SANTA CLARA COUNTY, CALIFORNIA

PERMANENTE QUARRY

RECLAMATION PLAN AMENDMENT

CA MINE ID 91-43-0004

VOLUME IV OF IV: APPENDICES G THROUGH K

JUNE 2023

This reclamation plan amendment is a comprehensive update that supersedes and replaces the prior approved 2012 reclamation plan.

Lead Agency:
Santa Clara County
Department of Planning and Development

Operator:
Lehigh Southwest Cement Company

Heidelberg Materials

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Lead Agency:
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Department of Planning and Development
70 West Hedding Street, East Wing, 7th Floor, San Jose, CA 95110

Operator:
Lehigh Southwest Cement Company
24001 Stevens Creek Blvd., Cupertino, CA 95104

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BIOLOGICAL RESOURCES

Biological Resources Assessment
Lehigh Permanente Quarry

SANTA CLARA COUNTY, CALIFORNIA

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February 2019

WRA ENVIRONMENTAL CONSULTANTS

EXECUTIVE SUMMARY

The Permanente Quarry (Quarry) is a surface mining operation for limestone and aggregate materials that has been in operation since the 1930s. Historical and active quarrying areas are surrounded by steep hillsides supporting forests and shrubland.

This purpose of this report is to describe the results of WRA's field investigations, which assessed the 3,510-acre Permanente Property for the (1) presence of special status species; (2) potential to support special status species; and (3) presence of other sensitive biological resources protected by local, state, and federal laws and regulations.

Six special status wildlife species have been observed on the Permanente Property: California Red-legged Frog, San Francisco Dusky-footed Woodrat, White-tailed Kite, Olive-sided Flycatcher, Yellow Warbler, and Grasshopper Sparrow. One species, the Pallid Bat, has a high potential to occur. Three additional special status wildlife species have a moderate potential to occur on the Permanente Property: Western Red Bat, Long-eared Owl and Loggerhead Shrike.

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1.0 INTRODUCTION

In April through September, 2008 and February through May, 2009, WRA, Inc. performed an assessment of biological resources at the Permanente Quarry and certain surrounding lands, in Santa Clara County, California (Figure 1). The purpose of the assessment was to gather information necessary to complete a review of biological resources in support of California Environmental Quality Act (CEQA) review. This review also supplies the information for conservation of rare, threatened or endangered species, sensitive species and wildlife habitat in compliance with California's Surface Mining and Reclamation Act regulations under CCR § 3703 Performance Standards for Wildlife Habitat.

This report describes the results of WRA's field investigations, which assessed the 3,510-acre Permanente Property, for the (1) presence of special status species; (2) potential to support special status species; and (3) presence of other sensitive biological resources protected by local, state, and federal laws and regulations.

Protocol level special status plant surveys and protocol level surveys for California Red-legged Frog were conducted on site, the results of which are presented herein. This assessment is based on information available at the time of the study and on site conditions that were observed during the period in which the Permanente Property were investigated.

1.1 Permanente Property Description

The Permanente Quarry (Quarry) is a limestone and aggregate mining operation in the unincorporated foothills of western Santa Clara County, approximately two miles west of the City of Cupertino (Figure 1). Elevation ranges from 500 to over 2,000 feet above sea level. The Quarry occupies a portion of an approximately 3,510-acre property owned by Hanson Permanente Cement, Inc. ("Permanente Property"). The Quarry is operated by Lehigh Southwest Cement Company ("Lehigh"). The Quarry currently comprises approximately 614 acres of existing and planned operational areas, which consist of surface mining excavations, overburden stockpiling, crushing and processing facilities, access roads, administrative offices and equipment storage. This includes approximately 19.5 acres of exploratory drilling roads and drill pads south of Permanente Creek. An additional 49.2 acres of predominantly historic mining disturbance is located adjacent to Permanente Creek in an area known as the Permanente Creek Reclamation Area (PCRA). The Quarry also includes other predominantly undisturbed areas, either held in reserve for future mining or which buffer operations from adjacent land uses.

Mining operations take place subject to California's Surface Mining and Reclamation Act (SMARA). SMARA mandates that surface mining operations have an approved reclamation plan that describes how mined lands will be prepared for alternative post-mining uses, and how residual hazards will be addressed. Santa Clara County acts as lead agency under SMARA. The County approved the Quarry's current reclamation plan in 2012.

A cement manufacturing plant lies adjacent to the Quarry on the east. The cement plant also is owned and operated by Lehigh. The cement plant is a separately-permitted industrial use which is not considered part of the Quarry and is not subject to SMARA's requirements. The cement plant was included in the scope of the biological assessment of the Permanente Property.

2.0 REGULATORY BACKGROUND

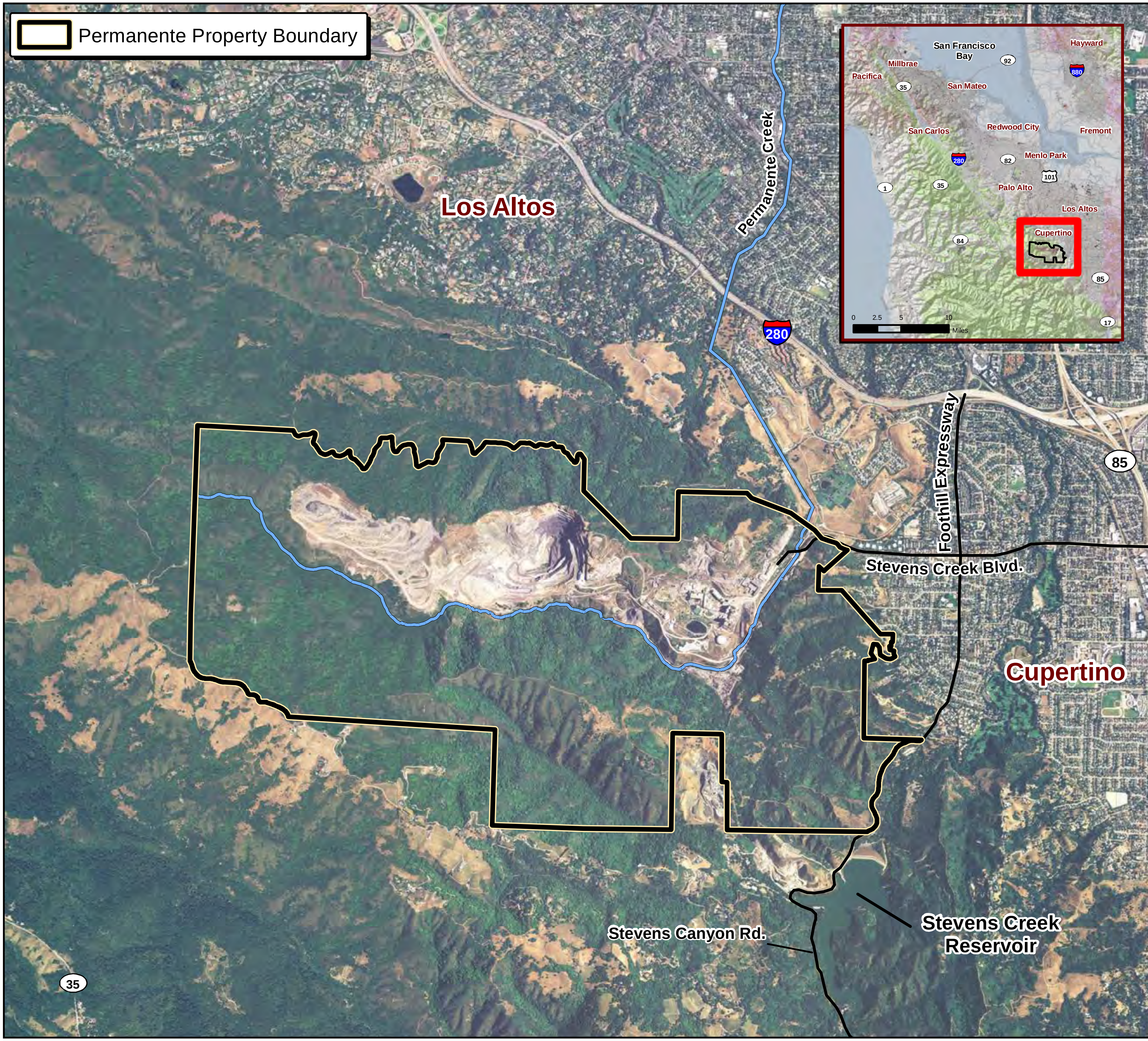
The following sections explain the regulatory context of the biological assessment, including applicable laws and regulations that were applied to the field investigations.

2.1 Sensitive Biological Communities

Sensitive biological communities include habitats that fulfill special functions or have special values, such as wetlands, streams, and riparian habitat. These habitats are protected under federal regulations (such as the Clean Water Act), state regulations (such as the Porter-Cologne Act, the California Department of Fish and Game [CDFG] Streambed Alteration Program, and CEQA), or local ordinances or policies (City or County Tree Ordinances, Special Habitat Management Areas, and General Plan Elements).

<u>Waters of the United States</u>

The U.S. Army Corps of Engineers (Corps) regulates “Waters of the United States” under Section 404 of the Clean Water Act. “Waters of the U.S.” are defined broadly as waters susceptible to use in commerce, including interstate waters and wetlands, all other waters (intrastate waterbodies, including wetlands), and their tributaries (33 CFR 328.3). Potential wetland areas, according to the three criteria used to delineate wetlands stated in the *Corps of Engineers Wetlands Delineation Manual* (Environmental Laboratory 1987), are identified by the presence of (1) hydrophytic vegetation, (2) hydric soils, and (3) wetland hydrology. Areas that are inundated for sufficient duration and depth to exclude growth of hydrophytic vegetation are subject to Section 404 jurisdiction as “other waters” and are often characterized by an ordinary high water mark (OHWM). Other waters, for example, generally include lakes, rivers, and streams. The placement of fill material into “Waters of the U.S.” (including wetlands) generally requires an individual or nationwide permit from the Corps under Section 404 of the Clean Water Act.



ENVIRONMENTAL CONSULTANTS

Lehigh Permanente Quarry
Santa Clara County, CA

Figure 1.

Permanente Property Location Map

N
W E
S

0 0.25 0.5 1
Miles

Date: May 2010
Map By: Michael Rochelle
Image: 2005 NAIP
Filepath: I:\Acad2000\16000\16143\gis\Arcmap\2010 Figures\BRA\Location.mxd

Waters of the State

The term “Waters of the State” (WOS) is defined by the Porter-Cologne Act as “any surface water or groundwater, including saline waters, within the boundaries of the state.” The Regional Water Quality Control Board (RWQCB) protects all waters in its regulatory scope, but has special responsibility for wetlands, riparian areas, and headwaters. These waterbodies have high resource value, are vulnerable to filling, and are not systematically protected by other programs. RWQCB jurisdiction includes “isolated” wetlands and waters that may not be regulated by the Corps under Section 404. “Waters of the State” are regulated by the RWQCB under the State Water Quality Certification Program which regulates discharges of fill and dredged material under Section 401 of the Clean Water Act and the Porter-Cologne Water Quality Control Act. Projects that require a Corps permit, or fall under other federal jurisdiction, and have the potential to impact “Waters of the State,” are required to comply with the terms of the Water Quality Certification determination. If a proposed project does not require a federal permit, but does involve dredge or fill activities that may result in a discharge to “Waters of the State,” the RWQCB has the option to regulate the dredge and fill activities under its state authority in the form of Waste Discharge Requirements.

Streams, Lakes, and Riparian Habitat

Streams and lakes, as habitat for fish and wildlife species, are subject to jurisdiction by CDFG under Sections 1600-1616 of the State Fish and Game Code. Certain alterations to a streambed or lake may require a 1602 Lake and Streambed Alteration Agreement. The term stream, which includes creeks and rivers, is defined in the California Code of Regulations (CCR) as follows: “a body of water that flows at least periodically or intermittently through a bed or channel having banks and supports fish or other aquatic life. This includes watercourses having a surface or subsurface flow that supports or has supported riparian vegetation” (14 CCR 1.72).

Riparian and freshwater habitats are identified as biological communities targeted for conservation in the Resource Conservation Element of the Santa Clara County (SCC) General Plan (County of Santa Clara 1995). Riparian setback distances are described as “flexible” in the SCC General Plan, and generally range up to 150 feet, with the larger setbacks recommended for streams in a natural, undisturbed state. Because Permanente Creek has been historically highly altered, a narrower setback is appropriate. Stream setbacks are approved on a project-by-project basis through discussion with County planners.

Other Sensitive Biological Communities

Other sensitive biological communities not discussed above include habitats that fulfill special functions or have special values. Natural communities considered sensitive are those identified in local or regional plans, policies, regulations, or by the CDFG. CDFG ranks sensitive communities as “threatened” or “very threatened” and keeps records of their occurrences in its Natural Diversity Database. Sensitive plant communities are also identified by CDFG on their *List of California Natural Communities Recognized by the CNDDB*. Impacts to sensitive natural communities identified in local or regional plans, policies, regulations or by the CDFG or USFWS must be considered and evaluated under CEQA (California Code of Regulations: Title 14, Div. 6, Chap. 3, Appendix G).

Specific habitats including bayland habitats, riparian and freshwater habitats, grassland/savanna habitats, and chaparral/mixed woodland/evergreen forest areas are generally identified for conservation in the Resource Conservation Element of the Santa Clara

County General Plan although specific ordinances for their conservation have yet to be developed. Implementation policies that apply to these habitat types include conformance with state and federal laws regarding commercial timber sales and endangered species preservation. The SCC General Plan specifies that conservation of these habitat types is important for the maintenance of wildlife habitat linkages and surface water quality.

Oak Woodlands

Under Public Resources Code section 21083.4 (SB 1334), Santa Clara County shall mitigate for conversion of oak woodlands that will have a significant effect on the environment. The code defines an oak tree as any species of native oak larger than five inches diameter at breast height (DBH).

2.2 Special Status Species

Special status species include those plants and wildlife species that have been formally listed, are proposed as endangered or threatened, or are candidates for such listing under the federal Endangered Species Act (FESA) or California Endangered Species Act (CESA). These acts afford protection to both listed and proposed species. In addition, California Department of Fish and Wildlife (CDFG) Species of Special Concern, which are species that face extirpation in California if current population and habitat trends continue, U.S. Fish and Wildlife Service (USFWS) Birds of Conservation Concern, sensitive species included in USFWS Recovery Plans, and CDFG special status invertebrates are all considered special status species. Although CDFG Species of Special Concern generally have no special legal status, they are given special consideration under the California Environmental Quality Act (CEQA). In addition to regulations for special status species, most birds in the United States, including non-status species, are protected by the Migratory Bird Treaty Act of 1918. Under this legislation, destroying active nests, eggs, and young is illegal. Plant species on California Native Plant Society (CNPS) Lists 1 and 2 are also considered special status plant species. Impacts to these species are considered significant according to CEQA. CNPS List 3 and 4 plants have little or no protection under CEQA, but are included in this analysis for completeness.

Critical Habitat

Critical habitat is a term defined and used in the Federal Endangered Species Act as a specific geographic area that contains features essential for the conservation of a threatened or endangered species and that may require special management and protection. The FESA requires federal agencies to consult with the USFWS to conserve listed species on their lands and to ensure that any activities or projects they fund, authorize, or carry out will not jeopardize the survival of a threatened or endangered species. In consultation for those species with critical habitat, federal agencies must also ensure that their activities or projects do not adversely modify critical habitat to the point that it will no longer aid in the species' recovery. In many cases, this level of protection is similar to that already provided to species by the FESA "jeopardy standard."

Santa Clara Valley Habitat Plan

The Santa Clara Valley Habitat Plan was completed in August 2012. Although the Permanente Property lies outside the limits of the Habitat Plan, species covered in this plan are also considered in this assessment as they are regionally important for conservation.

2.3 Other Regulatory Issues

Sudden Oak Death

The United States Department of Agriculture restricts the interstate movement of certain regulated and restricted articles from quarantined areas in California to prevent the spread of *Phytophthora ramorum*, the organism that causes Sudden Oak Death (SOD) (7 CFR Part 301). Within California, transport of regulated and restricted articles from quarantined counties is regulated by the California Department of Food and Agriculture (CCR3700). Fourteen California counties including Alameda, Contra Costa, Humboldt, Lake, Marin, Mendocino, Monterey, Napa, San Francisco, Santa Clara, Santa Cruz, San Mateo, Solano and Sonoma Counties are included in the quarantine. Regulated articles include nursery stock and soil and may only be moved interstate from a quarantined area if accompanied by a certificate. Restricted articles include bark chips, firewood, forest stock, or mulch from certain vegetation. Restricted articles may only be moved interstate from a quarantined area by the U.S. Department of Agriculture for experimental or scientific purposes.

3.0 METHODS

Between May 2008 and October 2009, the Permanente Property was traversed on foot to determine (1) biological communities present within the Permanente Property, (2) if existing conditions provided suitable habitat for any special status plant or wildlife species, and (3) if sensitive habitats are present. For those areas that were inaccessible due to extreme terrain or dense vegetation, inspection was conducted using aerial photographs and referencing to areas observed on foot.

3.1 Biological Communities

Prior to the site visit, the Soil Survey of the Santa Clara Area, California [U.S. Department of Agriculture (USDA) 1941], the US Fish and Wildlife Service (USFWS) National Wetland Inventory, U.S. Geologic Survey (USGS) topographic maps and USDA aerial photos were examined to determine if any unique soil types, vegetative features, and/or aquatic features that could support sensitive plant communities were present on the Permanente Property. Biological communities present on the Permanente Property were classified based on existing plant community descriptions described in the *Preliminary Descriptions of the Terrestrial Natural Communities of California* (Holland 1986). However, in some cases it is necessary to identify variants of community types or to describe non-vegetated areas that are not described in the literature. Figure 3 shows the general location and extent of the biological communities observed on the Permanente Property. See Appendix C for representative site photographs of the observed plant communities.

3.2 Sensitive Biological Communities and Aquatic Features

Biological communities identified on the Permanente Property were evaluated to determine if they are considered sensitive or non-sensitive as defined by the CEQA and other applicable laws and regulations.

3.2.1 Wetlands and Waters

Wetland areas were identified as areas dominated by plant species with a wetland indicator status[1] of OBL, FACW, or FAC as given on the U.S. Fish and Wildlife Service List of Plant Species that Occur in Wetlands (Reed 1988). Evidence of wetland hydrology can include direct evidence (primary indicators), such as visible inundation or saturation, surface sediment deposits, algal mats and drift lines or indirect indicators (secondary indicators), such as oxidized root channels. Some indicators of wetland soils include dark colored soils, soils with a sulfidic odor, and soils that contain redoximorphic features as defined by the Corps Manual and Field Indicators of Hydric Soils in the United States (NRCS 2002).

Areas that are inundated for sufficient duration and depth to exclude growth of hydrophytic vegetation, such as lakes and ponds, or convey water, such as streams, are also subject to Section 404 jurisdiction.

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[1] OBL = Obligate, always found in wetlands (> 99% frequency of occurrence); FACW = Facultative wetland, usually found in wetlands (67-99% frequency of occurrence); FAC = Facultative, equal occurrence in wetland or non-wetlands (34-66% frequency of occurrence).

Areas delineated as "Other Waters of the U.S." are characterized by an ordinary high water (OHW) mark, defined as:

> *...that line on the shore established by the fluctuations of water and indicated by physical characteristics such as clear, natural line impresses on the bank, shelving, changes in the characteristics of the soil, destruction of terrestrial vegetation, the presence of litter and debris, or other appropriate means that consider the characteristics of the surrounding areas."*
>
> Federal Register Vol. 51, No. 219,
> Part 328.3 (e). November 13, 1986

"Other waters" are identified in the field by the presence of a defined river or stream bed, a bank, and evidence of the flow of water, or by the absence of emergent vegetation in ponds or lakes. Corps jurisdiction of waters in non-tidal areas extends to the ordinary high water (OHW) mark. "Other waters" that were found on the Permanente Property were mapped and are described in the Results section of this report; however, some may be exempt from regulation under the Clean Water Act. "Waters of the State" may include additional aquatic areas not meeting federal definitions. Where this occurred, they were mapped as "Waters of the State". "Waters of the U.S." and "Waters of the State" were either mapped using sub-meter accuracy GPS units, or were mapped based on USGS topographic maps and aerial photograph interpretation; stream widths were noted from field observations. Between March 2008 and August 2009, WRA conducted a routine wetland delineation on the Permanente Property and prepared two reports fully describing the methods and results of the study (WRA 2008, 2010). The first of the two reports (WRA 2008) was verified in a letter dated March 02, 2009 (Corps file no. 2008-00356S); the second (WRA 2010a) was submitted to the Corps for verification on February 3, 2010.

3.2.2 Riparian Habitat

An inspection was conducted to determine if the banks of drainages, streams and other aquatic features on the Permanente Property support hydrophytic or stream-dependent woody plant species (riparian species). Streams supporting riparian vegetation were noted and the area of the riparian habitat was estimated and mapped using ArcGIS software.

3.2.3 Other Sensitive Biological Communities

The Permanente Property was evaluated for the presence of other sensitive biological communities recognized by the California Department of Fish and Game (CDFG) or other local or regional ordinances. All biological communities on the Permanente Property were mapped and are described in Section 4.1 below.

3.3 Special Status Species

3.3.1 Literature Review

Potential occurrence of special status species on the Permanente Property was evaluated by first determining which special status species occur in the vicinity of the Permanente Property through a literature and database search. Database searches for known occurrences of special status species focused on the Cupertino 7.5 minute USGS quadrangle and the eight surrounding USGS quadrangles. The following sources were reviewed to determine which special status plant and wildlife species have been documented to occur in the vicinity of the Permanente Property:

- California Natural Diversity Database records (CNDDB) (CDFG July 2009a)
- USFWS quadrangle species lists (USFWS July 2009)
- CNPS Electronic Inventory records (CNPS July 2009)
- CDFG publication “California’s Wildlife, Volumes I-III” (Zeiner et al. 1990)
- CDFG publication “Amphibians and Reptile Species of Special Concern in California” (Jennings 1994)
- A Field Guide to Western Reptiles and Amphibians (Stebbins, R.C. 2003)
- CDFG CalFish ArcIMS Fish Distribution Mapping Tool and Fish Passage Assessment Database (CDFG September 2009b)
- National Oceanic and Atmospheric Administration NMFS Distribution Maps for California Salmonid Species (1999)

3.3.2 Site Assessment

A site visit was made to the Permanente Property to search for suitable habitats for species identified in the literature review as occurring in the vicinity. The potential for each special status species to occur on the Permanente Property was then evaluated according to the following criteria:

> 1) <u>No Potential</u>. Habitat on and adjacent to the site is clearly unsuitable for the species requirements (foraging, breeding, cover, substrate, elevation, hydrology, plant community, site history, disturbance regime).
>
> 2) <u>Unlikely</u>. Few of the habitat components meeting the species requirements are present, and/or the majority of habitat on and adjacent to the site is unsuitable or of very poor quality. The species is not likely to be found on the site.
>
> 3) <u>Moderate Potential</u>. Some of the habitat components meeting the species requirements are present, and/or only some of the habitat on or adjacent to the site is unsuitable. The species has a moderate probability of being found on the site.
>
> 4) <u>High Potential</u>. All of the habitat components meeting the species requirements are present and/or most of the habitat on or adjacent to the site is highly suitable. The species has a high probability of being found on the site.
>
> 5) <u>Present</u>. Species is observed on the site or has been recorded (i.e. CNDDB, other reports) on the site recently.

The site assessment is intended to identify the presence or absence of suitable habitat for each special status species known to occur in the vicinity in order to determine its potential to occur on the Permanente Property. The site visit does not constitute a protocol-level survey and is not intended to determine the actual presence or absence of a species; however, if a special status species is observed during the site visit, its presence will be recorded and discussed. Appendix A presents the evaluation of potential for occurrence of each special status plant and wildlife species known to occur in the vicinity of the Permanente Property with their habitat requirements, potential for occurrence, and rationale for the classification based on criteria listed above.

Rare plant surveys

Based upon a review of the resources and databases given in Section 3.3.1, 81 plant species which have been given special protection status under state and federal species legislation occur in the vicinity of the Permanente Property. These species, their likelihood of occurrence on the Permanente Property, and the results of the protocol level rare plant surveys are presented in Appendix A.

Based on a reconnaissance level site visit and review of the literature, 32 of the 81 listed species were determined to have the potential to occur on the Permanente Property due to their habitat requirements, known distribution, and the habitats provided on the Permanente Property. Protocol level rare plant surveys were then performed to verify the presence or absence of these thirty two species. Forty-nine (49) of the 81 listed species were determined to have no potential to occur on site based on the lack of specific habitat requirements of the species on the Permanente Property such as coastal salt marsh or particular soil types.

Protocol level surveys were conducted in May and July, 2008 by WRA botanists who have experience with the rare plant species that could occur in the area. The surveys followed the protocol for plant surveys described by Nelson (1987). This protocol complies with recommended resource agency guidelines (CNPS 2001, CDFG 2000, USFWS 1996). In small portions of the Permanente Property, terrain, density of poison oak, or other safety issues proved to be significant obstacles to effectively surveying according to these methods. In these cases, all attempts were made to view the area from alternative locations.

All plants observed during the surveys were identified using The Jepson Manual (Hickman 1993), to the taxonomic level necessary to determine rarity.

Special Status Wildlife Species

Based upon a review of the resources and databases given in Section 3.3.1, 46 wildlife species which have been given special protection status under state and federal species legislation occur in the vicinity of the Permanente Property. These species, their likelihood of occurrence on the Permanente Property, and the results of the field surveys are presented in Appendix A.

