160.

—, 2005b, Guadalupe River Watershed Mercury TMDL Project, Final conceptual Model Report, Prepared for San Francisco Bay Regional Water Quality Control Board. Report dated May 20, 2005, p. 160.

Wentworth, C.M., Graham, S.E., Pike, R.J., Beukelman, G.S., Ramsey, D.W., and Barron, A.D., 1997, Summary distribution of slides and earth flows in Santa Clara County, California: USGS Open File Report 97-745.

7.0 INVESTIGATION LIMITATIONS

My services consist of professional opinions and recommendations made in accordance with generally accepted erosion and sediment control principals and practices. No warranty is expressed or implied, or merchantability of fitness, is made or intended in connection with my work, or by furnishing of oral or written reports or findings.

This report is conceptual in nature and is not to be used as the sole basis for final design, construction or remedial action, or as a basis for major capital decisions. Further studies should be performed prior to such decisions.

I trust that this provides you with the information that you need at this time. If you have any questions regarding this report, or need additional information, please feel free to contact me.

Sincerely,

Timothy C. Best
Certified Engineering Geologist #1682
Certified Professional in Erosion and Sediment Control #4353

8.0 APPENDIX 1: MERCURY TEST RESULTS

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Work Order #: 0060357
Reporting Date: December 8, 2010

Date Received:	Soil sample received June 09, 2010
Project # / Name:	None / None
Sample ID:	S1 Sampling Date: 04/29/10
Sampler's Name:	Tim Best / Timothy C. Best CEG
Matrix:	Soil
Lab Number:	0060357-01

Analyte	Sub-sampling Method	Results	Date Analyzed	Method of Analysis
Mercury (Hg)	Grab 20g, then Mortar & Pestle	180	06/28/10	EPA 7471A
Mercury (Hg)	Grab approximately 2g	150	08/24/10	EPA 7471A
Mercury (Hg)	Mortar & Pestle whole sample	100	12/07/10	EPA 7471A

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Date Received: Soil sample received June 09, 2010
Project # / Name: None / None
Sample ID: S2 Sampling Date: 05/21/10
Sampler's Name: Tim Best / Timothy C. Best CEG
Matrix: Soil
Lab Number: 0060357-02

Analyte	Sub-sampling Method	Results	Date Analyzed	Method of Analysis
Mercury (Hg)	Grab 20g, then Mortar & Pestle	68	06/28/10	EPA 7471A
Mercury (Hg)	Grab approximately 2g	67	08/24/10	EPA 7471A
Mercury (Hg)	Mortar & Pestle whole sample	68	12/07/10	EPA 7471A

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Date Received: Soil sample received June 09, 2010
Project # / Name: None / None
Sample ID: S3 Sampling Date: 05/21/10
Sampler's Name: Tim Best / Timothy C. Best CEG
Matrix: Soil
Lab Number: 0060357-03

Analyte	Sub-sampling Method	Results	Date Analyzed	Method of Analysis
Mercury (Hg)	Grab 20g, then Mortar & Pestle	6.0	06/28/10	EPA 7471A
Mercury (Hg)	Mortar & Pestle whole sample	3.2	12/07/10	EPA 7471A

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Date Received:	Soil sample received June 09, 2010		
Project # / Name:	None / None		
Sample ID:	S4	Sampling Date:	05/21/10
Sampler's Name:	Tim Best / Timothy C. Best CEG		
Matrix:	Soil		
Lab Number:	0060357-04		

Analyte	Sub-sampling Method	Results	Date Analyzed	Method of Analysis
Mercury (Hg)	Grab 20g, then Mortar & Pestle	1.8	06/28/10	EPA 7471A
Mercury (Hg)	Mortar & Pestle whole sample	4.6	12/07/10	EPA 7471A

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Date Received: Soil sample received June 09, 2010
Project # / Name: None / None
Sample ID: S5 Sampling Date: 05/21/10
Sampler's Name: Tim Best / Timothy C. Best CEG
Matrix: Soil
Lab Number: 0060357-05