Based on a reconnaissance level site visit and review of the literature, 10 of the 46 listed species were determined to have the potential to occur on the Permanente Property due to their habitat requirements, known distribution, and the habitats provided on the Permanente Property. A site assessment for wildlife species involved the identification of habitat types and quality within Permanente Property as it pertains to special status species. This included actively traversing the Permanente Property to identify important habitat features like small mammal burrows, tree cavities and snags, existing nest structures, rock outcroppings, and water features. Additional breeding bird surveys conducted during the breeding bird window (February 1 – August 31) were used to supplement the reconnaissance level site visit assessment of present habitat and present species, by documenting the type of avian species demonstrating nesting and breeding activity. Additional habitat features such as woodrat stick nests were encountered and noted during these surveys. Collaboration with botanical staff was also used to identify wildlife habitat and unique features identified during protocol level rare plant surveys.

3.4 Aquatic Surveys

WRA biologists conducted aquatic biota surveys within Permanente and Monte Bello Creeks in 2009. The surveys included fish sampling, amphibian surveys, and macroinvertebrate sampling. Fish sampling by net of approximately 100 foot reaches included various habitat features (i.e. pool, riffle, run). Sampling efforts took place in February and May in both watersheds to sample fish across varying flow conditions.

A tandem double observer nocturnal visual encounter survey (VES) methodology was used to survey for amphibians within suitable aquatic habitats within the Study Area. Nocturnal VES surveys were conducted from February through May 2009. Surveys began one hour after sunset and concluded at least one hour before sunrise.

In April 2009, WRA biologists collected 18 benthic macroinvertebrate samples (BMI) at six sites (four sites along Permanente Creek and two sites along Monte Bello Creek) in accordance with the California Stream Bioassessment Procedure (CSBP 2003) for non-point source assessments. The CSBP is a regional adaptation of the national U.S. Environmental Protection Agency's (EPA) Rapid Bioassessment Protocols for wadeable streams (Barbour et al. 1999), authored by the California Department of Fish and Game.

All BMI samples remained under the custody of WRA and were processed by WRA biologists.

Organisms were removed from the sample and placed in a petri dish for identification under a stereomicroscope. BMIs were then identified to a standard taxonomic level, typically family level for arthropods and order or class for non-arthropods using standard taxonomic keys (McCafferty 1999, Merritt and Cummins 1996, Voshell 2002).

In addition to aquatic biota surveys, water temperature data was collected at various sampling stations along Permanente Creek. Water temperature is an important consideration for some species, especially fish, who cannot tolerate warm water temperatures. Rainbow Trout are coldwater species, and have a relatively low tolerance for elevated water temperatures. Exposure to elevated water temperatures may lead to reduced health and fitness, reduced growth rates, increased susceptibility to predation and disease, and depending on life-stage and duration of the exposure, may cause direct mortality.

4.0 RESULTS

The Permanente Property is generally characterized by undeveloped hillsides to the south, and to the north, an operating limestone quarry with associated facilities. The quarry is surrounded on all sides by steeply sloping rugged terrain dominated by a mosaic of various open and impenetrable chaparral and scrub communities, open woodlands, and dense forests. The majority of the area is drained by Permanente Creek which runs west to east through the Permanente Property. Two smaller watersheds are present in the southern portion of the Permanente Property. The Permanente Property is bordered by open space lands to the north and west, Monte Bello Ridge and Stevens Creek Quarry to the south, and Stevens Creek Reservoir to the southeast and residential developments to the east.

The following sections present the results of the biological resources assessment for special status species, sensitive plant communities and aquatic features on the Permanente Property.

4.1 Biological Communities

Table 1 summarizes the area of each biological community type or other habitat observed on the Permanente Property. Biological communities were further classified based on specific vegetation alliances observed within each community. Twenty (20) distinct biological communities are located on the Permanente Property. Non-sensitive biological communities include: 1) ruderal herbaceous grassland, 2) mixed scrub, 3) northern mixed chaparral, 4) chamise chaparral, 5) oak chaparral, 6) poison oak scrub, 7) non-native annual grassland, 8) California bay forest, 9) California buckeye woodland, 10) rock outcrop, 11) revegetated areas, 12) active quarry, 13) disturbed areas, and 14) settling ponds and operational water features. Sensitive biological communities include: 15) wetland, 16) willow riparian forest and scrub, 17) sycamore alluvial woodland, 18) white alder riparian forest, 19) oak woodland, and 20) streams and ponds. The general locations and extent of these communities is shown in Figures 3(a) through 3(d). Table 2 shows the extent of the biological communities within the property.

4.1.1 Non-Sensitive Biological Communities

Ruderal herbaceous grassland - Ruderal herbaceous grassland is not described by Holland (1986) but includes habitats previously disturbed and/or reclaimed which have been inactive long enough to recruit a plant community dominated by herbaceous weeds and non-native grasses. Species typical of this plant community in California include brome grasses (*Bromus* spp.), wild oats (*Avena* spp.), Italian thistle (*Carduus pycnocephalus*), wild mustard (*Brassica* sp.), and filaree (*Erodium* sp.). This community is widespread throughout California.

Ruderal herbaceous grassland on the Permanente Property primarily occurs on slopes between quarry roads, or in areas adjacent to quarry activities. Species typical of this biological community on the Permanente Property include Italian thistle, field mustard (*Brassica rapa*), lupine (*Lupinus* sp.), Mediterranean barley (*Hordeum marinum* ssp. *gussoneanum*), yellow star thistle (*Centaurea solstitialis*), oleander (*Nerium oleander*), and slender wild oats (*Avena barbata*). Wildlife observed in this plant community on the Permanente Property include Dark-eyed Junco (*Junco hyemalis*), Ring-necked Snake (*Diadophis punctatus*), and California Towhee (*Pipilo crissalis*).

Mixed scrub - Mixed scrub includes shrub-dominated communities dominated by coyote brush (*Baccharis pilularis*), California sagebrush (*Artemisia californica*), and California buckwheat (*Eriogonum fasciculatum*) partially described as Diablan Sage Scrub by Holland (1986). This community occurs on shallow rocky soils, typically on hot southern exposures of the coast range from Oregon to Central California in areas out of the range of coastal fog incursion.

Mixed scrub was mapped in the eastern portion of the Permanente Property on southern exposures. Additionally, small patches of this community type were mapped throughout the Permanente Property where coyote brush or California buckwheat is the dominant shrub type.

Mixed scrub on the Permanente Property is characterized as dense to moderately open stands to 1.5 meters tall dominated by coyote brush, California sagebrush, and/or California buckwheat with little to no understory vegetation. Associated species include sticky monkey flower (*Mimulus auranticaus*), poison oak (*Toxicodendron diversilobum*), deerweed (*Lotus scoparius*), black sage (*Salvia mellifera*), golden yarrow (*Eriophyllum confertiflora*), and California cudweed (*Gnaphalium californica*). On the Permanente Property, this community type intergrades with chaparrals and oak woodlands. Wildlife observed in this community type on the Permanente Property include Hermit Thrush (*Catharus guttatus*), Northern Pacific Rattlesnake (*Crotalus viridis oreganus*), and Wrentit (*Chamaea fasciata*).

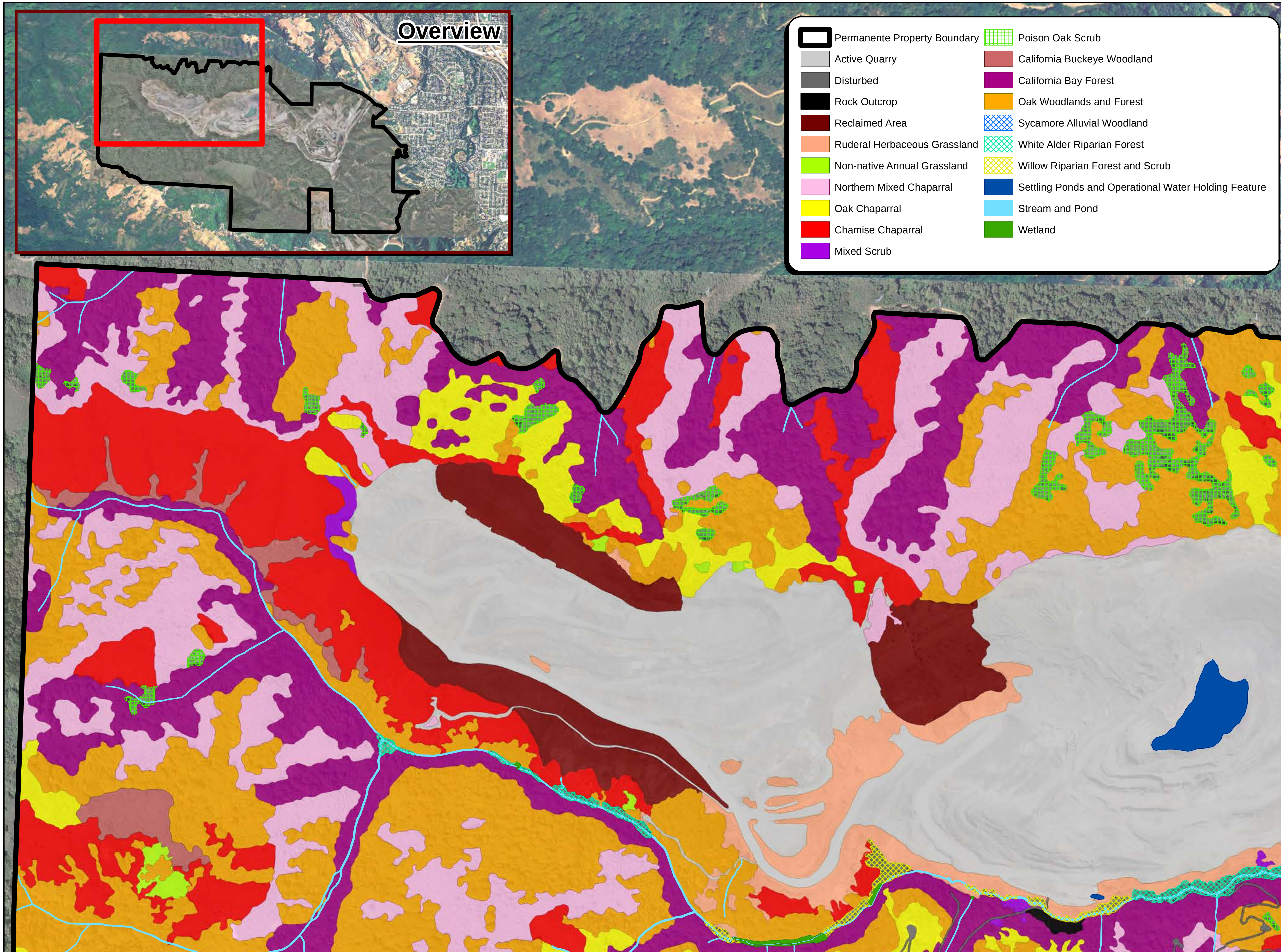
Northern mixed chaparral - Northern mixed chaparral is a community of broadleaved sclerophyll shrubs two to four meters tall forming dense often impenetrable stands dominated by chamise (*Adenostoma fasciculatum*), scrub oak (*Quercus berberidifolia*), various manzanitas (*Arctostaphylos* spp.), and various members of the genus *Ceanothus* (Holland 1986). This community type occurs on dry, rocky, steep, typically south-facing slopes with thin to little soil. It usually occurs below 3,000 feet elevation in Northern California. It is widely distributed throughout the mountain ranges of California.

On the Permanente Property, northern mixed chaparral was mapped in various locations on east and south-facing slopes. Northern mixed chaparral on the Permanente Property forms dense impenetrable stands two to three meters tall with high species diversity in the shrub strata. It intergrades with oak woodlands and oak chaparrals on deeper soils, and chamise chaparral on southern exposures. Species typical of this community type on the Permanente Property include chamise, scrub oak, Eastwood's Manzanita (*Arctostaphylos glandulosa* ssp. *glandulosa*), jimbrush (*Ceanothus oliganthus* var. *sorediatus*), buckbrush (*Ceanothus cuneatus*), birch-leaf mountain mahogany (*Cercocarpus betuloides*), poison oak, yerba santa (*Eriodictyon californicum*), white pitcher sage (*Lepechinia calycina*), coffeeberry (*Rhamnus californicus*), and redberry (*Rhamnus crocea*). There is little to no understory, but where present include Indian warrior (*Pedicularis densiflorus*), Pacific sanicle (*Sanicula crassicaulis*), coyote mint (*Monardella villosa* ssp. *villosa*), and Indian paintbrush (*Castilleja affinis*). Wildlife observed in this community type on the Permanente Property includes Brush Rabbit (*Sylvilagus bachmani*), California Thrasher (*Toxostoma redivivum*) and California Quail (*Callipepla californica*).

Chamise chaparral - Chamise chaparral is a one to three meter-tall chaparral community dominated by chamise with associated species contributing little to overall cover and mature stands containing very little herbaceous understory (Holland 1986). Associated species typically include Manzanita species, scrub oak, buckbrush, birch-leaf mountain mahogany, yerba santa, sage (*Salvia* sp.), and California buckwheat. It has a general distribution similar to northern mixed chaparral, but is more abundant in southern California.

Table 1. Biological Communities within the Permanente Property Boundary

Biological Community	Acres
Active Quarry	568.6
Buckeye Woodland	15.6
California Bay Forest	438.1
Chamise Chaparral	464.8
Disturbed	71.0
Mixed Scrub	67.9
Non-native Annual Grassland	48.5
Northern Mixed Chaparral	358.2
Oak Chaparral	225.8
Oak Woodlands and Forests	920.0
Operational Water Holding Feature	10.8
Poison Oak Scrub	109.4
Reclaimed Area	72.5
Rock Outcrop	0.9
Ruderal Herbaceous Grassland	103.0
Sediment Ponds	1.3
Streams and Ponds	8.8
Sycamore Riparian	6.2
Wetland	2.4
White Alder Riparian Forest	15.0
Willow Riparian Forest and Scrub	4.3
Total	**3,510**



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Lehigh Permanente Quarry
Santa Clara County, CA

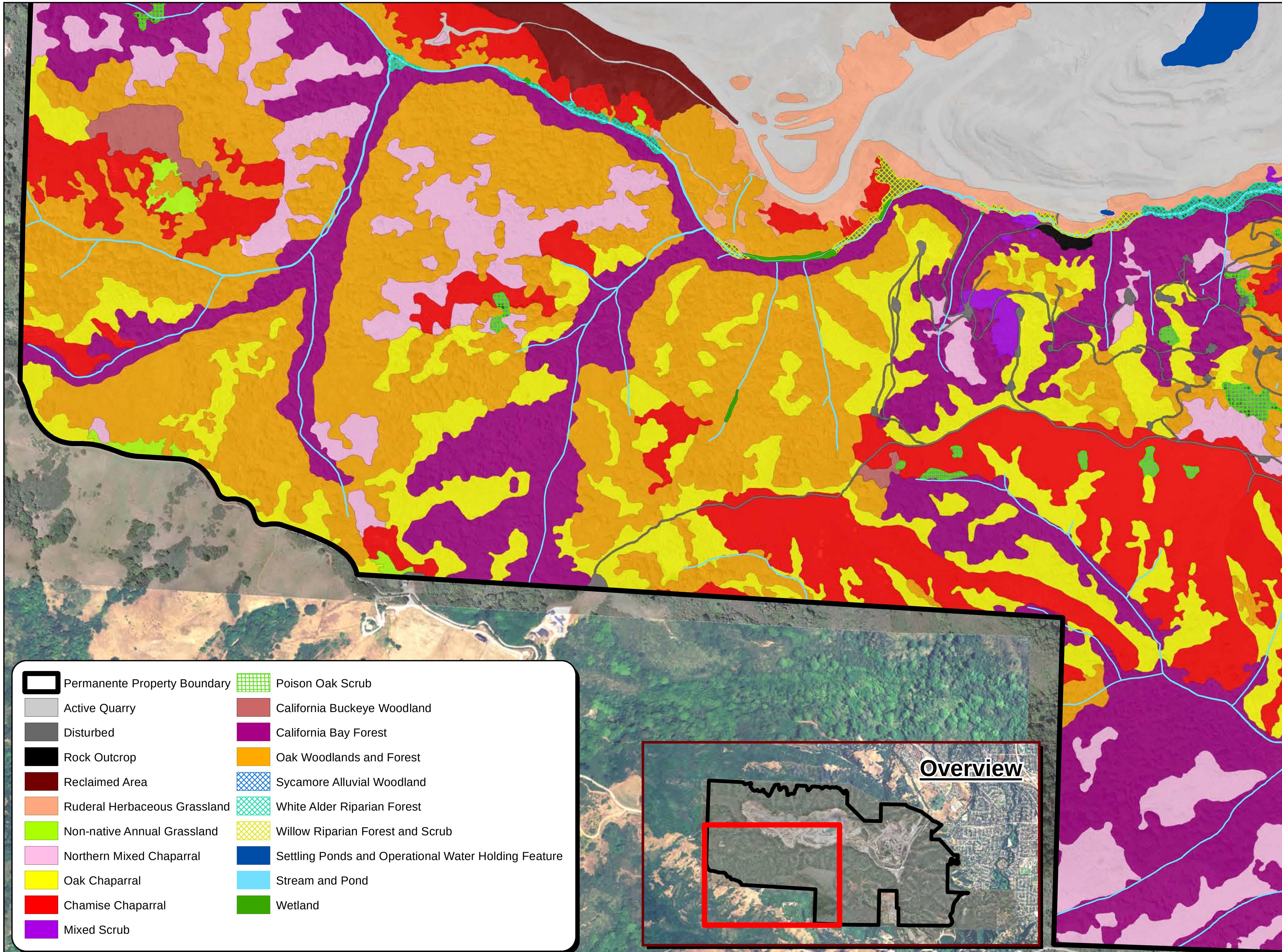
Figure 2a.

Biological Communities within the Permanente Property Boundary

N
W E
S

0 350 700 1,400
Feet

Date: May 2010
Map By: Michael Rochelle
Image: April 2007
Filepath: I:\Acad2000\16000\16143\gis\Arcmap\BRA\2010 Report\BioCommunities_A.mxd



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Lehigh Permanente Quarry
Santa Clara County, CA

Figure 2b.

Biological Communities within the Permanente Property Boundary

N
W E
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0 350 700 1,400 Feet

Date: May 2010
Map By: Michael Rochelle
Image: April 2007
Filepath: I:\Acad2000\16000\16143\gis\Arcmap\BRA\2010 Report\BioCommunties_B.mxd

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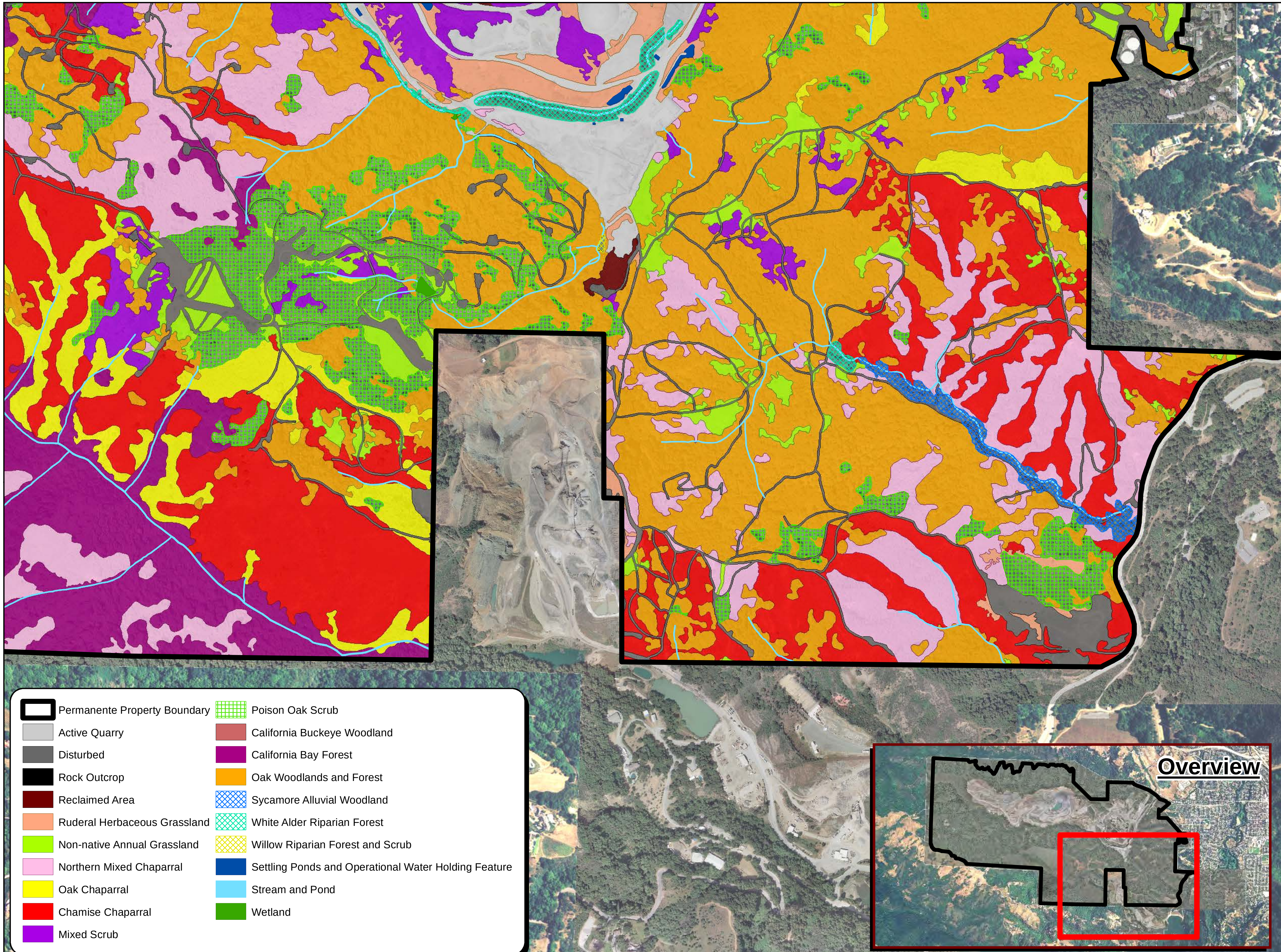
Lehigh Permanente Quarry
Santa Clara County, CA

Figure 2c.

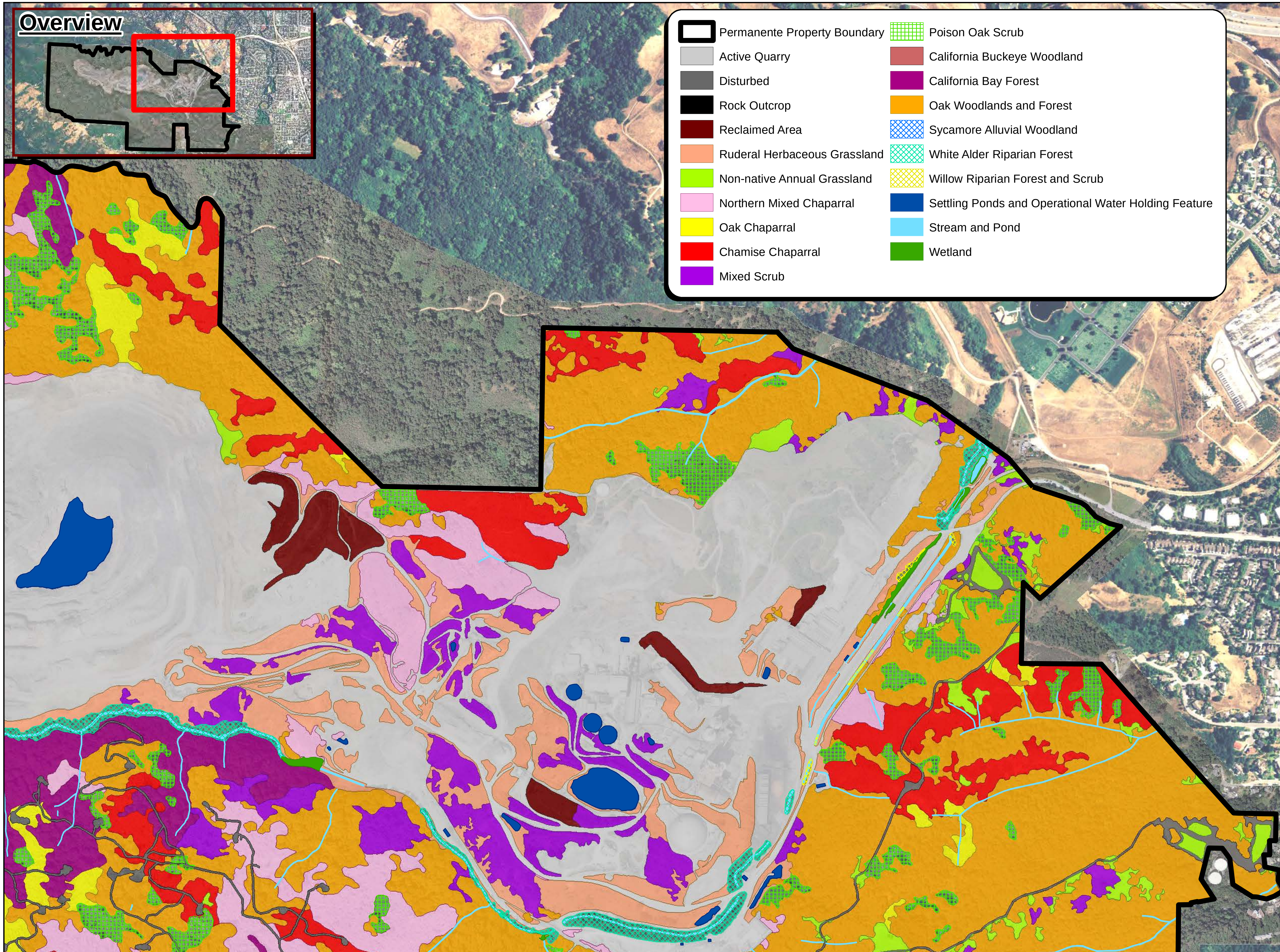
Biological Communities within the Permanente Property Boundary



N
W E
S

0 350 700 1,400
Feet

Date: May 2010
Map By: Michael Rochelle
Image: April 2007
Filepath: I:\Acad2000\16000\16143\gis\Arcmap\BRA\2010 Report\BioCommunities_C.mxd



Lehigh Permanente Quarry
Santa Clara County, CA

Figure 2d.

Biological Communities within the Permanente Property Boundary

N
W E
S

0 350 700 1,400
Feet

Date: May 2010
Map By: Michael Rochelle
Image: April 2007
Filepath: I:\Acad2000\16000\16143\gis\Arcmap\BRA\2010 Report\BioCommunities_D.mxd

Chamise chaparral on the Permanente Property dominates southern exposures with shallow soils. Chamise chaparral on the Permanente Property ranges from 0.5 to three meters tall forming impenetrable stands with no herbaceous understory. It intergrades with northern mixed chaparral on eastern exposures, and abruptly borders oak woodland and oak chaparral at ridgelines. Occasional associates include scrub oak, toyon (*Heteromeles arbutifolia*), and madrone (*Arbutus menziesii*). Wildlife observed in this community type on the Permanente Property includes Spotted Towhee (*Pipilo maculatus*), Bewick's Wren (*Thryomanes bewickii*), and Anna's Hummingbird (*Calypte anna*).

Oak chaparral - Oak chaparral includes plant communities described in Holland (1986) as scrub oak chaparral and undescribed plant communities dominated by canyon live oak (*Quercus chrysolepis*) under four meters tall. Oak chaparral is a dense, evergreen chaparral dominated by oak shrubs (*Quercus berberidifolia*, *Q. chrysolepis*, and *Q. agrifolia*) with considerable cover of birch-leaf mountain mahogany and accumulated leaf litter in the understory. It ranges from Tehama County to Baja California in the western Sierra Nevada and Coast Ranges.

On the Permanente Property, oak chaparral was mapped on various north and east-facing slopes where conditions are slightly more mesic than other slopes. It intergrades with northern mixed chaparral on northern exposures, chamise chaparral on eastern exposures, and oak woodlands on flatter north-facing slopes. Species typical of this community on the Permanente Property include scrub oak, bush interior live oak (*Quercus wislizeni* var. *frutescens*), coffeeberry, madrone, chaparral pipestem (*Clematis lasiantha*), poison oak, and birch-leaf mountain mahogany. Wildlife observed in this community type on the Permanente Property include Hutton's Vireo (*Vireo huttoni*), Blue-gray Gnatcatcher (*Polioptila caerulea*), and Fox Sparrow (*Passerella iliaca*).

Poison oak scrub - Briefly described in Holland (1986), poison oak scrub is a shrub-dominated community maintained by frequent fires or other disturbance and completely dominated by poison oak. Poison oak scrub on the Permanente Property contains extremely dense, monotypic stands of poison oak to two meters tall. There are no other species associated with this community type. Wildlife observed in this community type on the Permanente Property includes Ruby-crowned Kinglet (*Regulus calendula*), Wrentit, and San Francisco Dusky-footed Woodrat (*Neotoma fuscipes annectens*).

Non-native annual grassland - Non-native annual grassland is described in Holland (1986) as a dense to sparse cover of annual grasses and herbs 0.2 to 0.5 meters high. Characteristic species include wild oats, soft chess (*Bromus hordeaceus*), filaree (*Erodium botrys*, *E. cicutarium*), Italian ryegrass (*Lolium multiflorum*), small fescue (*Vulpia microstachys*), and various native and non-native herbs and wildlfowers. This community type is distributed throughout the valleys and foothills of most of California below 3,000 feet.

Non-native annual grassland was mapped on the Permanente Property in various landscape positions. Non-native annual grassland intergrades with chaparrals and oak woodlands on slopes and ridgelines. Species typical of this community type on the Permanente Property include wild oats, ripgut brome (*Bromus diandrus*), soft chess, Italian ryegrass, filaree, small fescue, California poppy (*Eschscholzia californica*), bird vetch (*Vicia cracca*), and birdfoot trefoil (*Lotus corniculatus*). Wildlife observed in this plant community on the Permanente Property include Western Meadowlark (*Sturnella neglecta*), Bobcat (*Lynx rufus*), and Violet-green Swallow (*Tachycineta thalassina*).

California bay forest - California bay forest is described in Holland (1986) as similar to a mixed evergreen forest but typically consisting entirely of California bay to 30 meters tall. It usually occurs on moist, north-facing slopes and intergrades with redwood forests in moister canyons and mixed chaparral on drier, rockier slopes. This community type is usually very dense and supports little or no understory. Characteristic species include jimbrush, dogwood (*Cornus* sp.), blackberries (*Rubus* sp.), and snowberry. It is distributed along the Coast Ranges from the Oregon border to northern San Luis Obispo County below 3,000 feet, with patchy occurrences of stands usually limited to a few acres.

On the Permanente Property, this community type occurs on north-facing slopes and in the protected valley bottoms. This community type on the Permanente Property consists of dense, monotypic stands of California bay with little to no understory. Reproduction is primarily vegetative with many stems arising from a single root system. Wildlife observed in this plant community include Steller's Jay (*Cyanocitta stelleri*), Chestnut-backed Chickadee (*Poecile rufescens*), and Mule Deer (*Odocoileus hemionus*).

California buckeye woodland - California buckeye woodland is not described in Holland (1986), but includes areas of open woodland dominated by California buckeye. California buckeye woodlands on the Permanente Property usually contain moderate cover of California buckeye with associated elderberry (*Sambucus mexicana*) and coast live oak. The understory is dominated by native grasses and herbs such as California melic grass (*Melica californica*), small-flowered needlegrass (*Nassella lepida*), California buttercup (*Ranunculus californicus*), and pacific sanicle as well as non-native grasses such as Italian ryegrass, soft chess, and ripgut brome. Wildlife observed in this plant community on the Permanente Property include Chestnut-backed Chickadee, American Robin (*Turdus migratorius*), and Red-breasted Sapsucker (*Sphyrapicus ruber*).

Rock outcrop - Rock outcrop includes areas that host little to no soil or plant cover. On the Permanente Property, they are primarily vertical exposures of various rock types amidst chaparral communities on all aspects. Many small rock outcrops are scattered throughout the Permanente Property, but were primarily too small to map in this effort. The largest rock outcrop on the Permanente Property is on the southern side of Permanente Creek in the center of the Permanente Property. This rock outcrop supports sparse coverage of bigleaf maple (*Acer macrophyllum*) saplings and pacific stonecrop (*Sedum spathulifolium*).

Reclaimed areas - Reclaimed areas are defined here as historically disturbed slopes that have been reclaimed by grading to a final contour, planted with native grass species, and/or planted at a low to moderate density with native shrubs and trees including coyote brush, chamise, and oaks from locally collected cuttings and acorns. Irrigation has been applied to some of the more recent, large-scale revegetated areas to encourage the establishment of planted trees and shrubs, and protective cages have been installed around most container plantings to reduce damage from deer browsing. Generally, these areas are dominated by grass species including wild oats, brome grasses, small fescue, and Italian rye-grass with some establishment of yellow star thistle throughout the open areas. Wildlife observed in this plant community on the Permanente Property include Grasshopper Sparrow (*Ammodramus savannarum*), Bewick's Wren, and Spotted Towhee.

Active quarry - Areas identified on the Permanente Property as active quarry have been disturbed by quarry activities and in some locations host a very small number of weedy and/or native plant species including yellow star thistle, coyote brush, chamise, wild oats, sweet fennel

(*Foeniculum vulgare*), and field mustard. Generally, plant cover in these areas is very sparse due to the lack of topsoil. This community offers little habitat for plants or animals.

Disturbed areas - Areas identified on the Permanente Property as disturbed have been disturbed by non-quarry activities such as plowing for fuel breaks and construction and maintenance of dirt roads and clearing of hiking trails. Disturbed areas generally have highly compacted soils and provide little habitat for plants or animals.

Settling ponds and operational water features - Settling ponds for quarry runoff and operational water ponds were identified on the Permanente Property as shown in Figures 3a-d.

4.1.2 Sensitive Biological Communities and Aquatic Features

The sensitive biological communities observed on the Permanente Property are shown in Figures 4(a-d) and described below.

Wetland - Wetlands mapped on the Permanente Property include two types of wetland: wetland seeps and freshwater emergent wetlands. Wetland seeps are not described in Holland (1986) but are characterized by a dominance of perennial herbs and ferns that are adapted to wetland conditions. On the Permanente Property, wetland seeps occur along slopes where freshwater lenses intersect the soil surface, or along intermittent spring-fed streams. Wetland seeps on the Permanente Property are dominated by California elk clover (*Aralia californica*), wild ginger (*Asarum caudatum*), giant chain fern (*Woodwardia finbriata*), maiden hair fern (*Adiantum jordanii*), and five-fingered fern (*Adiantum aleuticum*). Wildlife observed in this plant community on the Permanente Property include Stellar's Jay, Bewick's Wren, and California Newt (*Taricha torosa*).

Emergent freshwater wetland occurs in quiet sites permanently flooded with freshwater (Holland 1986). This community is dominated by perennial emergent monocots to five meters tall. Characteristic species of this community type include sedges (*Carex* sp.), bulrush (*Scirpus* sp.), cattails (*Typha* sp.), and spike rush (*Eleocharis* sp.). This community type occurs along the California coast and in coastal valleys near river mouths and around the margins of lakes and springs.

Emergent freshwater wetland on the Permanente Property includes areas adjacent to Permanente Creek which are permanently flooded and host a plant community dominated by perennial emergent grasses and herbs. Four constructed sedimentation basins (Ponds 13, 14, 21 and 22) were mapped as freshwater marshes due to the recruitment of this plant community in the accumulated sediments between maintenance cycles. Species typical of this community type on the Permanente Property include cattail, watercress (*Rorippa nasturtium* ssp. *aquaticum*), field horsetail (*Equisetum arvense*), stinging nettle (*Urtica dioica*), and short spike hedge nettle (*Stachys pycnantha*). Wildlife observed in this plant community on the Permanente Property include Song Sparrow (*Melospiza melodia*), Pacific Tree Frog (*Pseudacris regilla*), and Red-winged Blackbird (*Agelaius phoeniceus*).

Willow riparian forest and scrub - Willow riparian forest and scrub is not described in Holland (1986), but is characterized as a riparian community dominated by various willow species (*Salix* spp.). Species typical of this community type include arroyo willow (*Salix lasiolepis*), red willow (*S. laevigata*), and black willow *(S. gooddingii*). The overstory ranges from dense to open, and heights range from one to six meters. Associated understory species include short spike hedge nettle, stinging nettle, poison oak, California blackberry (*Rubus ursinus*), and western creek dogwood (*Cornus sericea* ssp. *occidentalis*). It occurs along flat areas adjacent to Permanente

Creek and wet tributaries. Wildlife observed in this plant community on the Permanente Property include Lincoln's Sparrow (*Melospiza lincolnii*), Wilson's Warbler (*Wilsonia pusilla*), and Great Blue Heron (*Ardea herodias*).

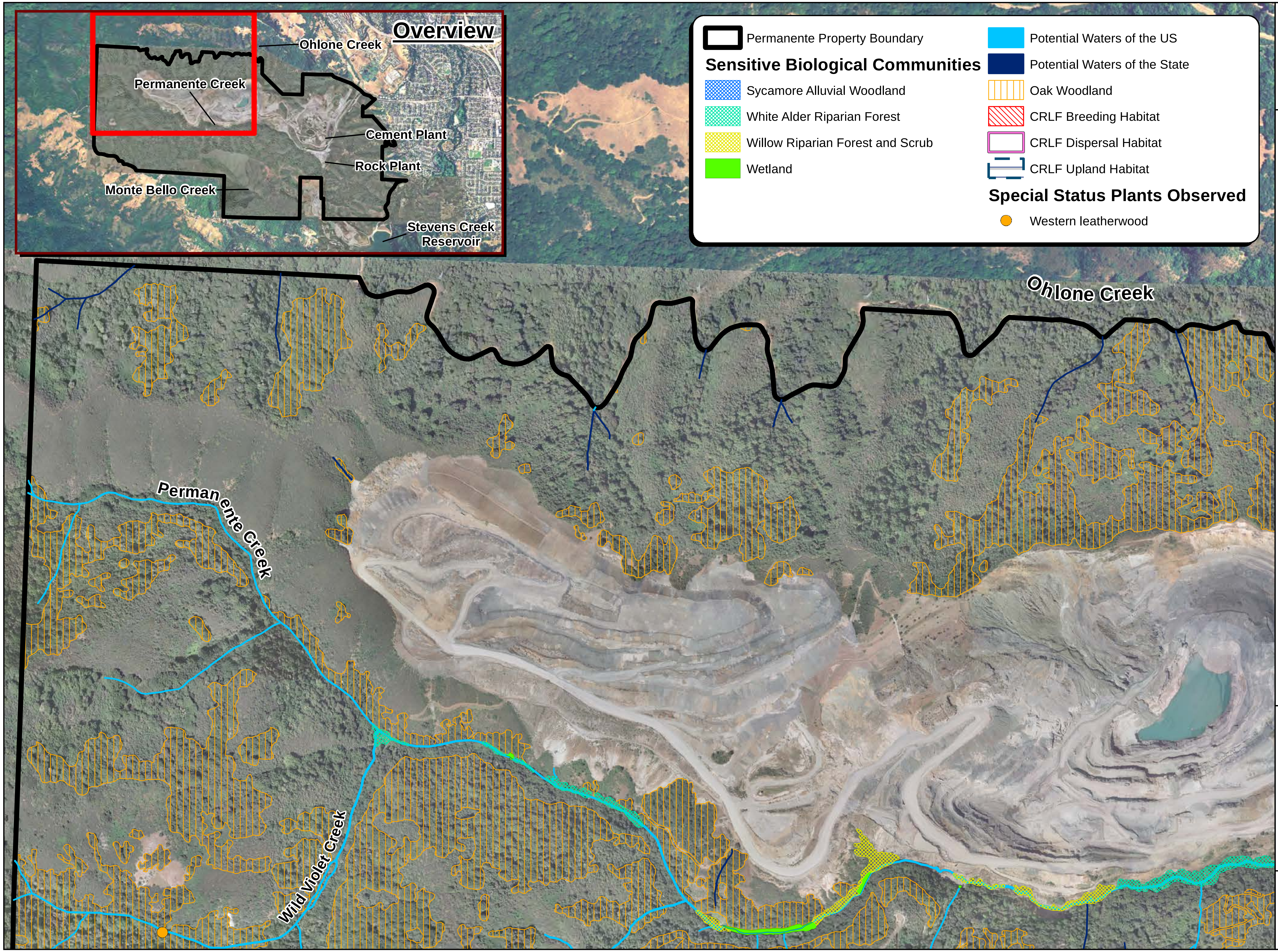
Sycamore alluvial woodland - Sycamore alluvial woodland is described in Holland (1986) as a moderately closed broadleaf riparian forest dominated by sycamore (*Platanus racemosa*) and cottonwood (*Populus fremontii*). Associated species include bigleaf maple (*Acer macrophyllum*), California buckeye, coast live oak, and various willow species. This community type usually occurs on floodplains of sub-perennial streams throughout the coast ranges of California.

Sycamore alluvial woodland was mapped in the far eastern portion of the Permanente Property along one unnamed tributary to Stevens Creek. This community has a moderately open canopy dominated by sycamore with occasional cottonwood, valley oak (*Quercus lobata*), and coast live oak. Understory species include California blackberry, poison oak, and annual grasses. Wildlife observed in this plant community on the Permanente Property include Hairy Woodpecker (*Picoides villosus*), Pacific Slope Flycatcher (*Empidonax difficilis*), and Brown Creeper (*Certhia americana*).

White alder riparian forest - White alder riparian forest is described in Holland (1986) as a medium-tall broadleaf deciduous streamside forest dominated by white alder (*Alnus rhombifolia*) typical of perennial streams in incised canyons below 6,000 feet. Stands in the coast ranges have abundant willows, poison oak, California wild rose (*Rosa californica*), and snowberry in the understory. Associated species include bigleaf maple, western creek dogwood, and Oregon ash (*Fraxinus latifolia*). White alder riparian forest is best formed along rapidly flowing, bedrock-constrained, steep sided canyons, so the riparian corridor is typically narrow.

White alder riparian forest was mapped on the Permanente Property along portions of Permanente Creek. This community type on the Permanente Property is dominated by white alder with abundant bigleaf maple, western creek dogwood, willows, poison oak, and snowberry. Wildlife observed in this plant community on the Permanente Property include Nuttall's Woodpecker (*Picoides nuttallii*), Black Phoebe (*Sayornis nigricans*), and Pacific Slope Flycatcher.

Oak woodland – Several oak woodland community types are described in more detail in Holland (1986), but were lumped in this vegetation mapping effort due to the lack of dominance of one oak species in most of the woodlands encountered on the Permanente Property. Permanente Property's oak woodlands are described as Blue Oak Woodland and Coast Live Oak Woodland in Holland (1986) but also contain oak woodland communities dominated by canyon live oak, and mixed oak woodlands. Species characteristic of these oak woodland types include blue oak (*Quercus douglasii*), coast live oak, canyon live oak, California buckeye, grey pine (*Pinus sabiniana*), California bay, elderberry, toyon, madrone, coffeeberry, poison oak, gooseberries (*Ribes* spp.), and manzanitas. These oak woodland types are distributed throughout California typically in protected valleys and north-facing slopes, intergrading with chaparrals on drier sites and mixed evergreen forests on moister sites.



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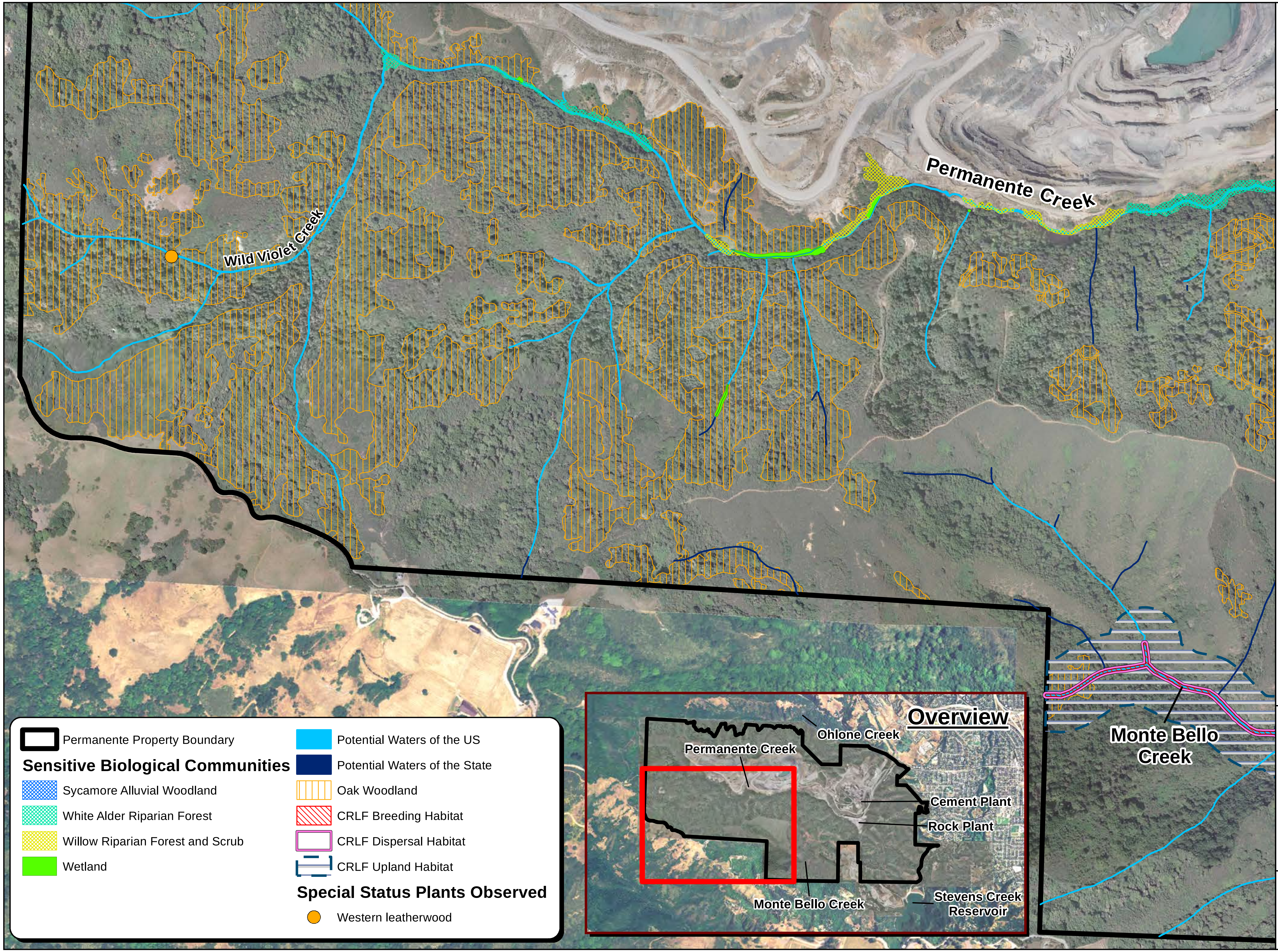
Lehigh Permanente Quarry
Santa Clara County, CA

Figure 3a.

Sensitive Biological Communities and Special Status Species Observed

Date: May 2010
Map By: Michael Rochelle
Image: 2005 NAIP
Filepath: I:\Acad2000\16000\16143\gis\Arcmap\BRA\2010 Report\SpecialStatus_A.mxd



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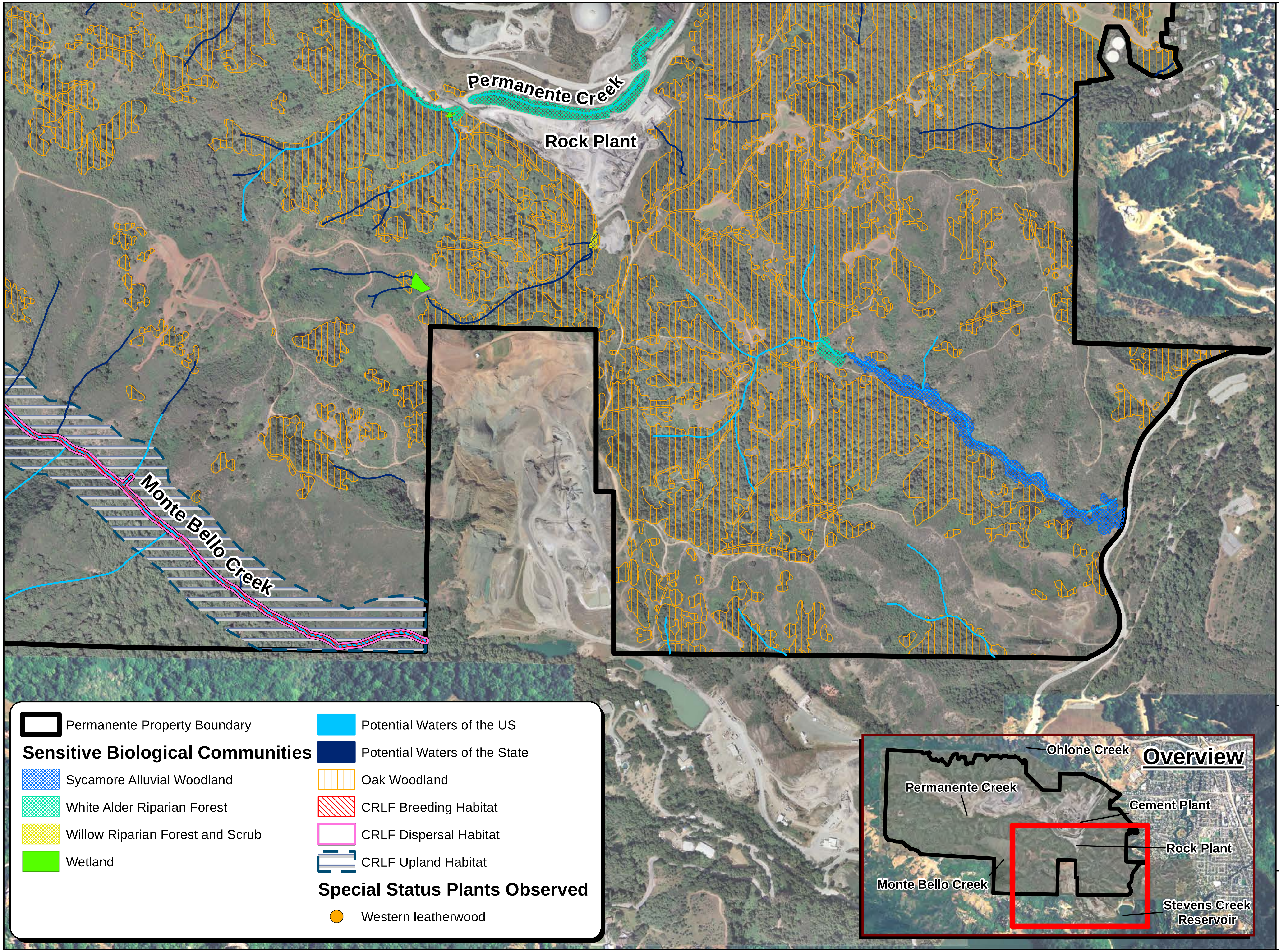
Lehigh Permanente Quarry
Santa Clara County, CA

Figure 3b.