Analyte	Sub-sampling Method	Results	Date Analyzed	Method of Analysis
Mercury (Hg)	Grab 20g, then Mortar & Pestle	2.7	06/28/10	EPA 7471A
Mercury (Hg)	Mortar & Pestle whole sample	2.4	12/07/10	EPA 7471A

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Date Received: Soil sample received June 09, 2010
Project # / Name: None / None
Sample ID: S6 Sampling Date: 05/21/10
Sampler's Name: Tim Best / Timothy C. Best CEG
Matrix: Soil
Lab Number: 0060357-06

Analyte	Sub-sampling Method	Results	Date Analyzed	Method of Analysis
Mercury (Hg)	Grab 20g, then Mortar & Pestle	26	06/28/10	EPA 7471A
Mercury (Hg)	Grab approximately 2g	45	08/24/10	EPA 7471A
Mercury (Hg)	Mortar & Pestle whole sample	6.8	12/07/10	EPA 7471A

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Date Received: Soil sample received June 09, 2010
Project # / Name: None / None
Sample ID: S7 Sampling Date: 05/21/10
Sampler's Name: Tim Best / Timothy C. Best CEG
Matrix: Soil
Lab Number: 0060357-07

Analyte	Sub-sampling Method	Results	Date Analyzed	Method of Analysis
Mercury (Hg)	Grab 20g, then Mortar & Pestle	15	06/28/10	EPA 7471A
Mercury (Hg)	Mortar & Pestle whole sample	16	12/07/10	EPA 7471A

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Date Received:	Soil sample received June 09, 2010		
Project # / Name:	None / None		
Sample ID:	S8	Sampling Date:	05/21/10
Sampler's Name:	Tim Best / Timothy C. Best CEG		
Matrix:	Soil		
Lab Number:	0060357-08		

Analyte	Sub-sampling Method	Results	Date Analyzed	Method of Analysis
Mercury (Hg)	Grab 20g, then Mortar & Pestle	4600	06/28/10	EPA 7471A
Mercury (Hg)	Grab approximately 2g	810	08/24/10	EPA 7471A
Mercury (Hg)	Mortar & Pestle whole sample	1600	12/07/10	EPA 7471A
Mercury (Hg)	Grab approximately 2g	990	12/07/10	EPA 7471A
Mercury (Hg)	Grab approximately 2g	2100	12/07/10	EPA 7471A
Mercury (Hg)	Grab approximately 2g	900	12/07/10	EPA 7471A
Mercury (Hg)	Grab approximately 2g	410	12/07/10	EPA 7471A

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Date Received: Soil sample received June 09, 2010
Project # / Name: None / None
Sample ID: S9 Sampling Date: 05/21/10
Sampler's Name: Tim Best / Timothy C. Best CEG
Matrix: Soil
Lab Number: 0060357-09

Analyte	Sub-sampling Method	Results	Date Analyzed	Method of Analysis
Mercury (Hg)	Grab 20g, then Mortar & Pestle	8400	06/28/10	EPA 7471A
Mercury (Hg)	Grab approximately 2g	0.5	08/24/10	EPA 7471A
Mercury (Hg)	Mortar & Pestle whole sample	5.4	12/07/10	EPA 7471A
Mercury (Hg)	Grab approximately 2g	770	12/07/10	EPA 7471A
Mercury (Hg)	Grab approximately 2g	1390	12/07/10	EPA 7471A
Mercury (Hg)	Grab approximately 2g	780	12/07/10	EPA 7471A
Mercury (Hg)	Grab approximately 2g	970	12/07/10	EPA 7471A

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Date Received: Soil sample received June 09, 2010
Project # / Name: None / None
Sample ID: S10 Sampling Date: 05/21/10
Sampler's Name: Tim Best / Timothy C. Best CEG
Matrix: Soil
Lab Number: 0060357-10

Analyte	Sub-sampling Method	Results	Date Analyzed	Method of Analysis
Mercury (Hg)	Grab 20g, then Mortar & Pestle	7.8	06/28/10	EPA 7471A
Mercury (Hg)	Mortar & Pestle whole sample	0.040	12/07/10	EPA 7471A