Sensitive Biological Communities and Special Status Species Observed

Date: May 2010
Map By: Michael Rochelle
Image: April 2007
Filepath: I:\Acad2000\16000\16143\gis\Arcmap\BRA\2010 Report\SpecialStatus_B.mxd



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Lehigh Permanente
Quarry
Santa Clara County, CA

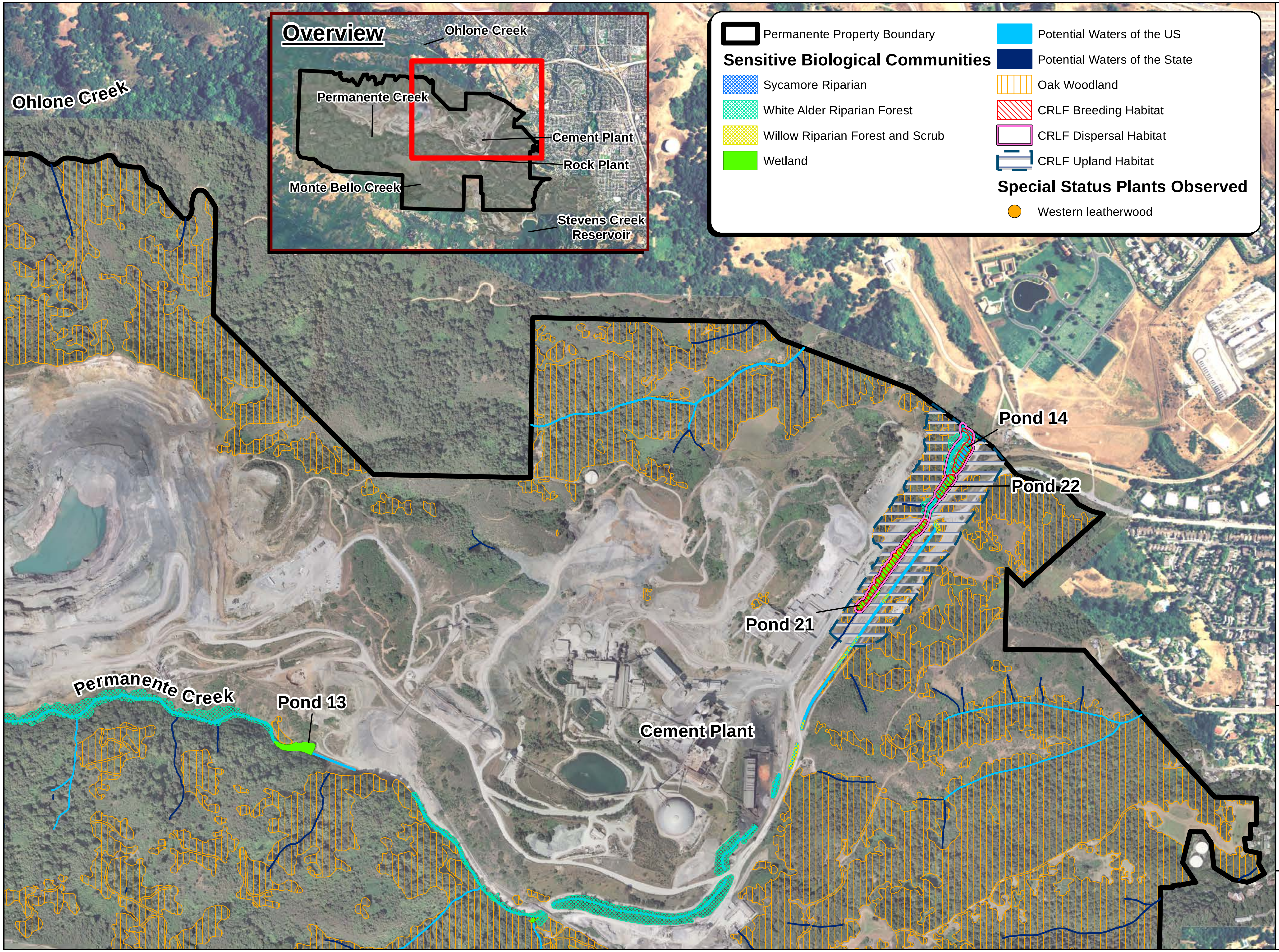
Figure 3c.

Sensitive Biological
Communities and Special
Status Species Observed

N
W E
S

0 350 700 1,400
Feet

Date: May 2010
Map By: Michael Rochelle
Image: April 2007
Filepath: I:\Acad2000\16000\16143\gis\Arcmap\
BRA\2010 Report\SpecialStatus_C.mxd



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Lehigh Permanente Quarry
Santa Clara County, CA

Figure 3d.

Sensitive Biological Communities and Special Status Species Observed

N W E S

0 350 700 1,400 Feet

Date: May 2010
Map By: Michael Rochelle
Image: April 2007
Filepath: I:\Acad2000\16000\16143\gis\Arcmap\BRA\2010 Report\SpecialStatus_D.mxd

Oak woodlands were mapped on the Permanente Property primarily along north-facing slopes and in valley bottoms. Oak woodlands on the Permanente Property are predominantly characterized as coast live oak and blue oak woodlands. A few small pockets of oak woodland dominated by interior live oak (northern portion of the Permanente Property) are also present. Oak woodlands on the Permanente Property have dense and diverse overstories containing madrone, tanbark oak (*Lithocarpus densiflorus*), and California bay with occasional grey pine, and Douglas-fir (*Pseudotsuga menziesii*). Species characteristic of the understory include poison oak, coffeeberry, ocean spray (*Holodiscus discolor*), elderberry, toyon, and gooseberries. Wildlife observed in this plant community on the Permanente Property includes Cooper's Hawk (*Accipiter cooperii*), Oak Titmouse (*Baeolophus inornatus*), and California Deer Mouse (*Peromyscus californicus*).

Streams and ponds - Streams and ephemeral drainages were mapped on the Permanente Property. The most significant of these is Permanente Creek which is a perennial stream that flows across the Permanente Property from its headwaters in the west to the northeastern boundary of the site. Portions of the creek only convey surface water for a few weeks during annual peak rains. Tributaries to Permanente Creek as well as tributaries to Ohlone Creek to the north and to Monte Bello Creek to the south of the Permanente Property were mapped and are described in detail in a jurisdictional determination report submitted to the U.S. Army Corps of Engineers in January 2010 (WRA 2010a).

Permanente Creek

The headwaters of Permanente Creek originate to the west of the Permanente Property. It is fed through a series of seeps and intermittent tributaries, in addition to surface runoff. Permanente Creek trends generally west to east, roughly through the center of the property before turning north and flowing for approximately nine miles before emptying into San Francisco Bay. In general, the western-most third of Permanente Creek in the Permanente Property follows a natural course. The central third of the creek has been subjected to historical disturbance, including fill, realignment and road crossings, associated with early mining activities. The eastern third of the creek, after flowing into settling Pond 13, flows through numerous culverts, channelized segments and impoundments before exiting at the north east corner of the Permanente Property. These portions of the Permanente Property have been historically managed and/or diverted as part of the quarry operations, which have been ongoing since the late 1930s based on aerial and historic site photographs. A delineation of Permanente Creek was verified by the U.S. Army Corps of Engineers (WRA 2008). Additionally a detailed analysis of the hydrology of Permanente and Monte Bello Creeks was performed by Golder Associates (2010).

Permanente Creek is heavily managed downstream of the Permanente Property where it runs through residential and commercial areas and is generally channelized until reaching Mountain View Slough and south San Francisco Bay. In Los Altos, just north of Mira Monte and Portland Avenues, there is a low flow diversion dam that spills water into Permanente Creek only during very high flow events effectively severing the creek downstream of this dam from receiving flows from upstream. The dam spills from the top through narrow slits from about five to six foot in height. Below this dam Permanente Creek is overgrown with vegetation. The dam is located along the western portion of an 8,000 foot long concrete diversion channel. The Permanente Diversion was designed to divert the majority of storm runoff from the upper Permanente watershed into Stevens Creek. The diversion structure diverts almost all flow to Stevens Creek (SCVWD 2002).

Generally, tributaries that drain into Permanente Creek are extremely flashy in nature and rarely convey surface flow except during high flow events. The slope to the south of Permanente Creek is densely vegetated and the soils are dominated by various loams which are highly permeable. Since surface water is not largely available (both in time and space) within these tributaries, they do not serve as aquatic habitat to organisms.

Monte Bello Creek

Monte Bello Creek originates from a combination of seeps and intermittent tributaries to the south of the Permanente Property on the north side of Monte Bello ridge and drains an area of approximately 950 acres in size. The Main Stem, also referred to as the “South Fork”, flows northeast until it meets the “North Fork” which originates on the Permanente Property. From the confluence, the Main Stem is perennial and trends southeast until it leaves the Permanente Property and drains into a series of large, in-stream, detention basins on the neighboring property. The creek drains into Stevens Creek Reservoir before emptying into Stevens Creek which trends north along Highway 85 and out to San Francisco Bay through Mountain View.

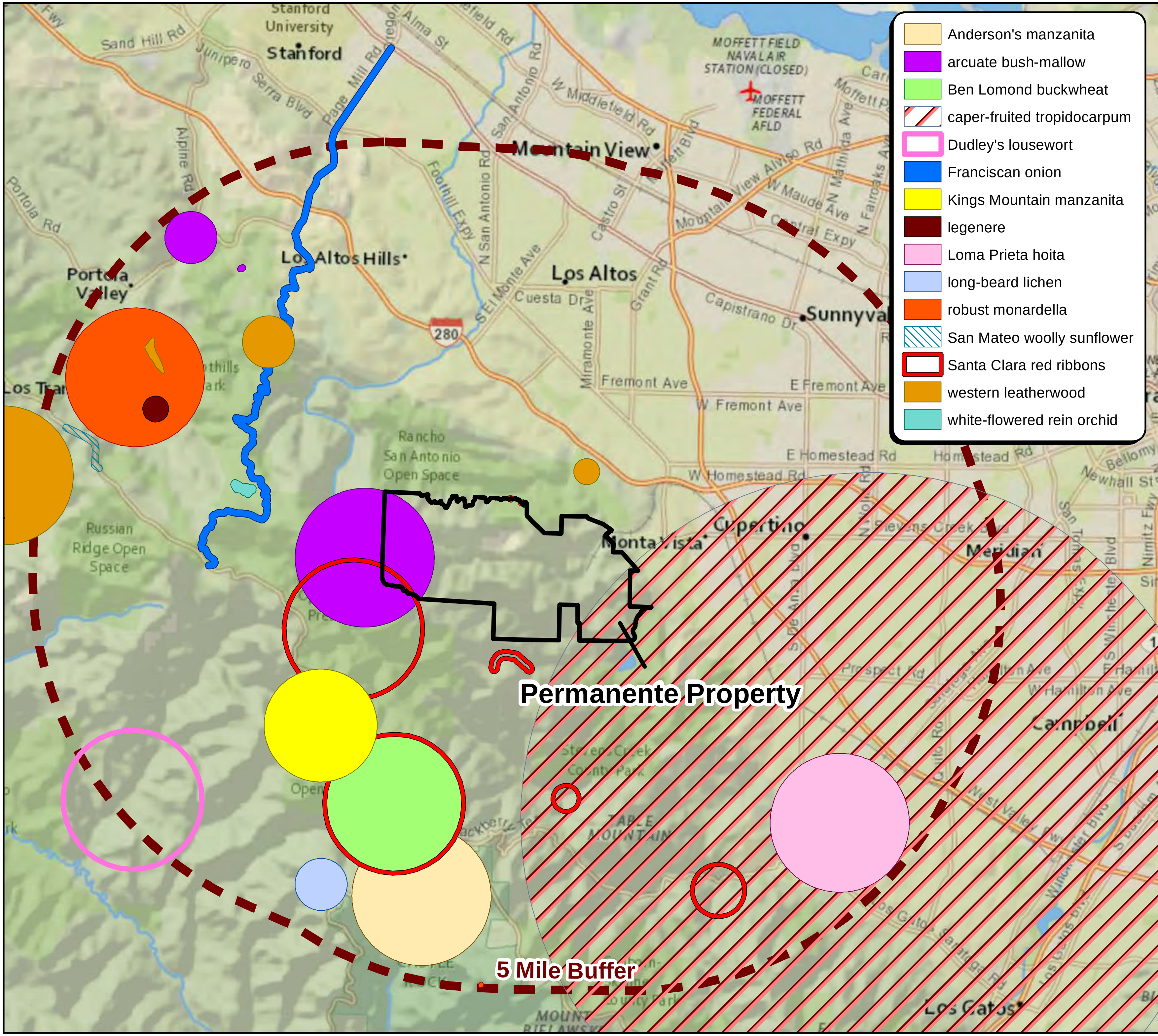
Tributaries to Monte Bello Creek within the Permanente Property range from ephemeral to intermittent. They do not display an OHW mark, nor do they support riparian vegetation. Calcareous limestone is also common in the tributaries to Monte Bello Creek, although no pools were observed which hold water long enough to support fish or breeding amphibians.

Unnamed tributary to Stevens Creek

One unnamed stream and its tributaries were mapped in the southeastern corner of the Permanente Property. This stream is a tributary to Stevens Creek, with their confluence on the eastern side of Stevens Canyon Boulevard off of the Permanente property. Almost the entire watershed for this stream is located on the Permanente Property. This stream is intermittent, with flow absent as early as May in 2008, although an OHW mark was observed throughout much of its length. No wetland seeps were observed in this watershed. The primary source of flow is runoff from adjacent slopes. The main stem of this stream is a low gradient, unconfined channel which supports a significant overstory of willow scrub and riparian sycamore woodland.

Ohlone Creek tributaries

Ohlone Creek is a tributary to Permanente Creek, although their confluence is north of the Permanente Property. The main stem of Ohlone Creek is located in Rancho San Antonio County Park (Mid-Peninsula Open Space District), but a portion of its watershed and several tributaries are located in the northern portion of the Permanente Property. Tributaries to Ohlone Creek observed on the Permanente Property are ephemeral and do not display an OHW mark. Additionally, they do not support an assemblage of plant species adapted to wetland conditions. The forest overstory in the vicinity of these tributaries is California bay forest and is not considered riparian in nature due to its abundance on ridgelines.



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Lehigh Permanente Quarry
Santa Clara County, CA

Figure 4.

Special Status Plant Occurrences within Five Miles of the Permanente Property Boundary

(*Based on CNDDB 2010 Data*)

N
W E
S

0 0.5 1 2 Miles

Date: May 2010
Map By: Michael Rochelle
Filepath: I:\Acad2000\16000\16143\gis\Arcmap\2010 Reports\BRA\CNDDB_Plants.mxd

4.2 Special Status Species

4.2.1 Plants

California Natural Diversity Database records (Figure 5) indicate that three special status plant species have been recorded on the Permanente Property although two of these occurrences are unlikely to apply to the Permanente Property due to uncertainties in mapping and identification. Caper-fruited tropidocarpum (*Tropidocarpum capparideum*) is reported in the southeastern corner of the Permanente Property, but the record presented is an approximately five-mile radius around a reported collection from 1907, which may have been misidentified (CNDDB 2009). Arcuate bushmallow (*Malacothamnus arcuatus*) is reported in the southwestern portion of the Permanente Property near Black Mountain, but the occurrence is an approximately one-mile radius around an uncertain location report from 1926 (CNDDB 2009). Robust coyote mint (*Monardella villosa* ssp. *globosa*) has been recorded on-site as recently as 2006 (CNDDB 2009), but field investigations by WRA biologists in the exact locations of these occurrences did not confirm the presence of this rare subspecies. In the vicinity of the reported occurrence, several populations of a common subspecies of coyote mint (*Monardella villosa* ssp. *villosa*) were observed. It is the professional opinion of the authors of this report that these three reported species are not present on the Permanente Property.

One early season and one late season protocol rare plant field survey was conducted on May 13-15 and July 10, 11, and 17, 2008. The surveys corresponded to peak blooming periods for observing and accurately identifying twenty five of the thirty two rare plant species with potential to occur on the Permanente Property and vicinity. The remaining species are identifiable outside their blooming period (one tree, five perennial shrubs, one lichen, and one moss).

A list of plant species observed during the surveys is provided in Appendix B. Two listed species were observed on site; Western leatherwood (*Dirca occidentalis*) and Northern California black walnut (*Juglans hindsii*), although only Western leatherwood is afforded protection under CEQA. After further investigation, it was determined that this observation was invalid due to misidentification of the plants, as described below. These species are described in detail below and their occurrence on the Permanente Property is shown in Figure 5.

Western leatherwood (*Dirca occidentalis*). CNPS List 1B. Western leatherwood is a deciduous shrub in the Mezereum family (Thylemaceae) that blooms from January through March and is endemic to California, specifically the San Francisco Bay Area. It primarily occurs on moist slopes in all types of forest- or shrub- dominated communities at elevations of 50 to 395 meters. One small population (< five individuals) was identified on the streambanks of a tributary to Permanente Creek in the far western portion of the Permanente Property.

After further investigation, it was determined that this observation of Western leatherwood was misidentified. During the initial identification of this species no flowering material was available. Subsequent investigation determined that the individual was oso berry (*Oemleria cerasiformis*), a perennial deciduous shrub that occurs on shaded, forested slopes. Oso berry is not a rare species.

Northern California black walnut (*Juglans hindsii*). CNPS List 1B. Northern California black walnut is a deciduous tree in the walnut family (Juglandaceae) that occurs in riparian forest and riparian woodland from 0 to 440 meters in elevation. The species is historically known from Alameda, Butte, Contra Costa, Lake, Napa, Sacramento, Solano, Sonoma, and Yolo counties; however, it can be difficult to determine which stands are native. Only native stands garner protected status. The species blooms from April to May.

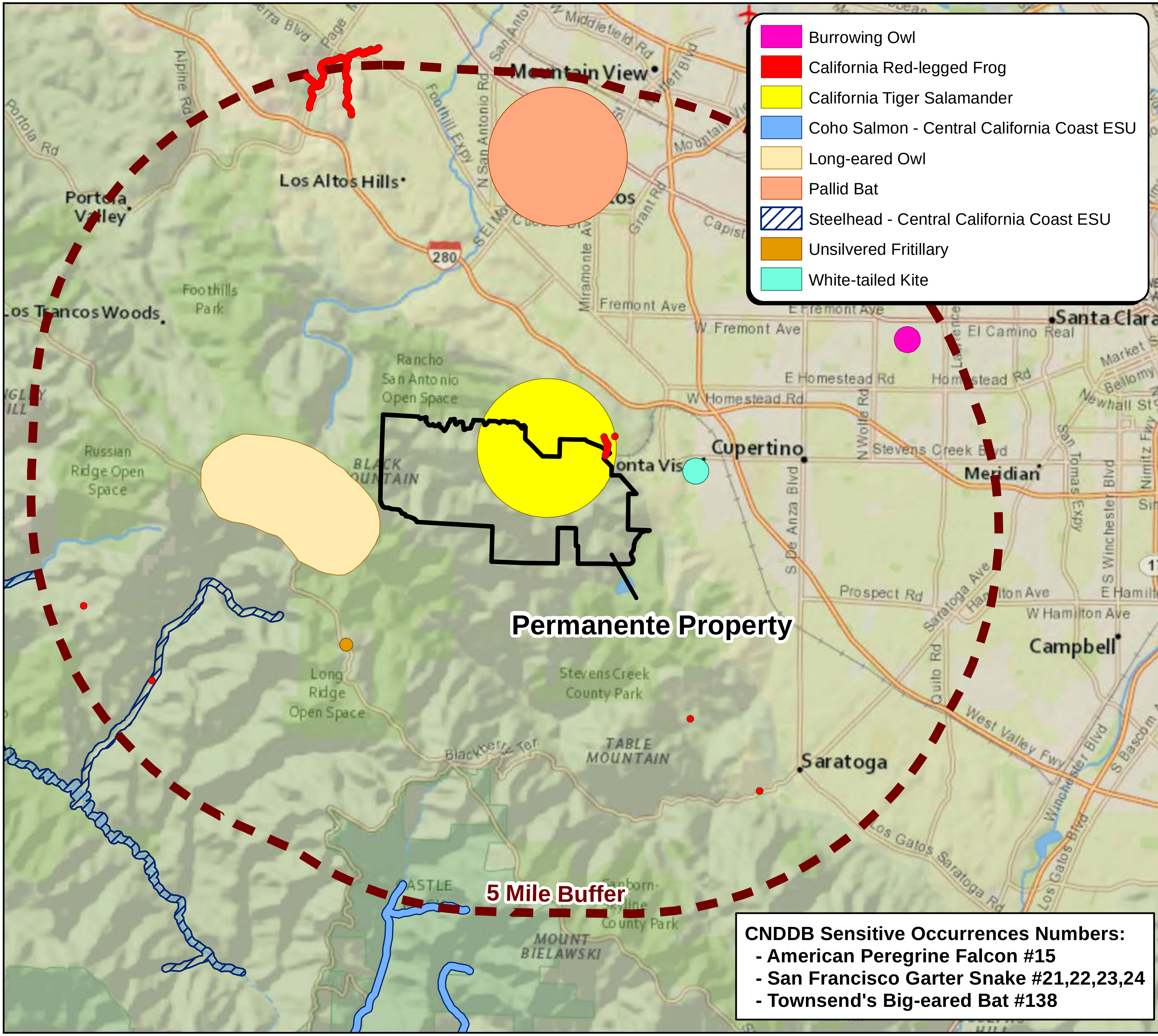
Northern California black walnut was observed in the southern portion of the Permanente Property near the remnants of historic homesites, and in drainages near these sites which serve as distribution corridors for this species. Other tree species observed near these sites include fruit trees (*Prunus* spp.), European olive (*Olea europa*), oleander (*Nerium oleander*), and English walnut (*Juglans regia*). Due to the long history of human disturbance near the observed populations and the strong evidence of horticultural tree plantings, it is the professional opinion of the authors that these populations do not constitute a native population but were in fact cultivated by prior human inhabitants in the last fifty to one hundred years; therefore these trees are not afforded protection under CEQA.

CNPS List 4 species. In addition to these two listed species described above, two CNPS List 4 species were observed during rare plant surveys. List 4 species are afforded no protection under CEQA, however they are identified as potentially limited in distribution, and may become listed species in the future. Santa Catalina Island buckwheat (*Eriogonum giganteum* ssp. *giganteum*) has a native distribution restricted only to Santa Catalina Island. A small population of this species was identified in a revegetated area near the cement plant. It has a history of horticultural plantings outside its native range (Hickman 1993) thus was presumably planted within the active quarry in an area previously revegetated for erosion control. Santa Clara red ribbons (*Clarkia concinna* ssp. *automixa*) was observed in several openings in chaparral on thin soils on rock outcrops in the southern portion of the Permanente Property. Observation data for these species may be requested from WRA.

4.2.2 Wildlife

Forty-six special status wildlife species have been recorded in the vicinity of the Permanente Property. These species and their likelihood of occurrence are presented in Appendix A. Figure 6 shows CNDDB documented special status wildlife occurrences within five miles of the Permanente Property. Of these, six species have been documented to occur on the Permanente Property: California Red-legged Frog (*Rana aurora draytonii*), San Francisco Dusky-footed Woodrat, White-tailed Kite (*Elanus leucurus*), Olive-sided Flycatcher (*Contopus cooperi*), Yellow Warbler (*Dendroica petechia*), and Grasshopper Sparrow (*Ammodramus savannarum*). There is a documented California Tiger Salamander (*Ambystoma californiense*) occurrence on the Permanente Property, however the validity of this occurrence is questioned (Jennings pers. comm.) due to the age of the reported occurrence (from 1893) and likely misidentification. One species, the Pallid Bat (*Antrozous pallidus*), has a high potential to occur. Three additional species have a moderate potential to occur on the Permanente Property: Western Red Bat (*Lasiurus blossevillii*), Long-eared Owl (*Asio otus*) and Loggerhead Shrike (*Lanius ludovicianus*).

The Permanente Property is not included in the coverage area for the Santa Clara Valley Habitat Plan, but is located within five miles of the northwestern portion of the Habitat Plan coverage. The potential for wildlife species covered by the Habitat Plan to occur on the Permanente Property, but not otherwise addressed in this report, is addressed in Appendix A. Special status wildlife species that are present or have a high or moderate potential to occur on the Permanente Property are discussed below.



Lehigh Permanente Quarry
Santa Clara County, CA

Figure 5.

Special Status Wildlife Occurrences within Five Miles of the Permanente Property Boundary

(*Based on CNDDB 2010 Data*)

0 0.5 1 2 Miles

Date: May 2010
Map By: Michael Rochelle
Filepath: I:\Acad2000\16000\16143\gis\Arcmap\2010 Reports\BRA\CNDDB_Animals.mxd

Species present on the Permanente Property

California Red-legged Frog (*Rana aurora draytonii*), Federally Threatened, CDFG Species of Special Concern. The California Red-legged Frog (CRLF) is a medium-sized frog with reddish-colored legs. The species is generally restricted to riparian and lacustrine habitats in California and northern Baja California. In response to a significant decrease in the historic range of the CRLF, the USFWS listed the subspecies as Threatened in 1996. CRLF prefer deep, quiet pools in creeks, rivers, or lakes below 1,500 meters in elevation. Habitat requirements include fresh emergent or dense riparian vegetation, especially willows adjacent to shorelines. Red-legged Frogs can survive in seasonal bodies of water that are dry for short periods if a permanent water body or dense vegetation stands are nearby; rodent burrows and grasslands provide upland aestivation habitat.

The USFWS (2008) has defined the four primary constituent elements essential to the conservation of the CRLF and are described below. Aquatic breeding habitat which are standing bodies of fresh water including natural and manmade ponds, slow-moving streams or pools within streams, and other ephemeral or permanent water bodies that typically become inundated during winter rains and hold water for a minimum of 20 weeks in all but the driest of years. Non-breeding aquatic habitats are freshwater and wetted riparian habitats that may not hold water long enough for the subspecies to hatch and complete its aquatic life cycle but that do provide for shelter, foraging, predator avoidance, and aquatic dispersal for juvenile and adult CRLF. Upland habitats are areas adjacent to or surrounding breeding and non-breeding aquatic and riparian habitat up to a distance of 300 feet in most cases and comprised of vegetation such as grasslands, woodlands, wetland, or riparian species that provides shelter, forage, and predator avoidance. Dispersal habitat includes upland or riparian dispersal habitat between occupied locations within a minimum of one mile (1.6 km) of each other and that allows for movement between such sites. Dispersal habitat includes various natural habitats and altered habitats such as agricultural fields, which do not contain barriers (e.g., heavily traveled roads without bridges or culverts) to dispersal.

Numerous surveys have been conducted for CRLF on the Permanente Property. CRLF were first discovered on the Permanente Property in September 1997 by Radian International while conducting a CRLF site assessment and field survey (Radian International 1997). These detections were made in a pool located north of Pond 14 between the Pond 14 diversion channel and the channel that drains Pond 14. Since the 1997 survey, the creek channel appears to have undermined this and two other ponds and breached these ponds such that they no longer hold water.

Hagar Environmental Science conducted a fish relocation effort from Ponds 13 and 22 in August of 2000 in preparation of sediment removal from these ponds. The effort was completed in compliance with the issued CDFG permits. During electrofishing surveys, a "few frogs (including one transforming tadpole) were captured". According to the report, Hagar Environmental (2000), these were "believed to be juvenile foothill yellow-legged frogs" (*Rana boylii*), but were "not positively identified". It is believed that these were actually CRLF occupying and breeding in Pond 22, as the pond was not at the time, nor is it now, suitable Foothill Yellow-legged Frog (FYLF) habitat. Additionally no FYLF have been detected within the Permanente Creek Watershed (CNDDB 2009).

Dr. Mark Jennings conducted protocol surveys for CRLF on the Permanente Property in 2006 (Jennings 2006b), 2007 (Jennings 2007), biological monitoring for CRLF in October and November 2006 (Jennings 2006a), December 2007 (Jennings 2008b), October 2008 (Jennings

2008c) and August and November 2009 (Jennings 2009a and 2009b). Surveys also were conducted by Dr. Jennings on the night of July 30, 2008 (Jennings 2008a) following current USFWS guidelines. The above-noted studies focused on all existing sedimentation basins and Permanente Creek. Additionally, Dr. Jennings has conducted a CRLF habitat assessment (Jennings 2010) within areas immediately surrounding the proposed reclamation area (Appendix D).

Incidental observations within the Permanente Creek Watershed by WRA biologists are consistent with past studies conducted by Dr. Jennings. In 2009, CRLF adults were frequently seen and vocalizing male CRLFs were detected in February and April in Pond 14. Additionally, a total of 11 CRLF egg masses were observed in Pond 14 in February 2009. CRLF adults have also been detected in Pond 14, although no evidence of breeding was observed here. The stream channel below Pond 14 also contains two deep pools where CRLF adults and larvae have been detected. It is not likely that CRLF are utilizing these pools as aquatic breeding habitat due to seasonally high water velocities. The larvae likely are washed down from Pond 14 and the adults are utilizing this section of Permanente Creek as non-breeding aquatic habitat.

Within the Monte Bello Creek Watershed, WRA biologists incidentally detected a sub-adult CRLF in the uplands adjacent to Monte Bello Creek on May 7, 2009. This individual was observed approximately 0.5 miles upstream from the southeast Property Boundary where Monte Bello Creek leaves the Permanente Property. The Main Stem and South Fork of Monte Bello Creek provide marginal aquatic breeding habitat based on the lack of deep, slack-water pools, but in some years, moderately deep pools may provide suitable conditions to allow for successful CRLF breeding. The creek also serves as non-breeding aquatic habitat and the surrounding uplands provide dispersal and foraging habitat for CRLF (Jennings 2010 – Appendix D).

The results of these surveys show that CRLF consistently occupy limited areas of lower Permanente Creek, and appear to be present in Monte Bello Creek. The protocol surveys conducted in 2007 concluded that CRLF were present in Ponds 14, 21, and 22. No CRLF were found in any other sedimentation basin on the Permanente Property. Most recently, CRLF were observed to successfully breed in Ponds 14 and 21. Upstream of the occupied ponds, aquatic breeding habitat is generally not present on the Permanente Property because of lack of deep slack-water pools and lack of upland habitat within the active quarry. CRLF are unlikely to occur in the active quarry or in heavily disturbed portions of the Permanente Property due to lack of cover, exposure to predation and frequent vehicle traffic. Accordingly, upland and dispersal habitat, two primary constituent habitat elements for CRLF, is limited to undisturbed hillside slopes and revegetated areas within 300 feet of occupied portions of Permanente and Monte Bello Creeks and the occupied sedimentation ponds. Permanente Creek may serve as a movement corridor between Pond 21 and downstream breeding locations off site.

Although CRLF occupy a small portion of Permanente Creek in the northeastern most portion of the Permanente Property as well as Monte Bello Creek in the southern most portion of the Permanente Property, CRLF are not likely to disperse between the two occupied locations. The landscape between these two occupied locations is dominated by heavily trafficked roads, paved industrial areas, and unvegetated arid slopes. The ephemeral nature of the intervening creeks and ponds, long distance (1.75 miles) and steep terrain precludes movement between Permanente and Monte Bello Creek drainages (Jennings 2010). Additionally, a history of CRLF surveys on the Permanente Property has failed to detect CRLF occupying the creeks and ponds between these two systems.

San Francisco Dusky-footed Woodrat (*Neotoma fuscipes annectens*), CDFG Species of Special Concern. This subspecies of Dusky-footed Woodrat occurs in the Coast Ranges between San Francisco Bay and the Salinas River (Matocq 2003). It prefers brushy riparian habitats, coast live oak woodland, and dense scrub communities. Prominent stick houses provide evidence of its presence.

On the Permanente Property, San Francisco Dusky-footed Woodrat is locally abundant in densely wooded forests and woodland, and in scrub and shrub habitat. This species' large stick houses are commonly found in nearly every terrestrial/upland biological community on the Permanente Property except chamise chaparral and grasslands.

White-tailed Kite (*Elanus leucurus*), California Fully Protected Species. Kites occur in low elevation grassland, agricultural, wetland, oak woodland, and savannah habitats. Riparian zones adjacent to open areas are also used. Vegetative structure and prey availability seem to be more important than specific associations with plant species or vegetative communities. lightly grazed or ungrazed fields generally support large prey populations and are often preferred to other habitats. Kites primarily feed on small mammals, although, birds, reptiles, amphibians, and insects are also taken. Nest trees range from single isolated trees to trees within large contiguous forests. Preferred nest trees are extremely variable, ranging from small shrubs (less than 10 feet tall), to large trees (greater than 150 feet. tall) (Dunk 1995). White-tailed Kites are regularly observed foraging on the Permanente Property. Although this species has not been documented to nest here, high quality foraging and nesting habitat is present on the Permanente Property.

Olive-sided flycatcher (*Contopus cooperi)*, CDFG Species of Special Concern, USFWS Bird of Conservation Concern. Olive-sided Flycatcher is typically associated with coniferous forest openings, forest edges near natural openings or human-made openings, or open to semi-open forest stands (Altman and Sallabanks 2000). This species frequently occurs along wooded shores of streams, lakes, rivers, ponds, bogs, and muskegs, where natural edge habitat occurs and standing dead trees often are present (Altman and Sallabanks 2000). This species' frequent presence near water may be due to higher insect abundance in these areas.

A female Olive-sided Flycatcher was observed on the Permanente Property on April 22, 2008. This individual may have been a migrant. While this species prefers montane coniferous forest, records of breeding Olive-sided Flycatcher are present at lower elevations near Santa Clara, and Berkeley (Altman and Sallabanks 2000). There are no other documented occurrences of this species within five miles of the Permanente Property in CNDDB (CNDDB 2009).

Yellow Warbler (*Dendroica petechia*), CDFG Species of Special Concern. Yellow Warbler breeds most commonly in wet, deciduous thickets, especially those dominated by willows, and in disturbed and early successional habitats (Lowther et al. 1999). This species is found between 100 to 2,700 meters elevation in California and at higher elevations along watercourses with riparian growth (Lowther et al. 1999). Yellow warbler populations have declined due to brood parasitism by brown-headed cowbirds (*Molothrus ater*) and habitat destruction. This species' diet is primarily comprised of insects supplemented with berries.

Yellow Warbler has been regularly observed on the Permanente Property during migration and breeding season. This species has been frequently observed foraging within scrub oak dominated habitats near ridge lines. On the Permanente Property, suitable breeding habitat is present within the riparian corridors along Permanente Creek, Monte Bello Creek and their major tributaries. This species may breed within the Permanente Property.

Grasshopper Sparrow (*Ammodramus savannarum*), California Species of Special Concern. This species generally prefers moderately open grasslands and prairies with patchy bare ground. They select different components of vegetation, depending on grassland ecosystem. This sparrow typically avoids grasslands with extensive shrub cover, although some level of shrub cover is important for birds in western regions (Vickery 1996).

Grasshopper Sparrows are ground nesting birds. The nest cup is domed with overhanging grasses and contains a side entrance. Eggs are usually laid in early to mid June and hatch 12 days later. Males and females provide care to the young and second broods are common. This species feed primarily on insects (Vickery 1996).

On the Permanente Property, Grasshopper Sparrows have been observed consistently within sparsely vegetated areas within active quarry areas. Suitable foraging and breeding habitat for this species is abundant within portions of the Permanente Property where shrub, grasslands and bare ground create a habitat mosaic.

<u>Species with a high or moderate potential to occur on the Permanente Property</u>

Pallid Bat (*Antrozous pallidus*), CDFG Species of Special Concern, WBWG High Priority. The Pallid Bat is found in a variety of low elevation habitats throughout California. It selects a variety of day roosts including rock outcrops, mines, caves, hollow trees, buildings, and bridges. Night roosts are usually found under bridges, but also in caves, mines, and buildings. Pallid Bats are sensitive to roost disturbance. Unlike most bats, Pallids primarily feed on large ground-dwelling arthropods and prey are typically taken on the ground (Zeiner, et al. 1990). Hollow trees in the oak woodland provide potential roost habitat for this species; therefore, there is a moderate potential for occurrence for this bat.

The Permanente Property supports several rock outcrops which contain suitable cavities capable of supporting roosting Pallid Bats. Pallid Bats may, however, roost within the walls of the North Quarry if suitable cracks and crevices are present. Large abandoned buildings and other structures on the Permanente Property provide suitable bat roosting habitat. A former aluminum plant building at the north east corner of the Permanente Property is known to support an unidentified bat roost where an outflight was observed at dusk by WRA biologists. The nearest documented occurrence of the Pallid Bat is 5.0 miles north of the Permanente Property (CNDDB 2009). There is a high potential for this species to roost on the Permanente Property.

Western Red Bat (*Lasiurus blossevillii*), WBWG High Priority. This species is considered highly migratory, and broadly distributed, reaching from southern Canada, through much of the western United States. They are typically solitary, roosting primarily in the foliage of trees or shrubs. Day roosts are commonly in edge habitats adjacent to streams or open fields, in orchards, and sometimes in urban areas possibly an association with riparian habitat (particularly willows, cottonwoods, and sycamores).

Suitable habitat for Western Red Bat may be present in the sycamore alluvial woodlands, white alder riparian forest and willow riparian forest on the Permanente Property. There are no known occurrences within 5.0 miles of the Permanente Property (CNDDB 2009). There is a moderate potential for this species to occur on the Permanente Property.

Long-eared Owl (*Asio otus*), CDFG Species of Special Concern. Nesting Long-eared Owls range from coastal lowlands to interior deserts and seem to prefer riparian groves, planted woodlots, and belts of live oaks paralleling streams (Shuford 1993). This owl generally frequents dense, riparian and live oak thickets paralleling stream courses, and nearby woodland and forest habitats (Zeiner et al. 1990). Long-eared Owls nest almost exclusively in old stick nests of crows, magpies, ravens, hawks, or herons.

The Permanente Property supports suitable foraging and breeding habitat for this bat species along woodland edges. Typical nesting habitat is present in mature riparian vegetation along on-site portions of Permanente Creek, Monte Bello Creek and associated tributaries. Some portions of otherwise suitable habitat along Permanente Creek, in the vicinity of the active quarry, may be unsuitable due to disturbance associated with quarry activities. A breeding pair of Long-eared Owls was recently documented to occur 1.3 miles west of the Permanente Property (CNDDB 2009). This species has a moderate potential to occur on the Permanente Property.

Loggerhead Shrike (*Lanius ludovicianus*), CDFG Species of Special Concern, USFWS Bird of Conservation Concern. Loggerhead Shrike is a common resident and winter visitor in lowlands and foothills throughout California. It prefers open habitats with scattered trees, shrubs, posts, fences, utility lines or other perches. Nests are usually built on a stable branch in a densely-foliaged shrub or small tree and are usually well-concealed. The highest densities occur in open-canopied valley foothill hardwood, valley foothill hardwood-conifer, valley foothill riparian pinyon-juniper, juniper, and desert riparian habitats. While this species eats mostly arthropods, they also take amphibians, small to medium-sized reptiles, small mammals and birds, and are also known to scavenge on carrion (Ziener et al. 1990).

Loggerhead Shrike has not been observed on the Permanente Property by WRA biologists, however, suitable nesting and foraging habitat is present. There are no documented occurrences of Loggerhead Shrike within 5 miles of the Permanente Property (CNDDB 2009). This species has a moderate potential to occur on the Permanente Property.

<u>Federally and State Listed Species Unlikely to occur within the Permanente Property Boundary</u>

The following species are not likely to occur on the property; however, they are discussed herein for completeness of the analysis. The reasons for a determination that they are not present are provided below. For the purposes of completeness, federal and or state listed species that are unlikely to be present are discussed below:

California Tiger Salamander (*Ambystoma californiense*; CTS) Central Valley Distinct Population Segment (DPS) was listed as Federally Threatened August 4, 2004 (69 FR 47212-47248) and the California Fish and Game Commission approved CTS for listing as State Threatened on March 3, 2010.

CTS require two primary habitat components: aquatic breeding sites and upland terrestrial aestivation or refuge sites. This species inhabits valley and foothill grasslands and the grassy understory of open woodlands, usually within one mile of water (Jennings and Hayes 1994). Adult CTS spend most of their time underground in upland subterranean refugia. Underground retreats usually consist of ground-squirrel burrows but can also be under logs and piles of lumber (Holland et al. 1990). CTS primarily use California ground squirrel burrows as upland refuge sites (Loredo et al. 1996, Trenham 2001).

Within the Permanente Property, a historic occurrence of CTS is documented from Permanente Creek[2], however, there are no seasonal waters capable of supporting CTS breeding. Permanente Creek, which is the original documented location of the specimen discussed above, is now channelized, and inhabited by several native and non-native fish species. This species is unlikely to occur on the Permanente Property.

Central California coast Steelhead (*Oncorhynchus mykiss*) DPS was federally listed as threatened in August 1997 (62 Fed Reg. 43937). Steelhead are sea-run (anadromous) Rainbow Trout. In California, Steelhead only run in the winter due to unsuitable summer stream conditions (low flows). Steelhead spawn in cool, clear, well-oxygenated streams with suitable gravel beds and flow velocity. Unlike salmon, which die after spawning, some Steelhead return to their natal streams several times to spawn.

Historically, Permanente Creek reportedly supported Steelhead (Santa Clara County 2010, Garza and Pearse 2008). The closest known extant Steelhead locale to Permanente Creek is Stevens Creek, just over one mile east of Permanente Creek. One of the largest obstacles to Steelhead reproduction is the placement of natural or man-made (anthropogenic) barriers in Steelhead spawning streams. Barriers within a stream course may limit or completely block access of mature inmigrating Steelhead from accessing suitable spawning habitat. In some cases barriers may also prevent outmigrating smolts from reaching the ocean. Partial or complete barriers include waterfalls, debris jams, excessive velocities, high temperatures, high turbidity, and dams (Barnhart 1986).

Because of dams and other barriers to fish passage downstream of the Permanente property, there is no potential for Steelhead to occur in Permanente Creek on the Permanente Property. In Los Altos, just north of Mira Monte and Portland avenues, there is a low flow diversion dam that spills water into Permanente Creek only during very high flow events. The dam spills from the top through narrow slits from about five to six feet in height. No plunge pool is present on the downstream side of the diversion dam; therefore it serves as an impassable barrier for in-migrating Steelhead. WRA did not assess any additional barriers that may be present downstream of the diversion dam.

The dam is located along the western portion of an 8,000-foot concrete diversion channel. The Permanente Diversion was designed to divert the majority of storm runoff from the Permanente Creek Watershed into Stevens Creek. The dam structure is currently not functioning properly and diverts almost all flow into Stevens Creek (SCVWD 2002), which has a documented Steelhead run. A Coastal Conservancy Report (2004) concluded that a similar, 3,900-foot concrete channel along Mission Creek in Santa Barbara County acts as a total barrier to Steelhead because during low flows, upstream Steelhead migration is not possible due to the water depth throughout the channel being less than the required 7 inches. When flows increase and the water depth in the channel is greater than 7 inches, increased flow velocities are

[2] Dr. Mark Jennings, an expert on rare amphibians, concluded in a report dated October, 2008 that: "The California Tiger Salamander is thought to be present on the Permanente Property because a specimen alleged to be this species, collected in 1893 in the Permanente Creek drainage system, is listed in the CNDDB. However, this is a museum specimen at the California Academy of Sciences that was destroyed during the 1906 San Francisco earthquake and fire. It was not uncommon during the late 19th century for specimens to be misidentified, especially if it was a juvenile or larval individual. Furthermore, the Permanente Property is currently too disturbed to support California Tiger Salamanders, and would preclude any successful breeding in these habitats by California Tiger Salamanders" (HBG, Inc. 2008).

sustained throughout the long channel with no velocity breaks. Upstream Steelhead passage is prevented due to exhaustion as fish attempt to migrate up the long channel.

Since resident Rainbow Trout are known to occur in Permanente Creek and there are no known barriers to downstream migration for trout, some Rainbow Trout may outmigrate to the ocean. Due to the barriers discussed above, it is not possible for these individuals to return to upper Permanente Creek to spawn and likely become part of the Stevens Creek Steelhead population.

Fish surveys confirmed the absence of Steelhead in Permanente Creek from the Permanente Property boundary downstream to the diversion channel. Liedy (1984) sampled six Permanente Creek sites downstream of the Permanente Property between Charleston Road and Interstate 280 in August 1981 and found no Steelhead. Liedy (2002) also sampled two sites in April 1996, one reach downstream of Highway 101 and one reach upstream of Interstate 280 and found no Steelhead. Since surveys have shown that Steelhead are not present in Permanente Creek between the diversion channel and the Permanente Property, and the diversion channel is a complete barrier to upstream Steelhead migration, Steelhead are unable to access this reach and are therefore unlikely to occur on the Permanente Property.

4.3 Aquatic Surveys

WRA conducted an analysis of the aquatic habitats of Permanente Creek and Monte Bello Creek on the Quarry Property. Some of these results are summarized in the sections that follow. The results of the entire study can be found in Appendix E, Permanente Aquatic Technical Report (WRA 2010b).

4.3.1 Aquatic Wildlife Sampling

The results of the aquatic surveys along Permanente Creek are presented for the “upper” and “lower” reaches of the creek that correspond approximately to stations MS-1 and MS-2, respectively, in Golder’s hydrology report (2010). The upper reach is within a largely natural portion of the Creek, while the lower reach is below the active quarry area and starts near the Rock Plant. These results describe existing conditions as observed in 2009.

Survey results for fish sampling identified three species, resident non-anadromous Rainbow Trout (*Oncorhynchus mykiss*), Sacramento Sucker (*Catostomus occidentalis*), and Western Mosquito Fish (*Gambusia affinis*) within the Permanente Property. Within the upper reaches of Permanente Creek, Rainbow Trout was the only species observed, with fry, juvenile, and adult life stages for this species recorded. Within the lower reach, Rainbow Trout, Sacramento Sucker, and Western Mosquito Fish were observed. For this reach, juvenile and adult Rainbow Trout and Western Mosquito Fish, and adult Sacramento Sucker were observed.

Survey results for amphibians identified nine species within the Permanente Property, including the California Red-legged Frog. Within the upper reaches of Permanente Creek, five amphibian species were observed, including California Giant Salamander (*Dicamptodon ensatus*), California Newt (*Taricha torosa*), Rough-skinned Newt (*Taricha granulosa*), Ensatina Salamander (*Ensatina eschscholtzii*) and Pacific Tree [=Chorus] Frog (*Hyla [=Pseudacris] regilla*). Within the lower reach of Permanente Creek, six aquatic species, the Rough-skinned Newt adult, California Red-legged Frog, the Pacific Tree [=Chorus] Frog, California Newt, Ensatina Salamander, and Western [=Boreal] Toad (*Bufo [=Anaxyrus] boreas*). California Red-legged Frog egg mass, juvenile and adult life stages have been observed within the lower reach.

Survey results for BMI found similar conditions between upper and lower reaches of Permanente Creek. The physical habitat quality score ranked as very high (a score greater than 160) for both reaches. For species richness, which accounts for the diversity of BMI taxa, the upper reach documented 26 species and 24 species were in the lower reach. Additionally, composition which reflects the number of individuals in a taxon compared to the total number of individuals sampled was similar between the two sampled reaches.

4.3.2 Bioassay Sample

A bioassay was conducted for water samples collected within the Permanente Property in February and April, 2009. For each sample date, water samples were collected from the upper and lower reaches of Permanente Creek. Aquatic Testing Laboratory in Ventura, California performed a Fathead Minnow 96-hour Percent Survival Bioassay (EPA-821-R-03-012) analysis on the collected samples. For all samples there was 100 percent survival of Fathead Minnows (*Pimephales promelas*) subject to the 96-hour test.

The combined results of the field surveys for fish, amphibians, and BMI indicate very similar composition of species and diversity between upper and lower reaches of Permanente Creek. This indicates that water pumped out of the North Quarry does not have a detrimental effect on the aquatic life in the creek. Additionally, the Fathead Minnow acute toxicity test indicates that water from both upper and lower Permanente Creek is not acutely toxic to this species.

5.0 REFERENCES

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APPENDIX A. Potential for Special Status Species to Occur on the Permanente Property

Appendix A. Potential for Special Status Plant and Wildlife Species to Occur in the Permanente Property. List compiled from the California Department of Fish and Game (CDFG) Natural Diversity Database (July 2009), U.S. Fish and Wildlife Service (USFWS) Species Lists, and California Native Plant Society (CNPS) Electronic Inventory search of the Cupertino, Castle Rock Ridge, Big Basin, Milpitas, San Jose West, Los Gatos, Mountain View, Palo Alto, and Mindego Hill USGS 7.5' quadrangles, Santa Clara Valley HCP/NCCP species, and a review of other CDFG lists and publications (Jennings and Hayes 1994, Zeiner et al. 1990).

SPECIES	STATUS*	HABITAT	POTENTIAL FOR OCCURRENCE	RECOMMENDATIONS
Mammals				
Salt-marsh Wandering Shrew *Sorex vagrans halicoetes*	SSC	Salt marshes of the south arm of San Francisco Bay. Medium high marsh 6 to 8 feet above sea level where abundant driftwood is scattered among *Salicornia*.	**No Potential.** No suitable tidal marsh habitat is available in the Permanente Property or vicinity. The nearest documented occurrence of this species is 8.7 miles northeast of the Permanente Property (CNDDB 2009).	No further actions are recommended for this species.

SPECIES	STATUS*	HABITAT	POTENTIAL FOR OCCURRENCE	RECOMMENDATIONS
Pallid Bat *Antrozous pallidus*	SSC, WBWG High Priority	Found in deserts, grasslands, shrublands, woodlands, and forests. Most common in open, dry habitats with rocky areas for roosting. Roosts must protect bats from high temperatures. Sensitive to disturbance of roosting sites.	**Moderate Potential.** Suitable roost habitat is present within the Permanente Property in tree hollows and in adjacent areas in buildings. Disturbance associated with quarry operations may preclude the presence of this species. The nearest documented occurrence of this species is 5.0 miles north of the Permanente Property (CNDDB 2009).	Removal of potential bat roost habitat (buildings, large trees, snags, and deposition of rock within the North Quarry) will take place in September and October to avoid impacts to roosts. If this is not feasible, surveys will be conducted. If bats are present, a buffer will be instated or bats will be excluded from the roost. Installation of outdoor artificial lighting will incorporate measures to lessen potential impacts to bats .