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Reporting Date: December 8, 2010

Date Received:	Soil sample received June 09, 2010		
Project # / Name:	None / None		
Sample ID:	S11	Sampling Date:	05/21/10
Sampler's Name:	Tim Best / Timothy C. Best CEG		
Matrix:	Soil		
Lab Number:	0060357-11		

Analyte	Sub-sampling Method	Results	Date Analyzed	Method of Analysis
Mercury (Hg)	Grab 20g, then Mortar & Pestle	0.45	06/28/10	EPA 7471A
Mercury (Hg)	Mortar & Pestle whole sample	0.50	12/07/10	EPA 7471A

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Reporting Date: December 8, 2010

Date Received:	Soil sample received June 09, 2010
Project # / Name:	None / None
Sample ID:	S12 — Sampling Date: 05/21/10
Sampler's Name:	Tim Best / Timothy C. Best CEG
Matrix:	Soil
Lab Number:	0060357-12

Analyte	Sub-sampling Method	Results	Date Analyzed	Method of Analysis
Mercury (Hg)	Grab 20g, then Mortar & Pestle	4.2	06/28/10	EPA 7471A
Mercury (Hg)	Mortar & Pestle whole sample	0.12	12/07/10	EPA 7471A

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Date Received: Soil sample received June 09, 2010
Project # / Name: None / None
Sample ID: S13 Sampling Date: 05/21/10
Sampler's Name: Tim Best / Timothy C. Best CEG
Matrix: Soil
Lab Number: 0060357-13

Analyte	Sub-sampling Method	Results	Date Analyzed	Method of Analysis
Mercury (Hg)	Grab 20g, then Mortar & Pestle	< 0.072	06/28/10	EPA 7471A
Mercury (Hg)	Mortar & Pestle whole sample	2.2	12/07/10	EPA 7471A

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Reporting Date: December 8, 2010

Date Received: Soil sample received June 09, 2010
Project # / Name: None / None
Sample ID: S14 Sampling Date: 05/21/10
Sampler's Name: Tim Best / Timothy C. Best CEG
Matrix: Soil
Lab Number: 0060357-14

Analyte	Sub-sampling Method	Results	Date Analyzed	Method of Analysis
Mercury (Hg)	Grab 20g, then Mortar & Pestle	< 0.15	06/28/10	EPA 7471A
Mercury (Hg)	Mortar & Pestle whole sample	0.30	12/07/10	EPA 7471A

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Work Order #: 0060357
Reporting Date: December 8, 2010

Date Received: Soil sample received June 09, 2010
Project # / Name: None / None
Sample ID: S15 Sampling Date: 05/21/10
Sampler's Name: Tim Best / Timothy C. Best CEG
Matrix: Soil
Lab Number: 0060357-15

Analyte	Sub-sampling Method	Results	Date Analyzed	Method of Analysis
Mercury (Hg)	Grab 20g, then Mortar & Pestle	< 0.060	06/28/10	EPA 7471A
Mercury (Hg)	Mortar & Pestle whole sample	0.089	12/07/10	EPA 7471A

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Work Order #: 0060357
Reporting Date: December 8, 2010

Date Received: Soil sample received June 09, 2010
Project # / Name: None / None
Sample ID: S16 Sampling Date: 05/21/10
Sampler's Name: Tim Best / Timothy C. Best CEG
Matrix: Soil
Lab Number: 0060357-16

Analyte	Sub-sampling Method	Results	Date Analyzed	Method of Analysis
Mercury (Hg)	Grab 20g, then Mortar & Pestle	< 0.10	06/28/10	EPA 7471A
Mercury (Hg)	Mortar & Pestle whole sample	0.053	12/07/10	EPA 7471A

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Work Order #: 0060357
Reporting Date: December 8, 2010