SPECIES	STATUS*	HABITAT	POTENTIAL FOR OCCURRENCE	RECOMMENDATIONS
Western Red Bat *Lasiurus blossevillii*	SSC	Roosts primarily in trees, 2-40 ft above ground, from sea level up through mixed conifer forests. Prefers habitat edges & mosaics with trees that are protected from above & open below with open areas for foraging.	**Moderate Potential.** The Permanente Property contains suitable large trees and edge habitat to support foraging and roosting red bats. Disturbance associated with quarry operations may preclude the presence of this species. There are no known occurrences within 5.0 miles of the Permanente Property (CNDDB 2009).	Removal of potential bat roost habitat (buildings, large trees, snags, and deposition of rock within the North Quarry) will take place in September and October to avoid impacts to roosts. If this is not feasible, surveys will be conducted. If bats are present, a buffer will be instated or bats will be excluded from the roost. Installation of outdoor artificial lighting will incorporate measures to lessen potential impacts to bats .
Townsend's Big-eared Bat *Corynorhinus townsendii*	SSC, WBWG High Priority	Live in a wide variety of habitats but most common in mesic sites. Day roosts highly associated with caves and mines. Need appropriate roosting, maternity, and hibernacula sites free from human disturbance.	**Unlikely.** Suitable roost habitat is limited to Buffer areas. Disturbance associated with the quarry may preclude the presence of this species. There are no documented occurrences within 5 miles of the Permanente Property (CNDDB 2009).	No further actions are recommended for this species.

SPECIES	STATUS*	HABITAT	POTENTIAL FOR OCCURRENCE	RECOMMENDATIONS
Saltmarsh Harvest Mouse *Reithrodontomys raviventris*	FE, SE, CFP	Found only in the saline emergent wetlands of San Francisco bay and its tributaries. Primary habitat is pickleweed-dominated, saline emergent marshes. Requires adjacent, upland areas for escape from high tides. Does not burrow.	**No Potential.** No suitable tidal marsh habitat is available in the Permanente Property or vicinity. There are no documented occurrences within 5.0 miles of the Permanente Property (CNDDB 2009).	No further actions are recommended for this species.

SPECIES	STATUS*	HABITAT	POTENTIAL FOR OCCURRENCE	RECOMMENDATIONS
San Francisco Dusky-footed Woodrat *Neotoma fuscipes annectens*	SSC	Forest habitats of moderate canopy & moderate to dense understory. May prefer chaparral & redwood habitats. Constructs nests of shredded grass, leaves & other material. May be limited by availability of nest-building materials.	**Present.** San Francisco Dusky-footed Woodrats are present within the Permanente Property.	Prior to ground disturbance, preconstruction surveys for active woodrat stick nests should occur. Any stick nests within the construction area will be flagged and avoided if possible. If avoidance is not feasible, the nests shall be dismantled by hand under the supervision of a biologist Trash and food waste should be disposed of in proper waste receptacles and emptied on a regular basis. Additionally, quarry personnel, contractors, and visitors should be dissuaded from feeding wildlife within the Quarry Property. Outdoor artificial lighting will incorporate measures to lessen potential impacts to woodrats .

SPECIES	STATUS*	HABITAT	POTENTIAL FOR OCCURRENCE	RECOMMENDATIONS
San Joaquin Kit Fox *Vulpes macrotis mutica*	FE	San Joaquin Kit Fox occupies annual grasslands or grassy open stages with scattered shrubby vegetation. This species needs loose-textured sandy soils for burrowing, and suitable prey base.	**Unlikely.** Marginal habitat for San Joaquin Kit Fox is present within the Permanente Property. The nearest documented occurrence of this species is in excess of 20 miles east southeast of the Permanente Property (CNDDB 2009).	No further actions are recommended for this species.

SPECIES	STATUS*	HABITAT	POTENTIAL FOR OCCURRENCE	RECOMMENDATIONS
American Badger *Taxidea taxus*	SSC	Most abundant in drier open stages of most shrub, forest, and herbaceous habitats, with friable soils. Requires friable soils and open, uncultivated ground. Preys on burrowing rodents.	**Unlikely.** The forested portions of the Permanente Property are dense. Open portions of the Permanente Property have recently been disced. The nearest documented occurrence of this species is 9.4 miles north west of the Permanente Property.	No further actions are recommended for this species.
Birds				

SPECIES	STATUS*	HABITAT	POTENTIAL FOR OCCURRENCE	RECOMMENDATIONS
Northern Harrier *Circus cyaneus*	SSC	Nests and forages in open meadows, savannah and grassland habitats, often in association with wetlands. Nests on ground in shrubby vegetation; nest built of a large mound of sticks in wet areas. May also occur in upland desert steeps; they generally avoid forested and mountainous areas.	**Unlikely.** Open grassland habitat within the Permanente Property is not of sufficient size to support Northern Harriers. Only very marginal nesting habitat of small size is present within the Permanente Property and is seasonally disturbed (disced). The nearest documented occurrence of nesting harriers is 11.3 miles north of the Permanente Property (CNDDB 2009).	No further actions are recommended for this species.
Golden Eagle *Aquila chrysaetos*	CFP, BCC, SLC	Nests and forages along rolling foothills, mountain areas, sage-juniper flats and deserts. Cliff-walled canyons provide nesting habitat in most parts of their range, they are also known to nest in large trees in open areas.	**Unlikely.** Within the Permanente Property there are no large trees within open areas that are not subject to disturbance from quarry operations. Additionally there are no unvegetated cliffs that are suitable to support nesting Golden Eagles. The nearest documented occurrence of nesting harriers is 15.5 miles northeast of the Permanente Property (CNDDB 2009).	No further actions are recommended for this species.

SPECIES	STATUS*	HABITAT	POTENTIAL FOR OCCURRENCE	RECOMMENDATIONS
White-tailed Kite *Elanus leucurus*	CFP	Year-long resident of coastal and valley lowlands; rarely found away from agricultural areas. Preys on small diurnal mammals and occasional birds, insects, reptiles, and amphibians.	**Present.** White-tailed Kites have been observed within the Permanente Property. Suitable nesting habitat is present within the Permanente Property. The nearest documented occurrence of nesting kites is 1.7 miles east of the Permanente Property (CNDDB 2009).	If brush and vegetation removal occurs between February 1 and September 1, pre-construction breeding bird surveys should be conducted in the vicinity and within 14 days of ground disturbance to avoid disturbance to active nests, eggs, and/or young.
American Peregrine Falcon *Falco peregrinus anatum*	FD, SE, BCC, CFP,	Prefers dry, open terrain, either level or hilly. Forages far afield, even to marshlands and ocean shores. Nests near wetlands, lakes, rivers, or other water; on cliffs, banks, dunes, mounds; also, human-made structures. Nest consists of a scrape on a depression or ledge in an open site.	**Unlikely**. Marginal nesting habitat is present adjacent to the Permanente Property. Disturbance associated with quarry operations may preclude this species from nesting. This species was observed flying over the Permanente Property on July 10, 2008. The nearest documented occurrence of nesting Peregrine Falcons is 11.3 miles east of the Permanente Property (CNDDB 2009).	No further actions are recommended for this species.

SPECIES	STATUS*	HABITAT	POTENTIAL FOR OCCURRENCE	RECOMMENDATIONS
Black Rail *Laterallus jamaicensis coturniculus*	ST, CFP	Rarely seen resident of saline, brackish, and fresh water emergent wetlands of the San Francisco Bay area. Nests in dense stands of pickleweed.	**Unlikely.** Small patches of marginal habitat are present in the detention ponds along Permanente Creek. There are no documented occurrences within 5.0 miles of the Permanente Property (CNDDB 2009).	No further actions are recommended for this species.
California Clapper Rail *Rallus longirostris obsoletus*	FE, SE	Found in tidal salt marshes of the San Francisco Bay area. Requires mud flats for foraging and dense vegetation on higher ground for nesting.	**No Potential.** No suitable habitat is available in the Permanente Property or vicinity. There are no documented occurrences within 5.0 miles of the Permanente Property (CNDDB 2009).	No further actions are recommended for this species.
Western Snowy Plover *Charadrius alexandrinus nivosus*	FT, CSC, BCC, RP	Federal listing applies only to the Pacific coastal population. Found on sandy beaches, salt pond levees and shores of large alkali lakes. Requires sandy, gravelly or friable soils for nesting.	**No Potential.** There is no sandy beach or alkali flat habitat within the Permanente Property. There are no documented occurrences within 5.0 miles of the Permanente Property (CNDDB 2009).	No further actions are recommended for this species.
California Least Tern *Sterna (Sternula) antillarum browni*	FE, SE, CFP	Nests along the coast from San Francisco Bay south to northern Baja California. Breeding colonies in San Francisco Bay found in abandoned salt ponds and along estuarine shores. Colonial breeder on barren or sparsely vegetated, flat substrates near water.	**No Potential.** There is no sandy beach or salt pond habitat within the Permanente Property. There are no documented occurrences within 5.0 miles of the Permanente Property (CNDDB 2009).	No further actions are recommended for this species.

SPECIES	STATUS*	HABITAT	POTENTIAL FOR OCCURRENCE	RECOMMENDATIONS
Marbled Murrelet *Brachyramphus marmoratus*	FT, SE	Feeds near shore; nests inland along the Pacific coast from Eureka to the Oregon border, and from Half Moon Bay to Santa Cruz. Nests in old-growth redwood-dominated forests, up to six miles inland. Nests often built in Douglas-fir or redwood stands containing platform-like branches.	**No Potential.** There is no coastal old-growth redwood habitat within the Permanente Property. There are no documented occurrences within 5.0 miles of the Permanente Property (CNDDB 2009).	No further actions are recommended for this species.
Long-eared Owl *Asio otus*	CSC	Nests in mature riparian bottomlands with willows and cottonwoods; also, belts of live oak paralleling stream courses. Require adjacent open land productive of mice and the presence of old nests of crows, hawks, or magpies for breeding.	**Moderate Potential.** Suitable oak woodland habitat within the Permanente Property uplands and along the Permanente Creek Riparian corridor within and adjacent to the Permanente Property. Disturbance associated with quarry operations may preclude presence of this species. The nearest documented occurrence of nesting Short-eared Owls is 4.2 miles west of the Permanente Property (CNDDB 2009).	If brush and vegetation removal occurs between February 1 and September 1, pre-construction breeding bird surveys should be conducted in the vicinity and within 14 days of ground disturbance to avoid disturbance to active nests, eggs, and/or young.

SPECIES	STATUS*	HABITAT	POTENTIAL FOR OCCURRENCE	RECOMMENDATIONS
Burrowing Owl *Athene cunicularia*	CSC, BCC	Frequents open, dry annual or perennial grasslands and scrub habitats with low-growing vegetation, perches and abundant burrows. Preys upon insects, small mammals, reptiles, birds, and carrion. Subterranean nester; nests and roosts in old burrows of small mammals.	**Unlikely.** The Permanente Property is dominated by steep, densely vegetated slopes and hardscape. These areas do not provide suitable habitat for this species. Marginal burrowing habitat is present along the railroad tracks where California Ground Squirrels have been observed. This area is subject to high levels of disturbance. The nearest documented occurrence of breeding Burrowing Owls is 5.3 miles northeast of the Permanente Property (CNDDB 2009).	No further actions are recommended for this species.
Olive-sided Flycatcher *Contopus cooperi*	SSC, BCC	Nesting habitats are mixed conifer, montane hardwood-conifer, douglas-fir, redwood, red fir & lodgepole pine. Most numerous in montane conifer forests where tall trees overlook canyons, meadows, lakes or other open terrain.	**Moderate Potential.** Foraging habitat and marginal nesting habitat is present within the Permanente Property. A female Olive-sided Flycatcher was observed within the Permanente Property on April 22, 2008. There are no documented occurrences of this species recorded in CNDDB (CNDDB 2009).	If brush and vegetation removal occurs between February 1 and September 1, pre-construction breeding bird surveys should be conducted in the vicinity and within 14 days of ground disturbance to avoid disturbance to active nests, eggs, and/or young.

SPECIES	STATUS*	HABITAT	POTENTIAL FOR OCCURRENCE	RECOMMENDATIONS
Loggerhead Shrike *Lanius ludovicianus*	SSC, BCC	Occurs in woodland, grassland, savannah, pinyon-juniper forest, desert, and scrub habitats. Prefers open areas with sparse shrubs, trees, posts, and other suitable perches which to forage for large insects. Nests are well-concealed above ground in densely-foliaged shrub or tree.	**Moderate Potential.** Foraging habitat is present in grassland portions of the Permanente Property. Trees and shrubs are present for nesting. The are no documented occurrences of this species within 5.0 miles of the Permanente Property (CNDDB 2009).	If brush and vegetation removal occurs between February 1 and September 1, pre-construction breeding bird surveys should be conducted in the vicinity and within 14 days of ground disturbance to avoid disturbance to active nests, eggs, and/or young.
Least Bell's Vireo *Vireo bellii pusillus*	FE, SE, BCC, SLC	This species is a Summer resident of Southern California but whose range is extending northward. Nesting occurs in riparian areas in vicinity of water or in dry river bottoms. Nests placed along margins of bushes or on twigs projecting into pathways, usually willow, coyote brush or mesquite.	**Unlikely.** The Permanente Property is outside the known distribution for this species. The nearest documented occurrence of breeding Least Bell's Vireos is 37.5 miles southeast of the Permanente Property (CNDDB 2009).	No further actions are recommended for this species.

SPECIES	STATUS*	HABITAT	POTENTIAL FOR OCCURRENCE	RECOMMENDATIONS
Yellow Warbler *Dendroica petechia*	SSC	Riparian plant associations. Prefers willows, cottonwoods, aspens, sycamores, & alders for nesting & foraging. Also nests in montane shrubbery in open conifer forests.	**Present.** Foraging and nesting habitat is present within the Permanente Property. This species has not been documented breeding on-site, Yellow Warblers have been observed within the Permanente Property by WRA Biologists. There are no documented occurrences of this species within 5 miles of the Permanente Property (CNDDB 2009).	If brush and vegetation removal occurs between February 1 and September 1, pre-construction breeding bird surveys should be conducted in the vicinity and within 14 days of ground disturbance to avoid disturbance to active nests, eggs, and/or young.
Saltmarsh Common Yellowthroat *Geothlypis trichas sinuosa*	SSC, BCC	Resident of the San Francisco Bay region, in fresh and salt water marshes. Frequents low, dense vegetation near water. Requires thick, continuous cover down to water surface for foraging, and tall grasses, tule patches, or willows for nesting.	**Unlikely.** No suitable marsh habitat is available in the Permanente Property. May occasionally be seen foraging and/or dispersing through the Permanente Property. The nearest documented occurrence is 8.0 miles north of the Permanente Property (CNDDB 2009).	No further actions are recommended for this species.

SPECIES	STATUS*	HABITAT	POTENTIAL FOR OCCURRENCE	RECOMMENDATIONS
Grasshopper Sparrow *Ammodramus savannarum*	SSC	Favors native grasslands with a mix of grasses, forbs and scattered shrubs. This species is loosely colonial when nesting. Prefers dense grasslands on rolling hills, lowland plains, in valleys and on hillsides on lower mountain slopes.	**Present.** Suitable grassland habitat is available for this species to nest within the Permanente Property. This species has been identified within the Permanente Property. There are no documented occurrences of this species nesting within 5 miles of the Permanente Property (CNDDB 2009).	If brush and vegetation removal occurs between February 1 and September 1, pre-construction breeding bird surveys should be conducted in the vicinity and within 14 days of ground disturbance to avoid disturbance to active nests, eggs, and/or young.
Alameda Song Sparrow *Melospiza melodia pusillula*	SSC, BCC	Resident of salt marshes bordering south arm of San Francisco Bay. Inhabits *Salicornia* marshes; nests low in *Grindelia* bushes (high enough to escape high tides) and in *Salicornia*.	**No Potential.** No suitable marsh habitat is available in the Permanente Property. There are no documented occurrences of this species within 5.0 miles of the Permanente Property (CNDDB 2009).	No further actions are recommended for this species.

SPECIES	STATUS*	HABITAT	POTENTIAL FOR OCCURRENCE	RECOMMENDATIONS
Tricolored Blackbird *Agelaius tricolor*	SSC, BCC, RP	A highly colonial species, most numerous in the Central Valley and vicinity. Usually nests over or near freshwater in dense cattails, tules, or thickets of willow, blackberry, wild rose or other tall herbs. Requires breeding habitat sufficient to support 30 nesting pairs.	**Unlikely.** Suitable freshwater marsh vegetation is not present in patch sizes large anough to support this species. This species has not been detected during 2006-2010 surveys. The nearest documented breeding colony is 14.0 miles northeast of the Permanente Property (CNDDB 2009).	No further actions are recommended for this species.
Reptiles and Amphibians				
Western Pond Turtle *Emys (Clemmys) marmorata*	SSC, SLC	Occurs in perennial ponds, lakes, rivers and streams with suitable basking habitat (mud banks, mats of floating vegetation, partially submerged logs) and submerged shelter.	**Unlikely.** Permanente Creek is relatively shallow and fast-flowing within the Permanente Property. Detention basins may provide marginal habitat for Western Pond Turtles, although upland habitat is limited around these basins. The nearest documented occurrence is 8.5 miles southeast of the Permanente Property (CNDDB 2009).	No further actions are recommended for this species.

SPECIES	STATUS*	HABITAT	POTENTIAL FOR OCCURRENCE	RECOMMENDATIONS
San Francisco Garter Snake *Thamnophis sirtalis tetrataenia*	FE, SE	Vicinity of freshwater marshes, ponds and slow moving streams in San Mateo County and northern Santa Cruz County. Prefers dense cover & water depths of at least one foot. Upland areas near water are also very important.	**Unlikely.** Santa Clara County is outside the accepted range of this sub-species. The nearest documented occurrence is 8.0 miles west of the Permanente Property (USFWS 2006).	No further actions are recommended for this species.
Alameda Whipsnake *Masticophis lateralis euryxanthus*	FT	Alameda Whipsnake is restricted to valley-foothill hardwood habitat of the Coast Ranges between Monterey and San Francisco Bay. They inhabit south-facing slopes and ravines where shrubs form a vegetative mosaic with oak trees and grasses.	**Unlikely.** There are no known occurrences of Alameda Whipsnake in Santa Clara County. Suitable habitat for Alameda Whipsnake is present, however the Permanente Property is outside of the accepted distribution of this sub species.	No further actions are recommended for this species.

SPECIES	STATUS*	HABITAT	POTENTIAL FOR OCCURRENCE	RECOMMENDATIONS
California Tiger Salamander *Ambystoma californiense*	FT, SSC, SLC	Inhabits annual grassland habitats with mammal burrows. Seasonal ponds and vernal pools are crucial to breeding.	**Unlikely.** Poor quality habitat is present in isolated sections of Permanente Creek adjacent to the Permanente Property. Poor water quality and annual disturbance in quarry detention ponds are likely to preclude breeding within the Permanente Property. Last known occurrence in Permanente Creek drainage system was in 1893 (CNDDB 2009) and was likely misidentified. Suitable upland estivation habitat with small mammal burrows is limited within the Permanente Property or adjacent areas.	No further actions are recommended for this species.
Foothill Yellow-legged Frog *Rana boylii*	SSC, SLC	FYLF occurs in partly-shaded, shallow streams and riffles with a rocky substrate in a variety of habitats. They need at least some cobble-sized substrate for egg-laying and at least 15 weeks to metamorphose.	**Unlikely.** Watersheds within the Permanente Property are either heavily shaded, channelized or have armored substrate. Focused amphibian surveys have failed to detect this species. The nearest documented occurrence of this species is 7.8 miles west-southwest of the Study Are (CNDDB 2009)	No further actions are recommended for this species.

SPECIES	STATUS*	HABITAT	POTENTIAL FOR OCCURRENCE	RECOMMENDATIONS
California Red-legged Frog *Rana aurora draytonii*	FT, SSC, SLC	Associated with quiet perennial to intermittent ponds, stream pools and wetlands. Prefers shorelines with extensive vegetation. Documented to disperse through upland habitats after rains.	**Present.** CRLF have been documented within the Permanente Property. This species breeds in Pond 14 and 21 and are present in Pond 22. Pond 22 presently does not provide aquatic breeding habitat for CRLF. Adult CRLF currently occupy Ponds 14, 21 and 22, and within Permanente Creek downstream from Pond 14. Additionally, Ponds 4A, 13, 20 and 21 are considered to be suitable habitat for CRLF, with Pond 13 supporting breeding habitat. One adult CRLF was observed in the Montebello Creek watershed along the southern Property boundary. Montebello Creek may provide suitable aquatic breeding habitat in some years and non-aquatic breeding, upland foraging and dispersal habitats.	A pre-construction survey shall be conducted immediately preceding construction activites within 300 feet of CRLF habitat. An erosion and sedimentation control plan will be implemented to prevent impacts to CRLF outside of the RPA Area. No leaks of mechanical fluids such as fuels, oils and solvents are allowed. Hazardous materials will be stored in sealable containers in a designated location at least 300 feet from any pool, pond or waterway. Water levels in Ponds 14 and 22 should be monitored during mining activities. The existing screw gate above Pond 14 will be used to maintain stable water levels to prevent take of CRLF. Upon completion of the Project, all areas subjected to ground disturbance will be reclaimed according to the RPA.

SPECIES	STATUS*	HABITAT	POTENTIAL FOR OCCURRENCE	RECOMMENDATIONS
Fishes				
Green Sturgeon *Acipenser medirostris*	FT, NMFS	Green Sturgeon spawn in the Sacramento and Klamath Rivers. Requires water temperatures between 8-14 degrees celsius to spawn. Preferred spawning substrate is large cobble, but can range from clean sand to bedrock.	**No Potential.** Permanente Property is outside of the present distribution range of Green Sturgeon (NOAA 2008).	No further actions are recommended for this species.
Pacific Lamprey *Lampetra tridentata*	SLC	Found in Pacific coast streams north of San Luis Obispo County, however regularly runs in the Santa Clara River. This species prefers high velocity, gravel bottomed areas for spawning with water temps between 12-18 degrees Celsius. Juveniles need soft sand or mud.	**Unlikely.** Pacific Lamprey are capable or surmounting all but the largest barriers to upstream migration (Moyle 2002). The Permanente Creek Diversion is a possible barrier to this species. This species was not detected within the Permanente Property during focused fish surveys in 2009. There are no documented occurrences of this species in CNDDB (2008).	No further actions are recommended for this species.

SPECIES	STATUS*	HABITAT	POTENTIAL FOR OCCURRENCE	RECOMMENDATIONS
Tidewater Goby *Eucyclogobius newberryi*	FE	Tidewater Gobies occur in brackish water habitats along the California Coast from Agua Hedionda Lagoon in San Diego County to the mouth of the Smith River. They are found in shallow lagoons and lower stream reaches. They require fairly still but not stagnant water and high oxygen levels.	**No Potential.** Permanente Property is outside of the present distribution range of Tidewater Goby (NOAA 2008).	No further actions are recommended for this species.
Delta Smelt *Hypomesus transpacificus*	FT	Delta Smelt are found in the Sacramento - San Joaquin Delta. They seasonally occur in Suisun Bay, Carquinez Strait and San Pablo Bay. This species most often occurs at salinities less than 2 ppt and is seldom found at salinities greater than 10 ppt.	**No Potential.** Permanente Property is outside of the present distribution range of Delta Smelt (NOAA 2008).	No further actions are recommended for this species.
Chinook Salmon - Central Valley fall run ESU *Oncorhynchus tshawytscha*	SSC, SLC	Central Valley fall run Chinook Salmon include all naturally spawned populations of fall-run Chinook salmon in the Sacramento River and its tributaries in California, including the Feather River, as well as the Feather River Hatchery spring-run Chinook program. This species requires clean, cold water over gravel beds with water temperatures between 6 and 14 degrees Celsius for spawning.	**No Potential.** Permanente Property is outside of the present distribution range of Central Valley fall run Chinook Salmon (NOAA 2008).	No further actions are recommended for this species.

SPECIES	STATUS*	HABITAT	POTENTIAL FOR OCCURRENCE	RECOMMENDATIONS
Chinook Salmon - Central Valley spring run ESU *Oncorhynchus tshawytscha*	FT, NMFS	Central Valley spring run Chinook Salmon include all naturally spawned populations of spring-run Chinook salmon in the Sacramento River and its tributaries in California, including the Feather River, as well as the Feather River Hatchery spring-run Chinook program. This species requires clean, cold water over gravel beds with water temperatures between 6 and 14 degrees Celsius for spawning.	**No Potential.** Permanente Property is outside of the present distribution range of Central Valley spring run Chinook Salmon (NOAA 2008).	No further actions are recommended for this species.
Chinook Salmon - Sacramento River winter run ESU *Oncorhynchus tshawytscha*	FE, NMFS	Winter run Chinook Salmon occur in the Sacramento River below Keswick Dam. They spawn in the Sacramento River but not in tributary streams. This species requires clean, cold water over gravel beds with water temperatures between 6 and 14 degrees Celsius for spawning.	**No Potential.** Permanente Property is outside of the present distribution range of Sacramento River winter run Chinook Salmon (NOAA 2008).	No further actions are recommended for this species.
Coho Salmon - Central California Coast ESU *Oncorhynchus kisutch*	FE, NMFS	Occurs inland and in coastal marine waters. Requires beds of loose, silt-free, coarse gravel for spawning. Also needs cover, cool water and sufficient dissolved oxygen.	**No Potential.** Permanente Property is outside of the present distribution range of central California Coast Coho Salmon (NOAA 2008).	No further actions are recommended for this species.

SPECIES	STATUS*	HABITAT	POTENTIAL FOR OCCURRENCE	RECOMMENDATIONS
Steelhead - Central Valley ESU *Oncorhynchus mykiss*	FT, NMFS	Populations in the Sacramento and San Joaquin rivers and their tributaries. Adults migrate upstream to spawn in cool, clear, well-oxygenated streams. Juveniles remain in fresh water for 1 or more years before migrating downstream to the ocean.	**No Potential.** Permanente Property is outside of the present distribution range of Central Valley Steelhead (NOAA 2008)	No further actions are recommended for this species.
Steelhead - central CA coast ESU *Oncorhynchus mykiss*	FT, NMFS	Occurs from the Russian River south to Soquel Creek and Pajaro River. Also in San Francisco and San Pablo Bay Basins. Adults migrate upstream to spawn in cool, clear, well-oxygenated streams. Juveniles remain in fresh water for 1 or more years before migrating downstream to the ocean.	**Unlikely.** Documented to occur in Peters Creek on the west side of Highway 35 within 3 miles of Permanente Property (CNDDB 2009). Barriers along Permanente Creek including the Permanente Creek Diversion are complete barriers to upstream migration and preclude the presence of this species in the Permanente Property.	No further actions are recommended for this species.
Invertebrates				
Bay checkerspot butterfly *Euphydryas editha bayensis*	FT, SSI, RP	Restricted to native grasslands on outcrops of serpentine soil in the vicinity of San Francisco Bay and San Jose. *Plantago erecta* is the primary host plant; *Orthocarpus densiflorus* and *O. purpurscens* are the secondary host plants.	**No Potential.** Suitable serpentine soil habitat is not present in the Permanente Property. There are no documented occurrences within 5 miles of the Permanente Property (CNDDB 2009).	No further actions are recommended for this species.

SPECIES	STATUS*	HABITAT	POTENTIAL FOR OCCURRENCE	RECOMMENDATIONS
San Bruno elfin butterfly *Incisalia mossii bayensis*	FE	Occurs on coastal, mountainous areas with grassy ground cover, mainly in the vicinity of San Bruno Mountain in San Mateo County. Colonies are located on steep, north-facing slopes within the fog belt. Larval host plant is *Sedum spathulifolium*.	**No Potential.** The Permanente Property is outside the known range for this species. There are no documented occurrences within 5 miles of the Permanente Property (CNDDB 2009).	No further actions are recommended for this species.
unsilvered fritillary butterfly *Speyeria adiaste adiaste*	SSI	Restricted range: Santa Clara north to San Mateo County; east to north Los Angeles County and Kern County. Larval host plant is *Viola quercetorum*. Adults utilize openings in redwood and coniferous forests, oak woodlands, and chaparral habitats.	**Unlikely.** The host plant of this species has not been identified within the Permanente Property and/or adjacent areas. The nearest documented occurrence is 3.9 miles southwest of the Permanente Property (CNDDB 2009).	No further actions are recommended for this species.
Zayante band-winged grasshopper *Trimerotropis infantilis*	FE	Isolated sandstone deposits in the Santa Cruz Mountains (the Zayante Sand Hills Ecosystem) mostly on sand parkland habitat but also in areas with well-developed ground cover & in sparse chaparral with grass.	**No Potential.** The Permanente Property does not contain suitable soils to support this species and is outside the accepted range of this species. The nearest documented occurrence is 10.4 miles south-southeast of the Permanente Property (CNDDB 2009).	No further actions are recommended for this species.

SPECIES	STATUS*	HABITAT	POTENTIAL FOR OCCURRENCE	RECOMMENDATIONS
conservancy fairy shrimp *Branchinecta conservatio*	FE	This species is endemic to the grasslands of the northern two-thirds of the Central Valley. They are found in large, turbid pools and inhabit pools located in swales formed by old, braided alluvium. Occupied pools remain inundated until June.	**No Potential.** The Permanente Property is outside the known range for this species. There are no documented occurrences within 5 miles of the Permanente Property (CNDDB 2009).	No further actions are recommended for this species.
vernal pool tadpole shrimp *Lepidurus packardi*	FE, SSI, RP	Inhabits vernal pools and swales in the Sacramento Valley and San Francisco Bay Area containing clear to highly turbid water. Pools commonly found in grass bottomed swales of unplowed grasslands. Some pools are mud-bottomed and highly turbid.	**Unlikely.** Marginal seasonal wetland habitat is present within the Permanente Property. There is no known connectivity between the known occurrences of this species and the Permanente Property. There are no documented occurrences within 5 miles of the Permanente Property (CNDDB 2009).	No further actions are recommended for this species.

SPECIES	STATUS*	HABITAT	POTENTIAL FOR OCCURRENCE	RECOMMENDATIONS
Plants				
San Mateo thorn mint *Acanthomintha duttonii*	List 1B, FE, SE	Occurs in chaparral and valley and foothill grassland on serpentinite soils. 5-300 meters. Blooms April-June.	**No Potential.** The Permanente Property lacks suitable serpentinite soils. Additionally, this species was not identified during rare plant surveys which were conducted during its blooming period.	No further actions are recommended for this species.
Franciscan onion *Allium peninsulare* var. *franciscanum*	List 1B	Occurs in cismontane woodland, valley and foothill grassland on clay, volcanic, and often serpentinite soils. 52 - 300 meters. Blooms May-June.	**No Potential.** The Permanente Property lacks suitable clay, volcanic, and serpentinite soils. Additionally, this species was not identified during rare plant surveys which were conducted during its blooming period.	No further actions are recommended for this species.
Sharsmith's onion *Allium sharsmithiae*	List 1B	Occurs in chaparral and cismontane woodland on rocky, serpentinite soils. 400-1200 meters. Blooms March-May.	**No Potential.** The Permanente Property lacks suitable serpentinite soils. Additionally, this species was not identified during rare plant surveys which were conducted during its blooming period.	No further actions are recommended for this species.

SPECIES	STATUS*	HABITAT	POTENTIAL FOR OCCURRENCE	RECOMMENDATIONS
bent-flowered fiddleneck *Amsinckia lunaris*	List 1B	Occurs in coastal bluff scrub, cismontane woodland and valley and foothill grassland. 3-500 meters. Blooms March-June.	**No Potential.** Although suitable grassland habitat is present in the Permanente Property, this species was not identified during rare plant surveys which were conducted during its blooming period.	No further actions are recommended for this species.
slender silver moss *Anomobryum julaceum*	List 2	Occurs in broadleafed upland forest, lower montane coniferous forest, and North Coast coniferous forest on damp rock and soils on outcrops and roadcuts. 100-1000 meters.	**No Potential.** Although suitable forested habitat for this species is present in the Permanente Property, the only known occurrence of this species in the vicinity of the Permanente Property is uncertain (CDFG 2008). Additionally, this species was not observed during rare plant surveys.	No further actions are recommended for this species.
Santa Cruz Mountains manzanita *Arctostaphylos andersonii*	List 1B	Occurs in openings and edges of broadleafed upland forest, chaparral, and North Coast coniferous forest. 60-730 meters. Blooms November-April.	**No Potential.** Although suitable chaparral habitat is present in the Permanente Property, this species can be identified out of its blooming period and was not identified on site during rare plants surveys.	No further actions are recommended for this species.

SPECIES	STATUS*	HABITAT	POTENTIAL FOR OCCURRENCE	RECOMMENDATIONS
Schreiber's manzanita *Arctostaphylos glutinosa*	List 1B	Occurs in closed-cone coniferous forest, and chaparral on diatomaceous shale. 170-685 meters. Blooms (November-April).	**No Potential.** Although suitable chaparral habitat is present in the Permanente Property, this species can be identified out of its blooming period and was not identified on site during rare plants surveys.	No further actions are recommended for this species.
Pajaro manzanita *Arctostaphylos pajaroensis*	List 1B	Occurs in chaparral on sandy soils. 30-760 meters. Blooms December-March.	**No Potential.** The Permanente Property lacks suitable chaparral habitat on sandy soils.	No further actions are recommended for this species.
King's Mountain manzanita *Arctostaphylos regismontana*	List 1B	Occurs in broadleafed upland forest, chaparral and North Coast coniferous forest on granitic or sandstone substrates. 305-730 meters. Blooms January-April.	**No Potential.** The Permanente Property lacks suitable forest or chaparral habitat on granitic or sandstone substrates.	No further actions are recommended for this species.
Bonny Doon manzanita *Arctostaphylos silvicola*	List 1B	Occurs in closed-cone coniferous forest, chaparral and lower montane coniferous forest on inland marine-derived sandy soils. 120-600 meters. Blooms February-March.	**No Potential.** The Permanente Property lacks suitable forest and chaparral habitats on inland marine-derived sandy soils.	No further actions are recommended for this species.
alkali milk-vetch *Astragalus tener var. tener*	List 1B	Alkali playa, valley and foothill grassland, vernal pools. Low ground, alkali flats, and flooded lands. 1-170m. Blooms March-June.	**No Potential.** The Permanente Property lacks suitable alkali flooded habitats.	No further actions are recommended for this species.

SPECIES	STATUS*	HABITAT	POTENTIAL FOR OCCURRENCE	RECOMMENDATIONS
brittlescale *Atriplex depressa*	List 1B	Occurs in chenopod scrub, meadows and seeps, playas, valley and foothill grassland and vernal pools, on alkaline clay soils. 1-320 meters. Blooms May-Oct.	**No Potential.** The Permanente Property lacks suitable alkaline clay soils.	No further actions are recommended for this species.
San Joaquin spearscale *Atriplex joaquiniana*	List 1B	Chenopod scrub, alkali meadow, valley and foothill grassland. In seasonal alkali wetlands or alkali sink scrub with *Distichlis spicata*, *Frankenia salina*, etc. 1-250m. Blooms April-October.	**No Potential.** The Permanente Property lacks suitable alkali wetlands.	No further actions are recommended for this species.
big-scale balsamroot *Balsamorhiza macrolepis var. macrolepis*	List 1B	Occurs in chaparral, cismontane woodland and valley and foothill grassland, sometimes on serpentinite soils. 90-1400 meters. Blooms March-June.	**No Potential.** Although suitable chaparral and woodland habitat on non-serpentinite soils is present in the Permanente Property, this species was not identified during rare plant surveys which were conducted during its blooming period.	No further actions are recommended for this species.
round-leaved filaree *California macrophylla*	List 1B	Occurs in cismontane woodland and valley and foothill grassland on clay soils. 15-1200 meters. Blooms March-May.	**No Potential.** The Permanente Property lacks suitable clay soils. Additionally, this species was not identified during rare plant surveys which were conducted during its blooming period.	No further actions are recommended for this species.

SPECIES	STATUS*	HABITAT	POTENTIAL FOR OCCURRENCE	RECOMMENDATIONS
Santa Cruz Mountains pussypaws *Calyptridium parryi var. hesseae*	List 3	Occurs in chaparral and cismontane woodland. 305-1115 meters. Blooms May-July.	**No Potential.** Although suitable chaparral and woodland habitat is present in the Permanente Property, this species was not identified during rare plant surveys which were conducted during its blooming period.	No further actions are recommended for this species.
chaparral harebell *Campanula exigua*	List 1B	Occurs in chaparral, usually on rocky, serpentinite soils. 275-1250 meters. Blooms May-June.	**No Potential.** The Permanente Property lacks suitable serpentinite soils.	No further actions are recommended for this species.
Sharsmith's harebell *Campanula sharsmithiae*	List 1B	Occurs in chaparral, usually on serpentine barrens. 480-855 meters. Blooms April-June.	**No Potential.** The Permanente Property lacks suitable serpentinite barrens.	No further actions are recommended for this species.
Tiburon paintbrush *Castilleja affinis ssp. neglecta*	List 1B, FE, ST	Occurs in valley and foothill grassland on serpentinite soils. 60-400 meters. Blooms April-June.	**No Potential.** The Permanente Property lacks suitable serpentinite soils.	No further actions are recommended for this species.
pink creamsacs *Castilleja rubicundula ssp. rubicundula*	List 1B	Occurs within openings in chaparral, cismontane woodland, meadows and seeps and in valley and foothill grassland on serpentinite soils. 20-900 meters. Blooms April-June.	**No Potential.** The Permanente Property lacks suitable serpentinite soils.	No further actions are recommended for this species.

SPECIES	STATUS*	HABITAT	POTENTIAL FOR OCCURRENCE	RECOMMENDATIONS
coyote ceanothus *Ceanothus ferrisiae*	List 1B, FE	Occurs in chaparral, coastal scrub and valley and foothill grassland on serpentinite soils. 120-460 meters. Blooms January-May.	**No Potential.** The Permanente Property lacks suitable serpentinite soils. This species is known from fewer than five occurrences in the Mt. Hamilton Range.	No further actions are recommended for this species.
Congdon's tarplant *Centromadia parryi ssp. congdonii*	List 1B	Occurs on valley and foothill grassland on alkaline soils. 1-230 meters. Blooms May-October, occasionally to November.	**No Potential.** The Permanente Property lacks suitable alkaline soils.	No further actions are recommended for this species.
Ben Lomond spineflower *Chorizanthe pungens var. hartwegiana*	List 1B, FE	Occurs in lower montane coniferous forest, on maritime ponderosa pine sandhills. 90-610 meters. Blooms April-July.	**No Potential.** The Permanente Property lacks suitable coniferous forest or pine sandhill habitat.	No further actions are recommended for this species.
robust spineflower *Chorizanthe robusta var. robusta*	List 1B, FE	Occurs maritime chaparral, openings in cismontane woodland, coastal dunes, and sandy or gravelly coastal scrub. 3-300 meters. Blooms April-September.	**No Potential.** Although suitable woodland habitat is present in the Permanente Property, this species was not identified during rare plant surveys which were conducted during its blooming period.	No further actions are recommended for this species.
Mt. Hamilton fountain thistle *Cirsium fontinale var. campylon*	List 1B	Occurs in chaparral, cismontane woodland and valley and foothill grassland in serpentinite seeps. 100-890 meters. Blooms April-October, occasionally beginning in February.	**No Potential.** The Permanente Property lacks suitable serpentinite seep habitat.	No further actions are recommended for this species.

SPECIES	STATUS*	HABITAT	POTENTIAL FOR OCCURRENCE	RECOMMENDATIONS
Crystal Springs fountain thistle *Cirsium fontinale var. fontinale*	List 1B, FE, SE	Occurs in chaparral openings, cismontane woodland, and valley and foothill grassland in serpentinite seeps. 46-175 meters. Blooms May-October.	**No Potential.** The Permanente Property lacks suitable serpentinite seep habitat.	No further actions are recommended for this species.
lost thistle *Cirsium praeteriens*	List 1A	Habitat unknown. Possibly an introduction from the Old World. Known from only two collections from Palo Alto, the most recent in 1901. 0-100 meters. Blooms June-July.	**No Potential.** Although suitable habitat for this species may be present in the Permanente Property, this species was not identified during rare plant surveys which were conducted during its blooming period.	No further actions are recommended for this species.
Santa Clara red ribbons *Clarkia concinna* ssp. *automixa*	List 4			
San Francisco collinsia *Collinsia multicolor*	List 1B	Occurs in closed-cone coniferous forest and coastal scrub, sometimes on serpentinite soils. 30-250 meters. Blooms March-May.	**No Potential.** Although suitable forest and scrub habitat on non-serpentinite soils is present in the Permanente Property, this species was not identified during rare plant surveys which were conducted during its blooming period.	No further actions are recommended for this species.
Point Reyes bird's beak *Cordylanthus maritimus* ssp. *palustris*	List 1B	Occurs in coastal salt marsh. 0-10 meters. Blooms June-October.	**No Potential.** The Permanente Property lacks suitable salt marsh habitat.	No further actions are recommended for this species.

SPECIES	STATUS*	HABITAT	POTENTIAL FOR OCCURRENCE	RECOMMENDATIONS
Mt. Hamilton coreopsis *Coreopsis hamiltonii*	List 1B	Occurs in cismontane woodland on rocky soils. 550-1300 meters. Blooms March-May.	**No Potential.** Although suitable woodland habitat on rocky soils is present in the Permanente Property, this species was not identified during rare plant surveys which were conducted during its blooming period.	No further actions are recommended for this species.
Sant Cruz cypress *Cupressus abramsiana*	List 1B, FE, SE	Occurs within closed-cone coniferous forest, chaparral, and lower-montane coniferous forest. Restricted to the Santa Cruz mountains, usually found with *Pinus attenuata*. 280-800 meters.	**No Potential.** The Permanente Property hosts very few coniferous species. This tree species was not identified during rare plant surveys.	No further actions are recommended for this species.
Hospital Canyon larkspur *Delphinium californicum ssp. interius*	List 1B	Occurs in openings in chaparral, and mesic sites in cismontane woodland. 230-1095 meters. Blooms April-June.	**No Potential.** Although suitable chaparral and woodland habitat is present in the Permanente Property, this species was not identified during rare plant surveys which were conducted during its blooming period.	No further actions are recommended for this species.
Norris' beard moss *Didymodon norrisii*	List 2	Occurs in cismontane woodland, and lower montane coniferous forest on rocky, intermittently mesic sites. 600-1973 meters.	**No Potential.** Although suitable woodland and forest habitat is present in the Permanente Property, this species was not identified during rare plant surveys.	No further actions are recommended for this species.

SPECIES	STATUS*	HABITAT	POTENTIAL FOR OCCURRENCE	RECOMMENDATIONS
western leatherwood *Dirca occidentalis*	List 1B	Occurs in broadleafed upland forest, closed-cone coniferous forest, chaparral, cismontane woodland, North Coast coniferous forest, riparian forest, and riparian woodland, usually on brushy slopes and mesic sites. 50-395 meters. Blooms January-March.	**Present.** This shrub species is identifiable outside of its blooming period, and was observed in one location along the banks of an intermittent creek in the western portion of the Permanente Property.	Impacts to this plant species should be avoided as possible.
Santa Clara Valley dudleya *Dudleya setchellii*	List 1B, FE	Occurs in cismontane woodland and valley and foothill grassland on rocky, serpentinite outcrops. 60-455 meters. Blooms April-October.	**No Potential.** The Permanente Property lacks serpentinite outcrops.	No further actions are recommended for this species.
Brandegee's eriastrum *Eriastrum brandegeeae*	List 1B	Occurs in chaparral and cismontane woodland on volcanic, sandy soils. 305-1030 meters. Blooms April-August.	**No Potential.** The Permanente Property lacks suitable chaparral and woodland habitat on volcanic or sandy soils. Additionally, this species was not identified during rare plant surveys which were conducted during its blooming period.	No further actions are recommended for this species.
Tracy's eriastrum *Eriastrum tracyi*	List 1B, SR	Occurs in chaparral and cismontane woodland. 315-975 meters. Blooms June-July.	**No Potential.** Although suitable chaparral and woodland habitat is present in the Permanente Property, this species was not identified during rare plant surveys which were conducted during its blooming period.	No further actions are recommended for this species.

SPECIES	STATUS*	HABITAT	POTENTIAL FOR OCCURRENCE	RECOMMENDATIONS
Santa Catalina Island buckwheat *Eriogonum giganteum* ssp. *giganteum*	List 4			
Ben Lomond buckwheat *Eriogonum nudum* var.*decurrens*	List 1B	Occurs in chaparral, cismontane woodland, and lower montane coniferous forest, usually found on maritime Ponderosa Pine sandhills. 50-800 meters. Blooms June-October.	**No Potential.** The Permanente Property lacks suitable chaparral, woodland, and forest habitats on maritime Ponderosa Pine sandhills.	No further actions are recommended for this species.
San Mateo woolly sunflower *Eriophyllum latilobum*	List 1B, FE, SE	Occurs in cismontane woodland, often on serpentine in roadcuts. 45-150 meters. Blooms May-June.	**No Potential.** The Permanente Property lacks suitable woodland habitat with serpentine outcrops.	No further actions are recommended for this species.
Hoover's button-celery *Eryngium aristulatum* var. *hooveri*	List 1B	Occur in alkaline depressions, vernal pools, roadside ditches and other wet places near the coast. 5-45 meters. Blooms in July.	**No Potential.** The Permanente Property lacks suitable alkaline depressions and vernal pool habitat.	No further actions are recommended for this species.
talus fritillary *Fritillaria falcata*	List 1B	Occurs in chaparral, cismontane woodland and lower montane coniferous forest on serpentinite talus fields. 300-1525 meters. Blooms March-May.	**No Potential.** The Permanente Property lacks suitable chaparral and woodland on serpentinite talus fields.	No further actions are recommended for this species.

SPECIES	STATUS*	HABITAT	POTENTIAL FOR OCCURRENCE	RECOMMENDATIONS
fragrant fritillary *Fritillaria liliacea*	List 1B	Occurs in cismontane woodland, coastal prairie, coastal scrub, valley and foothill grassland, usually associated with serpentine. 3-410 meters. Blooms February-April.	**No Potential.** The Permanente Property lacks suitable woodland, prairie, scrub, or grassland habitats on serpentine soils.	No further actions are recommended for this species.
short-leaved evax *Hespervax sparsiflora* var. *brevifolia*	List 2	Occurs in coastal bluff scrub and coastal dunes. 0-215 meters. Blooms March-June.	**No Potential.** The Permanente Property lacks suitable coastal bluff scrub and dune habitat.	No further actions are recommended for this species.
Marin western flax *Hesperolinon congestum*	List 1B, FT, ST	Occurs in valley and foothill grasslands and chaparral, on serpentinite soils. 30-365 meters. Blooms April-July.	**No Potential.** The Permanente Property lacks suitable serpentinite soils.	No further actions are recommended for this species.
Northern California black walnut *Juglans hindsii*	List 1B	Occurs in riparian forest and riparian woodland. 0 to 440 meters. Blooms April to May. The species is historically known from Alameda, Butte, Contra Costa, Lake, Napa, Sacramento, Solano, Sonoma, and Yolo counties. Only native stands garner protected status.	**No Potential.** Although this species was observed within the Permanente Property, it was determined not to be a native stand. Native stands of this species was not identified during rare plant surveys which were conducted during its blooming period. No native stands are known from Santa Clara County.	No further actions are recommended for this species.
Loma Prieta hoita *Hoita strobilina*	List 1B	Occurs in chaparral, cismontane woodland, riparian woodland, usually on serpentine soils and mesic sites. 30-860 meters. Blooms May-July.	**No Potential.** The Permanente Property lacks suitable chaparral and woodland habitat on serpentine soils.	No further actions are recommended for this species.

SPECIES	STATUS*	HABITAT	POTENTIAL FOR OCCURRENCE	RECOMMENDATIONS
Contra Costa goldfields *Lasthenia conjugens*	List 1B, FE	Occurs in cismontane woodland, playas, valley and foothill grassland, and alkaline vernal pools. 0-470 meters. Blooms March-June.	**No Potential.** The Permanente Property lacks suitable wetland habitat. Additionally, this species was not identified during rare plant surveys which were conducted during its blooming period.	No further actions are recommended for this species.
legenere *Legenere limosa*	List 1B	Vernal pools. 1-880 meters. Blooms April-June.	**No Potential.** The Permanente Property lacks suitable vernal pool habitat.	No further actions are recommended for this species.
woolly-headed lessingia *Lessingia hololeuca*	List 3	Occurs in broadleafed upland forest, coastal scrub, lower montane coniferous forest and valley and foothill grassland. Usually associated with clay and serpentine soils. 15-305 meters. Blooms June-October.	**No Potential.** The Permanente Property lacks suitable clay and serpentine soils. Additionally, this species was not identified during rare plant surveys which were conducted during its blooming period.	No further actions are recommended for this species.
smooth lessingia *Lessingia micradenia* var. *glabrata*	List 1B	Occurs in chaparral, cismontane woodland, usually on serpentine soils near roadsides. 120-420 meters. Blooms July-November.	**No Potential.** The Permanente Property lacks suitable serpentine soils. Additionally, this species was not identified during rare plant surveys which were conducted during its blooming period.	No further actions are recommended for this species.

SPECIES	STATUS*	HABITAT	POTENTIAL FOR OCCURRENCE	RECOMMENDATIONS
Mt. Hamilton lomatium *Lomatium observatorium*	List 1B	Occurs in cismontane woodland. 1219-1330 meters. Blooms March-May.	**No Potential.** Although suitable woodland habitat is present in the Permanente Property, this species was not identified during rare plant surveys which were conducted during its blooming period.	No further actions are recommended for this species.
arcuate bushmallow *Malacothamnus arcuatus*	List 1B	Occurs in chaparral, cismontane woodland, usually in gravelly alluvium. 15-355 meters. Blooms April-September.	**No Potential.** The Permanente Property lacks suitable chaparral and woodland habitats on gravelly alluvium.	No further actions are recommended for this species.
Davidson's bushmallow *Malacothamnus davidsonii*	List 1B	Occurs in chaparral, cismontane woodland, coastal scrub and riparian woodland, usually in sandy washes. 185-855 meters. Blooms June-January.	**No Potential.** The Permanente Property lacks suitable chaparral, woodland, and scrub habitat in sandy washes.	No further actions are recommended for this species.
Hall's bushmallow *Malacothamnus hallii*	List 1B	Occurs in chaparral, coastal scrub, some populations on serpentine. 10-760 meters. Blooms May-September.	**No Potential.** Although suitable chaparral habitat on non-serpentine soils is present in the Permanente Property, this species was not identified during rare plant surveys which were conducted during its blooming period.	No further actions are recommended for this species.
Oregon meconella *Meconella oregana*	List 1B	Occurs in coastal prairie and coastal scrub. 250-620 meters. Blooms March-April.	**No Potential.** The Permanente Property lacks suitable coastal scrub and prairie habitat.	No further actions are recommended for this species.