Date Received:	Soil sample received June 09, 2010		
Project # / Name:	None / None		
Sample ID:	S17	Sampling Date:	04/29/10
Sampler's Name:	Tim Best / Timothy C. Best CEG		
Matrix:	Soil		
Lab Number:	0060357-17		

Analyte	Sub-sampling Method	Results	Date Analyzed	Method of Analysis
Mercury (Hg)	Grab 20g, then Mortar & Pestle	480	06/28/10	EPA 7471A
Mercury (Hg)	Grab approximately 2g	190	08/24/10	EPA 7471A
Mercury (Hg)	Mortar & Pestle whole sample	150	12/07/10	EPA 7471A

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Work Order #: 0090543
Reporting Date: December 8, 2010

Date Received: Soil sample received September 20, 2010
Project # / Name: None / None
Sample ID: SA-20 Sampling Date/Time: 09/15/10
Sampler's Name: Tim Best / Timothy C. Best CEG
Matrix: Soil
Lab Number: 0090543-01

Analyte	Sub-sampling Method	Results	Date Analyzed	Method of Analysis
Mercury (Hg)	Grab 20g, then Mortar & Pestle	130	09/24/10	EPA 7471A
Mercury (Hg)	Mortar & Pestle whole sample	150	12/07/10	EPA 7471A

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Work Order #: 0090543
Reporting Date: December 8, 2010

Date Received: Soil sample received September 20, 2010
Project # / Name: None / None
Sample ID: SA-22 Sampling Date/Time: 09/15/10
Sampler's Name: Tim Best / Timothy C. Best CEG
Matrix: Soil
Lab Number: 0090543-03

Analyte	Sub-sampling Method	Results	Date Analyzed	Method of Analysis
Mercury (Hg)	Grab 20g, then Mortar & Pestle	17	09/24/10	EPA 7471A
Mercury (Hg)	Mortar & Pestle whole sample	15	12/07/10	EPA 7471A

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Work Order #: 0090543
Reporting Date: December 8, 2010

Date Received: Soil sample received September 20, 2010
Project # / Name: None / None
Sample ID: SA-21 Sampling Date/Time: 09/15/10
Sampler's Name: Tim Best / Timothy C. Best CEG
Matrix: Soil
Lab Number: 0090543-02

Analyte	Sub-sampling Method	Results	Date Analyzed	Method of Analysis
Mercury (Hg)	Grab 20g, then Mortar & Pestle	33	09/24/10	EPA 7471A
Mercury (Hg)	Mortar & Pestle whole sample	24	12/07/10	EPA 7471A

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Date Received:	Soil sample received September 20, 2010
Project # / Name:	None / None
Sample ID:	SA-23 Sampling Date/Time: 09/15/10
Sampler's Name:	Tim Best / Timothy C. Best CEG
Matrix:	Soil
Lab Number:	0090543-04

Analyte	Sub-sampling Method	Results	Date Analyzed	Method of Analysis
Mercury (Hg)	Grab 20g, then Mortar & Pestle	1.6	09/24/10	EPA 7471A
Mercury (Hg)	Mortar & Pestle whole sample	2.3	12/07/10	EPA 7471A

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Date Received:	Soil sample received September 20, 2010
Project # / Name:	None / None
Sample ID:	SA-24 Sampling Date/Time: 09/15/10
Sampler's Name:	Tim Best / Timothy C. Best CEG
Matrix:	Soil
Lab Number:	0090543-05

Analyte	Sub-sampling Method	Results	Date Analyzed	Method of Analysis
Mercury (Hg)	Grab 20g, then Mortar & Pestle	38	09/24/10	EPA 7471A
Mercury (Hg)	Mortar & Pestle whole sample	12	12/07/10	EPA 7471A

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Date Received: Soil sample received September 20, 2010
Project # / Name: None / None
Sample ID: SA-25 Sampling Date/Time: 09/15/10
Sampler's Name: Tim Best / Timothy C. Best CEG
Matrix: Soil
Lab Number: 0090543-06

Analyte	Sub-sampling Method	Results	Date Analyzed	Method of Analysis
Mercury (Hg)	Grab 20g, then Mortar & Pestle	7.1	09/24/10	EPA 7471A
Mercury (Hg)	Mortar & Pestle whole sample	11	12/07/10	EPA 7471A

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Date Received:	Soil sample received September 20, 2010		
Project # / Name:	None / None		
Sample ID:	SA-26	Sampling Date/Time:	09/15/10
Sampler's Name:	Tim Best / Timothy C. Best CEG		
Matrix:	Soil		
Lab Number:	0090543-07		

Analyte	Sub-sampling Method	Results	Date Analyzed	Method of Analysis
Mercury (Hg)	Grab 20g, then Mortar & Pestle	33	09/24/10	EPA 7471A
Mercury (Hg)	Mortar & Pestle whole sample	34	12/07/10	EPA 7471A

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Date Received: Soil sample received September 20, 2010
Project # / Name: None / None
Sample ID: SA-27 Sampling Date/Time: 09/15/10
Sampler's Name: Tim Best / Timothy C. Best CEG
Matrix: Soil
Lab Number: 0090543-08

Analyte	Sub-sampling Method	Results	Date Analyzed	Method of Analysis
Mercury (Hg)	Grab 20g, then Mortar & Pestle	15	09/24/10	EPA 7471A
Mercury (Hg)	Mortar & Pestle whole sample	13	12/07/10	EPA 7471A

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Work Order #: 0090543
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Date Received: Soil sample received September 20, 2010
Project # / Name: None / None
Sample ID: SA-28 Sampling Date/Time: 09/15/10
Sampler's Name: Tim Best / Timothy C. Best CEG
Matrix: Soil
Lab Number: 0090543-09

Analyte	Sub-sampling Method	Results	Date Analyzed	Method of Analysis
Mercury (Hg)	Grab 20g, then Mortar & Pestle	1700	09/24/10	EPA 7471A
Mercury (Hg)	Mortar & Pestle whole sample	1100	12/07/10	EPA 7471A
Mercury (Hg)	Grab approximately 2g	940	12/07/10	EPA 7471A
Mercury (Hg)	Grab approximately 2g	1000	12/07/10	EPA 7471A
Mercury (Hg)	Grab approximately 2g	1200	12/07/10	EPA 7471A
Mercury (Hg)	Grab approximately 2g	430	12/07/10	EPA 7471A

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Date Received: Soil sample received September 20, 2010
Project # / Name: None / None
Sample ID: SA-29 Sampling Date/Time: 09/15/10
Sampler's Name: Tim Best / Timothy C. Best CEG
Matrix: Soil
Lab Number: 0090543-10

Analyte	Sub-sampling Method	Results	Date Analyzed	Method of Analysis
Mercury (Hg)	Grab 20g, then Mortar & Pestle	92	09/24/10	EPA 7471A
Mercury (Hg)	Mortar & Pestle whole sample	75	12/07/10	EPA 7471A

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Work Order #: 0090543
Reporting Date: December 8, 2010

Date Received:	Soil sample received September 20, 2010		
Project # / Name:	None / None		
Sample ID:	SA-30	Sampling Date/Time:	09/15/10
Sampler's Name:	Tim Best / Timothy C. Best CEG		
Matrix:	Soil		
Lab Number:	0090543-11		

Analyte	Sub-sampling Method	Results	Date Analyzed	Method of Analysis
Mercury (Hg)	Grab 20g, then Mortar & Pestle	2.6	09/24/10	EPA 7471A
Mercury (Hg)	Mortar & Pestle whole sample	0.96	12/07/10	EPA 7471A

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Work Order #: 0090543
Reporting Date: December 8, 2010

Date Received:	Soil sample received September 20, 2010
Project # / Name:	None / None
Sample ID:	SA-31 Sampling Date/Time: 09/15/10
Sampler's Name:	Tim Best / Timothy C. Best CEG
Matrix:	Soil
Lab Number:	0090543-12

Analyte	Sub-sampling Method	Results	Date Analyzed	Method of Analysis
Mercury (Hg)	Grab 20g, then Mortar & Pestle	170	09/24/10	EPA 7471A
Mercury (Hg)	Mortar & Pestle whole sample	190	12/07/10	EPA 7471A

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Work Order #: 0090543
Reporting Date: December 8, 2010

Date Received: Soil sample received September 20, 2010
Project # / Name: None / None
Sample ID: SA-32 Sampling Date/Time: 09/15/10
Sampler's Name: Tim Best / Timothy C. Best CEG
Matrix: Soil
Lab Number: 0090543-13

Analyte	Sub-sampling Method	Results	Date Analyzed	Method of Analysis
Mercury (Hg)	Grab 20g, then Mortar & Pestle	400	09/24/10	EPA 7471A
Mercury (Hg)	Mortar & Pestle whole sample	580	12/07/10	EPA 7471A

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Reporting Date: December 8, 2010

Date Received:	Soil sample received September 20, 2010
Project # / Name:	None / None
Sample ID:	SA-33 Sampling Date/Time: 09/15/10
Sampler's Name:	Tim Best / Timothy C. Best CEG
Matrix:	Soil
Lab Number:	0090543-14

Analyte	Sub-sampling Method	Results	Date Analyzed	Method of Analysis
Mercury (Hg)	Grab 20g, then Mortar & Pestle	240	09/24/10	EPA 7471A
Mercury (Hg)	Mortar & Pestle whole sample	270	12/07/10	EPA 7471A

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Work Order #: 0090543
Reporting Date: December 8, 2010

Date Received: Soil sample received September 20, 2010
Project # / Name: None / None
Sample ID: SA-35 Sampling Date/Time: 09/15/10
Sampler's Name: Tim Best / Timothy C. Best CEG
Matrix: Soil
Lab Number: 0090543-16

Analyte	Sub-sampling Method	Results	Date Analyzed	Method of Analysis
Mercury (Hg)	Grab 20g, then Mortar & Pestle	16	09/24/10	EPA 7471A
Mercury (Hg)	Mortar & Pestle whole sample	26	12/07/10	EPA 7471A

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Work Order #: 0110330
Reporting Date: December 8, 2010

Date Received: Soil sample received November 11, 2010
Project # / Name: None / None
Sample ID: S-41 Sampling Date/Time: 10/27/10
Sampler's Name: Tim Best / Timothy C. Best CEG
Matrix: Soil
Lab Number: 0110330-01

Analyte	Sub-sampling Method	Results	Date Analyzed	Method of Analysis
Mercury (Hg)	Grab 20g, then Mortar & Pestle	76	11/30/10	EPA 7471A
Mercury (Hg)	Mortar & Pestle whole sample	100	12/07/10	EPA 7471A

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Work Order #: 0110330
Reporting Date: December 8, 2010

Date Received: Soil sample received November 11, 2010
Project # / Name: None / None
Sample ID: S-42 Sampling Date/Time: 10/27/10
Sampler's Name: Tim Best / Timothy C. Best CEG
Matrix: Soil
Lab Number: 0110330-02

Analyte	Sub-sampling Method	Results	Date Analyzed	Method of Analysis
Mercury (Hg)	Grab 20g, then Mortar & Pestle	140	11/30/10	EPA 7471A
Mercury (Hg)	Mortar & Pestle whole sample	100	12/07/10	EPA 7471A

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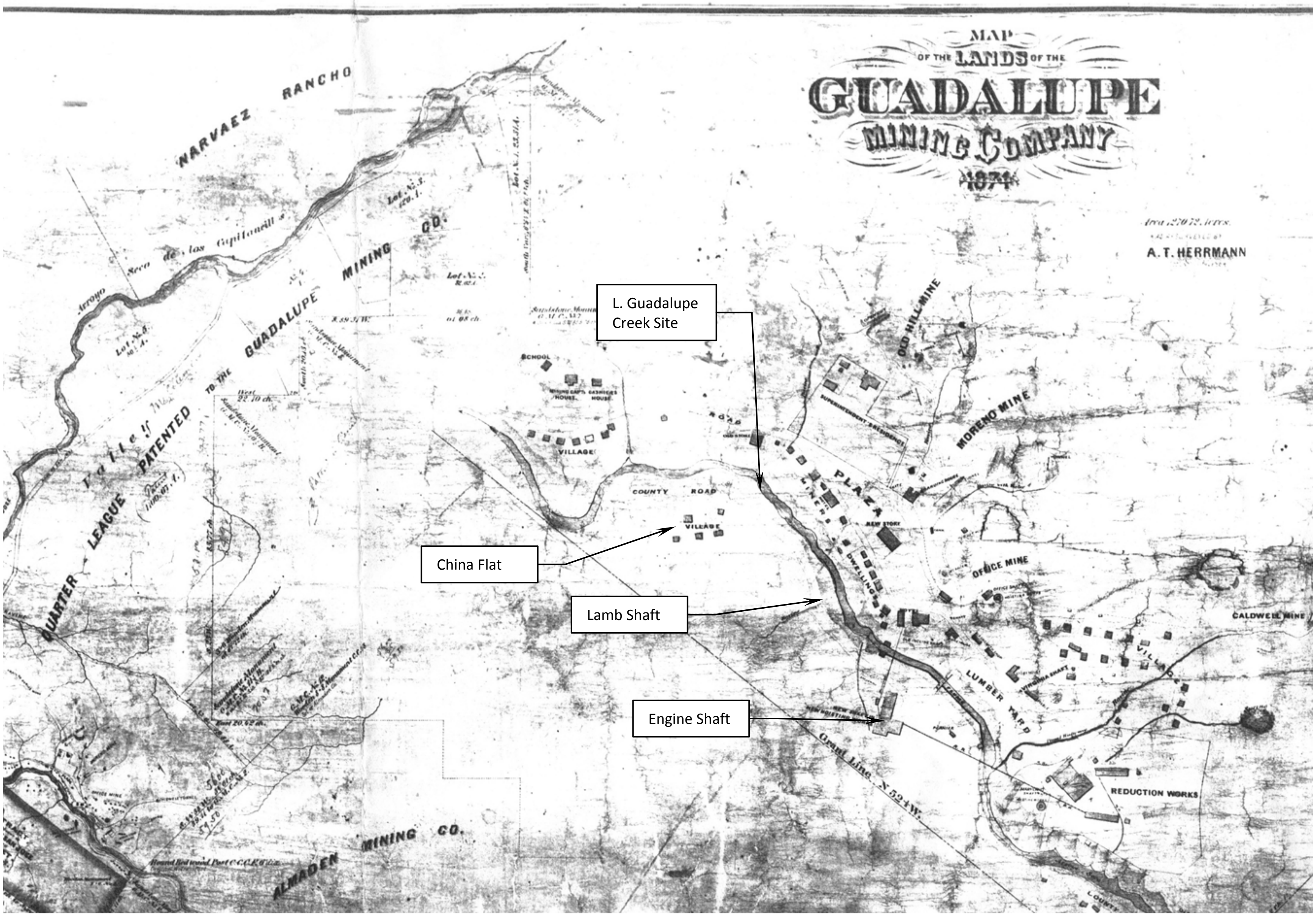
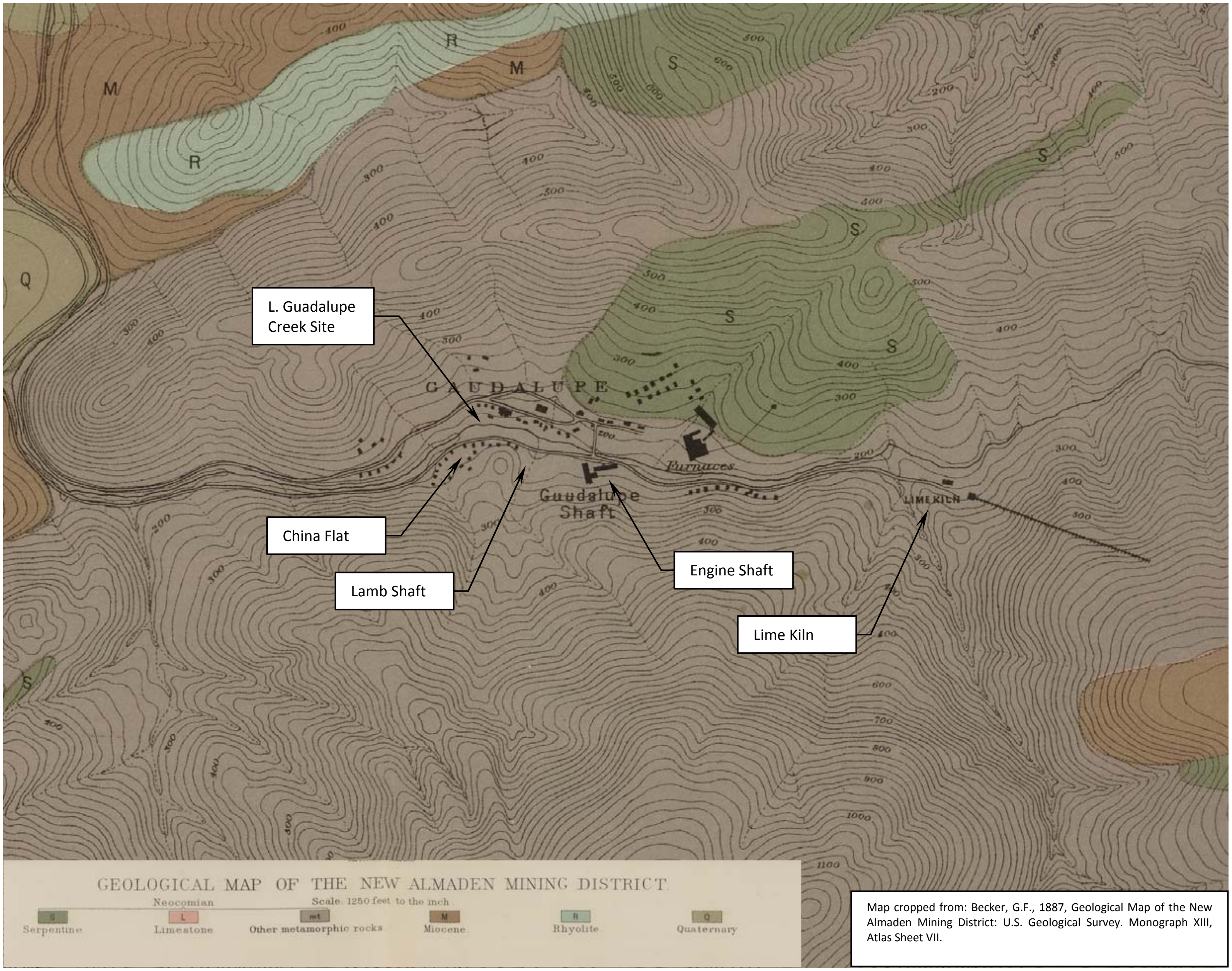
9.0 APPENDIX 2: HISTORIC MAPS


MAP
OF THE LANDS OF THE
GUADALUPE
MINING COMPANY
1871
A. T. HERRMANN
NARVAEZ RANCHO
PATENTED TO THE GUADALUPE MINING CO.
QUARTER LEAGUE
ALMADEN MINING CO.
SCHOOL
VILLAGE
COUNTY ROAD
PLAZA
OLD HILL MINE
MORENO MINE
OFFICE MINE
CALDWELL MINE
LUMBER YARD
REDUCTION WORKS
Grand Line N 52° W.
L. Guadalupe Creek Site
China Flat
Lamb Shaft
Engine Shaft



Map cropped from: Becker, G.F., 1887, Geological Map of the New Almaden Mining District: U.S. Geological Survey. Monograph XIII, Atlas Sheet VII.