SPECIES	STATUS*	HABITAT	POTENTIAL FOR OCCURRENCE	RECOMMENDATIONS
Mt. Diablo cottonweed *Micropus amphibolus*	List 3	Occurs in broadleafed upland forest, chaparral, cismontane woodland, valley and foothill grassland in rocky soils. 45-825 meters. Blooms March-May.	**No Potential**. This species was observed in grassland areas outside of the eastern boundary of the Permanente Property. It was not identified on site during rare plant surveys which were conducted during its blooming period.	No further actions are recommended for this species.
San Antonio Hills monardella *Monardell antonina* ssp. *antonina*	List 3	Occurs in chaparral and cismontane woodland. 500-1000 meters. Blooms June-August.	**No Potential.** Although suitable chaparral and woodland habitat is present in the Permanente Property, this species was not identified during rare plant surveys which were conducted during its blooming period.	No further actions are recommended for this species.
robust monardella *Monardella villosa* ssp.*globosa*	List 1B	Occurs in openings in chaparral, broadleafed upland forest, cismontane woodland, and valley and foothill grassland. 30-915 meters. Blooms June-July.	**No Potential.** Although suitable chaparral, forest, and woodland habitat is present in the Permanente Property, this species was not identified during rare plant surveys which were conducted during its blooming period.	No further actions are recommended for this species.

SPECIES	STATUS*	HABITAT	POTENTIAL FOR OCCURRENCE	RECOMMENDATIONS
prostrate navarretia *Navarretia prostrata*	List 1B	Occurs in coastal scrub, meadows and seeps, valley and foothill grassland, and alkaline vernal pools. 15-700 meters. Blooms April-July.	**No Potential.** The Permanente Property lacks suitable seep and vernal pool habitats. Additionally, this species was not identified during rare plant surveys which were conducted during its blooming period.	No further actions are recommended for this species.
Kellman's bristle moss *Orthotrichum kellmanii*	List 1B	Occurs in chaparral and cismontane woodland. Restricted to sandstone outcrops. 343-685 meters. Blooms January-February.	**No Potential.** The Permanente Property lacks suitable sandstone outcrops.	No further actions are recommended for this species.
Dudley's lousewort *Pedicularis dudleyi*	List 1B, SR	Occurs in chaparral, lower montane coniferous forest, North Coast coniferous forest. 60-900 meters. Blooms April-June.	**No Potential.** Although suitable chaparral and forest habitat is present in the Permanente Property, this species was not identified during rare plant surveys which were conducted during its blooming period.	No further actions are recommended for this species.
Santa Cruz mountains beardtongue *Penstemon rattanii* var. *kleei*	List 1B	Occurs in chaparral, lower montane coniferous forest and North Coast coniferous forest, usually on sandy shale slopes and sometimes in the transition zone between forest and chaparral. 400-1100 meters. Blooms May-June.	**No Potential.** Although suitable chaparral and forest habitat is present in the Permanente Property, this species was not identified during rare plant surveys which were conducted during its blooming period.	No further actions are recommended for this species.

SPECIES	STATUS*	HABITAT	POTENTIAL FOR OCCURRENCE	RECOMMENDATIONS
white-rayed pentacheata *Pentachaeta bellidiflora*	List 1B, FE, SE	Occurs in valley and foothill grassland, often associated with serpentine soils. 35-620 meters. Blooms March-May.	**No Potential.** The Permanente Property lacks suitable grassland habitat on serpentine soils.	No further actions are recommended for this species.
San Benito pentachaeta *Pentachaeta exilis ssp. aeolica*	List 1B	Occurs in cismontane woodland and valley and foothill grassland. 640-855 meters. Blooms March-May.	**No Potential.** Although suitable woodland and grassland habitat is present in the Permanente Property, this species was not identified during rare plant surveys which were conducted during its blooming period.	No further actions are recommended for this species.
Mt. Diablo phacelia *Phacelia phacelioides*	List 1B	Occurs in chaparral and cismontane woodland in rocky soils. 500-1370 meters. Blooms April-May.	**No Potential.** Although suitable chaparral and woodland habitat is present in the Permanente Property, this species was not identified during rare plant surveys which were conducted during its blooming period.	No further actions are recommended for this species.
white-flowered rein orchid *Piperia candida*	List 1B	Occurs in broadleafed upland forest, lower montane coniferous forest and North Coast coniferous forest, occasionally on serpentinite soils. 30-1310 meters. Blooms May-September.	**No Potential.** Although suitable forest habitat on non-serpentine soils is present in the Permanente Property, this species was not identified during rare plant surveys which were conducted during its blooming period.	No further actions are recommended for this species.

SPECIES	STATUS*	HABITAT	POTENTIAL FOR OCCURRENCE	RECOMMENDATIONS
hairless popcorn-flower *Plagiobothrys glaber*	List 1A	Occurs in alkaline meadows and seeps, coastal salt marshes and swamps. 15-180 meters. Blooms March-May.	**No Potential.** The Permanente Property lacks suitable alkaline meadows and seeps, and suitable coastal salt marshes and swamps.	No further actions are recommended for this species.
hooked popcorn-flower *Plagiobothrys uncinatus*	List 1B	Occurs in chaparral (sometimes on sandy soils), cismontane woodland and valley and foothill grassland. 300-760 meters. Blooms April-May.	**No Potential.** Although suitable chaparral, woodland, and grassland habitat is present in the Permanente Property, this species was not identified during rare plant surveys which were conducted during its blooming period.	No further actions are recommended for this species.
slender-leaved pondweed *Potamogeton filiformis*	List 2	Occurs in assorted shallow freshwater marshes and swamps. 300-2150 meters. Blooms May-July.	**No Potential.** The Permanente Property lacks suitable freshwater marsh and swamp habitat.	No further actions are recommended for this species.
rock sanicle *Sanicula saxatilis*	List 1B, SR	Occurs in broadleafed upland forest, chaparral and valley and foothill grassland, on rocky soils and outcrops. 620-1175 meters. Blooms April-May.	**No Potential.** Although suitable forest, chaparral, and grassland habitat is present in the Permanente Property, this species was not identified during rare plant surveys which were conducted during its blooming period.	No further actions are recommended for this species.

SPECIES	STATUS*	HABITAT	POTENTIAL FOR OCCURRENCE	RECOMMENDATIONS
chaparral ragwort *Senecio aphanactis*	List 2	Occurs in chaparral, cismontane woodland, and coastal scrub, often alkaline soils. 15-800 meters. Blooms January-April.	**No Potential.** The Permanente Property lacks suitable alkaline soils.	No further actions are recommended for this species.
San Francisco campion *Silene verecunda* ssp. *verecunda*	List 1B	Occurs in coastal bluff scrub, chaparral, coastal prairie, coastal scrub and valley and foothill grassland, often on mudstone or shale. 30-645 meters. Blooms March-June.	**No Potential.** Although suitable chaparral and grassland habitat is present in the Permanente Property, this species was not identified during rare plant surveys which were conducted during its blooming period.	No further actions are recommended for this species.
Santa Cruz microseris *Stebbinoseris decipiens*	List 1B	Occurs in openings in broadleafed upland forest, closed-cone coniferous forest, chaparral, coastal prairie, coastal scrub and valley and foothill grassland. Sometimes on serpentine soils. 10-500 meters. Blooms April-May.	**No Potential.** Although suitable forest, chaparral, and grassland habitat is present in the Permanente Property, this species was not identified during rare plant surveys which were conducted during its blooming period.	No further actions are recommended for this species.
Metcalf Canyon jewel-flower *Streptanthus albidus* ssp. *albidus*	List 1B, FE	Occurs in relatively open areas in dry grassy meadows on serpentine soils and serpentine balds. 45-800 meters. Blooms April-July.	**No Potential.** The Permanente Property lacks suitable serpentinite soils and serpentinite bald habitat.	No further actions are recommended for this species.

SPECIES	STATUS*	HABITAT	POTENTIAL FOR OCCURRENCE	RECOMMENDATIONS
most beautiful jewel-flower *Streptanthus albidus* ssp. *peramoenus*	List 1B	Occurs in chaparral, cismontane woodland and valley and foothill grassland, often on serpentine soils. 110-1000 meters. Blooms April-June.	**No Potential.** The Permanente Property lacks suitable serpentine soils.	No further actions are recommended for this species.
Mt. Hamilton jewel-flower *Streptanthus callistus*	List 1B	Occurs in chaparral and cismontane woodland. 600-790 meters. Blooms April-May.	**No Potential.** Although suitable chaparral and woodland habitat is present in the Permanente Property, this species was not identified during rare plant surveys which were conducted during its blooming period. This species is known from approximately five occurrences in the Mt. Hamilton Range.	No further actions are recommended for this species.
California seablite *Sueda californica*	List 1B, FE	Occurs in coastal salt marshes and swamps. 0-15 meters. Blooms July-October.	**No Potential.** The Permanente Property lacks suitable coastal salt marshes and swamps.	No further actions are recommended for this species.
two-fork clover *Trifolium amoenum*	List 1B, FE	Occurs in coastal bluff scrub and valley and foothill grassland, occasionally on serpentinite soils. 5-415 meters. Blooms April-June.	**No Potential.** Although suitable grassland habitat on non-serpentinite soils is present in the Permanente Property, this species was not identified during rare plant surveys which were conducted during its blooming period.	No further actions are recommended for this species.

SPECIES	STATUS*	HABITAT	POTENTIAL FOR OCCURRENCE	RECOMMENDATIONS
saline clover *Trifolium depauperatum* var. *hydrophilum*	List 1B	Typically found in valley and foothill grassland or vernal pools in mesic, alkaline soils. Occasionally in marshes and swamps. 0-300m. Blooms April-June.	**No Potential.** The Permanente Property lacks suitable vernal pool or grassland habitats on alkaline soils.	No further actions are recommended for this species.
caper-fruited tropidocarpum *Tropidocarpum capparideum*	List 1B	Occurs in valley and foothill grassland on alkaline clay soils. 0-455 meters. Blooms March-April.	**No Potential.** The Permanente Property lacks suitable grassland habitat on alkline clay soils. The known occurrences in the vicinity of the Permanente Property date from 1902 and 1907, and may have been incorrectly identified.	No further actions are recommended for this species.
Methuselah's beard lichen *Usnea longissima*	none	Occurs in North Coast coniferous forest, closed-cone coniferous forest and cismontane woodland. Found near open water, either the margins of rivers and streams or of lakes or standing water in swamps.	**No Potential.** Although suitable forest and woodland habitat is present in the Permanente Property, this species was not identified during rare plant surveys.	No further actions are recommended for this species.

SPECIES	STATUS*	HABITAT	POTENTIAL FOR OCCURRENCE	RECOMMENDATIONS

*** Key to status codes:**

FE	Federal Endangered
FT	Federal Threatened
FC	Federal Candidate
FD	Federal De-listed
FPD	Federal Proposed for De-listing
NMFS	Species under the Jurisdiction of the National Marine Fisheries Service
BCC	USFWS Birds of Conservation Concern
RP	Sensitive species included in a USFWS Recovery Plan or Draft Recovery Plan
SE	State Endangered
ST	State Threatened
SR	State Rare
CSC	CDFG Species of Special Concern
Draft CSC	4 April 2000 Draft CDFG Species of Special Concern
CFP	CDFG Fully Protected Animal
SSI	CDFG Special Status Invertebrates
SLC	Species of Local Concern - Included for coverage under a Habitat Conservation Plan (HCP)
WBWG	Western Bat Working Group High Priority species
List 1A	CNPS List 1A: Plants presumed extinct in California
List 1B	CNPS List 1B: Plants rare, threatened or endangered in California and elsewhere
List 2	CNPS List 2: Plants rare, threatened, or endangered in California, but more common elsewhere
List 3	CNPS List 3: Plants about which CNPS needs more information (a review list)
List 4	CNPS List 4: Plants of limited distribution - a watch list

APPENDIX B. Species Observed on the Permanente Property

Appendix B. Species observed within the Permanente Property Boundary

Scientific name	Common name
MAMMALS	
Neotoma fuscipes annectens	San Francisco Dusky-footed Woodrat
Peromyscus californicus	California Deer Mouse
Sylvilagus bachmani	Brush Rabbit
Sciurus griseus	Western Gray Squirrel
Spermophillus beecheyi	California Ground Squirrel
Tamias merriami	Merriam's Chipmunk
Lynx rufus	Bobcat
Canis latrans	Coyote
Procyon lotor	Raccoon
Mephitis mephitis	Striped Skunk
Odocoileus hemionus	Mule Deer
BIRDS	
Ardea herodias	Great Blue Heron
Anas platyrhynchos	Mallard
Anas americana	American Wigeon
Anas clypeata	Northern Shoveler
Bucephala clangula	Common Goldeneye
Bucephala albeola	Bufflehead
Lophodytes cucullatus	Hooded Merganser
Cathartes aura	Turkey Vulture
Pandion haliaetus	Osprey
Elanus leucurus	White-tailed Kite
Falco sparverius	American Kestrel
Accipiter cooperii	Cooper's Hawk
Buteo lineatus	Red-shouldered Hawk
Buteo jamaicensis	Red-tailed Hawk
Falco peregrinus	Peregrine Falcon
Callipepla californica	California Quail
Zenaida macroura	Mourning Dove
Columba livia	Rock Pigeon
Columba fasciata	Band-tailed Pigeon
Aeronautes saxatalis	White-throated Swift
Calypte anna	Anna's Hummingbird
Selasphorus sasin	Allen's Hummingbird
Sphyrapicus ruber	Red-breasted Sapsucker
Picoides pubescens	Downy Woodpecker
Picoides villosus	Hairy Woodpecker
Picoides nuttallii	Nuttall's Woodpecker
Colaptes auratus	Northern Flicker
Contopus cooperi	Olive-sided Flycatcher
Empidonax difficilis	Pacific-slope Flycatcher
Myiarchus cinerascens	Ash-throated Flycatcher
Sayornis nigricans	Black Phoebe
Vireo huttoni	Hutton's Vireo

Scientific name	Common name
Cyanocitta stelleri	Steller's Jay
Aphelocoma californica	Western Scrub Jay
Corvus Corax	Common Raven
Corvus brachyrhychos	American Crow
Stelgidopteryx serripennis	Northern Rough-winged Swallow
Tachycineta thalassina	Violet-green Swallow
Tachycineta bicolor	Tree Swallow
Petrochelidon pyrrhonota	Cliff Swallow
Hirundo rustica	Barn Swallow
Baeolophus inornatus	Oak Titmouse
Poecile rufescens	Chestnut-backed Chickadee
Psaltriparus minimus	Bushtit
Certhia americana	Brown Creeper
Thryomanes bewickii	Bewick's Wren
Chamaea fasciata	Wrentit
Regulus calendula	Ruby-crowned Kinglet
Polioptila caerulea	Blue-gray Gnatcatcher
Sialia maxicana	Western Bluebird
Turdus migratorius	American Robin
Catharus ustulatus	Swainson's Thrush
Catharus guttatus	Hermit Thrush
Toxostoma redivivum	California Thrasher
Vermivora celata	Orange-crowned Warbler
Dendroica petechia	Yellow Warbler
Dendroica cerulea	Cerulean Warbler
Dendroica coronata	Yellow-rumped Warbler
Dendroica townsendii	Townsend's Warbler
Dendroica occidentalis	Hermit Warbler
Wilsonia pusilla	Wilson's Warbler
Pipilo maculatus	Spotted Towhee
Pipilo crissalis	California Towhee
Ammodramus savannarum	Grasshopper Sparrow
Passerculus sandwichensis	Savannah Sparrow
Zonotricha atricapilla	Golden-crowned Sparrow
Zonotricha leucophrys	White-crowned Sparrow
Passerella iliaca	Fox Sparrow
Melospiza melodia	Song Sparrow
Melospiza linconii	Lincoln's Sparrow
Junco hyemalis	Dark-eyed Junco
Sturnella neglecta	Western Meadowlark
Agelaius phoeniceus	Red-winged Blackbird
Euphagus cyanocephalus	Brewer's Blackbird
Carpodacus mexicanus	House Finch
Carduelis psaltria	Lesser Goldfinch
Carduelis tristis	American Goldfinch
AMPHIBIANS	
Taricha torosa	California newt

Scientific name	Common name
Taricha granulosa	Rough-skinned Newt
Dicamptodon ensatus	California Giant Salamander
Batrachoseps attenuatus	California Slender Salamander
Aneides lugubris	Arboreal Salamander
Ensatina eschscholtzii	Ensatina
Bufo [=Anaxyrus] boreas	Western [=Boreal] Toad
Rana aurora draytonii	California Red-legged Frog
Hyla [=Pseudacris] regilla	Pacific Tree [=Chorus] Frog
REPTILES	
Sceloporus occidentalis	Western Fence Lizard
Eumeces skiltonianus	Western Skink
Elgaria multicarinata	Southern Alligator Lizard
Cnemidophorus tigris	Western Whiptail (lizard)
Pituophis catenifer	Gopher Snake
Lampropeltis getula	California Kingsnake
Thamnophis elegans	Western Terrestrial Garter Snake
Diadophis punctatus	Ringneck Snake
Crotalus viridis	Western Rattlesnake
FISHES	
Gambusia affinis	Mosquitofish
Gasterosteus aculeatus Linnaeus	Three-spined Stickleback
Catostomus occidentalis	Sacramento Sucker
Onchorynchus mykiss	Rainbow Trout
INVERTEBRATES	
Papilio rutulus	western tiger swallowtail (butterfly)
Papilio zelicaon	anise swallowtail (butterfly - yellow form)
Anthocharis sara	Sara orangetip (butterfly)
Glaucopsyche lygadmus	silvery blue (butterfly)
Plebejus acmon	acmon blue (butterfly)
Euphydryas chalcedona	variable checkerspot (butterfly)
Phyciodes mylitta	mylitta crescent (butterfly)
Vanessa atalanta	red admiral (butterfly)
Vanessa cardui	painted lady (butterfly)
Junonia coenia	common buckeye (butterfly)
Limenitis lorquini	Lorquin's admiral (butterfly)
Coenonympha tullia	common ringlet (butterfly)
Hyalophora euryalus	ceanothus silk moth

PLANTS

Family	Scientific name	Common name
Aceraceae	*Acer macrophyllum*	Big leaf maple
Aceraceae	*Acer negundo*	box elder
Aceraceae	*Acer saccharinum*	silver maple
Amaranthaceae	*Amaranthus albus*	pigweed amaranth
Amygdalaceae	*Oemleria cerasiformis*	Indian plum
Anacardiaceae	*Toxicodendron diversilobum*	poison oak
Anarcadiaceae	*Rhus trilobata*	skunk brush
Anarcadiaceae	*Schinus molle*	Peruvian pepper tree

Family	Scientific name	Common name
Apiaceae	*Anthriscus caucalis*	bur chervil
Apiaceae	*Conium maculatum*	poison hemlock
Apiaceae	*Foeniculum vulgare*	sweet fennel
Apiaceae	*Osmorhiza chilensis*	sweet cicely
Apiaceae	*Sanicula crassicaulis*	Pacific sanicle
Apiaceae	*Scandix pecten-veneris*	Venus' needle
Apiaceae	*Torilis arvensis*	hedge parsley
Apocynaceae	*Nerium oleander (Horticultural)*	oleander
Apocynaceae	*Vinca major*	periwinkle
Araliaceae	*Aralia californica*	bear clover
Araliaceae	*Hedera helix*	English ivy
Aristolochiaceae	*Asarum caudatum*	wild ginger
Asteraceae	*Achillea millefolium*	common yarrow
Asteraceae	*Achyrachaena mollis*	blow wives
Asteraceae	*Adenocaulon bicolor*	trailfinder
Asteraceae	*Anaphalis margaritaceae*	pearly everlasting
Asteraceae	*Artemisia californica*	California sagebrush
Asteraceae	*Artemisia douglasiana*	California mugwort
Asteraceae	*Artemisia dracunculus*	tarragon
Asteraceae	*Aster radulensis*	rough-leaved aster
Asteraceae	*Baccharis pilularis*	coyote brush
Asteraceae	*Carduus pycnocephalus*	Italian thistle
Asteraceae	*Centaurea calcitrapa*	purple star thistle
Asteraceae	*Centaurea melitensis*	tocalote
Asteraceae	*Centaurea solstitialis*	yellow star thistle
Asteraceae	*Cichorium intybus*	chickory
Asteraceae	*Cirsium arvense*	canada thistle
Asteraceae	*Cirsium occidentale*	cobweb thistle
Asteraceae	*Cirsium vulgare*	bull thistle
Asteraceae	*Conyza canadensis*	horseweed
Asteraceae	*Dittrichia graveolens*	stinkwort
Asteraceae	*Eriophyllum confertiflorum*	golden yarrow
Asteraceae	*Eriophyllum lanatum*	woolly sunflower
Asteraceae	*Filago gallica*	Filago
Asteraceae	*Gnaphalium californicum*	California cudweed
Asteraceae	*Gnaphalium canescens ssp beneolens*	cudweed
Asteraceae	*Gnaphalium luteo-album*	everlasting cudweed
Asteraceae	*Grindelia camporum*	Great Valley gumweed
Asteraceae	*Heterotheca grandiflora*	telegraphweed
Asteraceae	*Hieracium albiflorum*	white hawkweed
Asteraceae	*Hypochaeris glabra*	smooth catsear
Asteraceae	*Hypochaeris radicata*	rough catsear
Asteraceae	*Lactuca serriola*	prickly wild lettuce
Asteraceae	*Lactuca virosa*	bitter lettuce
Asteraceae	*Lagophylla ramosissima ssp. ramosissima*	common hareleaf
Asteraceae	*Madia elegans*	common madia
Asteraceae	*Madia exigua*	meager tarweed

Family	Scientific name	Common name
Asteraceae	*Madia sativa*	coast tarweed
Asteraceae	*Picris echioides*	bristly ox-tongue
Asteraceae	*Senecio vulgare*	common groundsel
Asteraceae	*Silybum marianum*	milk thistle
Asteraceae	*Sonchus asper*	prickly sow thistle
Asteraceae	*Sonchus oleraceus*	common sow thistle
Asteraceae	*Stylocline gnaphaloides*	everlasting nest straw
Asteraceae	*Uropappus lindleyi*	silver puffs
Asteraceae	*Wyethia glabra*	smooth mule ears
Asteraceae	*Wyethia helenioides*	whitehead mule ears
Asteraceae	*Xanthium strumarium*	cocklebur
Berberidaceae	*Berberis pinnata ssp pinnata*	California barberry
Betulaceae	*Alnus rhombifolia*	white alder
Blechnaceae	*Woodwardia fimbriata*	giant chain fern
Boraginaceae	*Amsinckia menziesii*	fiddle neck
Boraginaceae	*Amsinckia tessellata*	fiddle neck
Boraginaceae	*Cryptantha clevlandii*	common cryptantha
Boraginaceae	*Cynoglossum grande*	hound's tongue
Boraginaceae	*Heliotropium curassavicum*	heliotrpoe
Boraginaceae	*Plagiobothrys nothofulvus*	rusty popcornflower
Brachytheciaceae	*Homalothecium pinnatifidum*	pinnatifid homalothecium moss
Brassicaceae	*Brassica nigra*	black mustard
Brassicaceae	*Brassica rapa*	wild mustard
Brassicaceae	*Capsella bursa-pastoris*	shepherd's purse
Brassicaceae	*Cardamine oligosperma*	bitter cress
Brassicaceae	*Lepidium latipes*	dwarf pepperweed
Brassicaceae	*Nasturtium officinale*	water cress
Brassicaceae	*Raphanus sativus*	wild radish
Brassicaceae	*Rapistrum rugosum*	wild turnip*
Brassicaceae	*Sinapis arvensis*	charlock mustard
Brassicaceae	*Streptanthus glandulosus ssp. glandulosus*	bristly jewelflower
Bryaceae	*Bryum* sp.	bryum moss
Caprifoliaceae	*Lonicera hispidula var vacillans*	California honeysuckle
Caprifoliaceae	*Lonicera interrupta*	chaparral honeysuckle
Caprifoliaceae	*Sambucus mexicana*	blue elderberry
Caprifoliaceae	*Symphoricarpos albus*	snowberry
Caprifoliaceae	*Symphoricarpos mollis*	creeping snowberry
Caryophyllaceae	*Cerastium arvense*	field chickweed
Caryophyllaceae	*Cerastium glomeratum*	sticky chickweed
Caryophyllaceae	*Stellaria media*	common chickweed
Chenopodiaceae	*Salsola soda*	alkali russian thistle
Convolvulaceae	*Calystegia sp*	morning glory
Convolvulaceae	*Convolvulus arvensis*	field bindweed
Cornaceae	*Cornus nutalii*	dogwood
Cornaceae	*Cornus sericea ssp. occidentalis*	western creek dogwood
Corylaceae	*Corylus cornuta var. californica*	California hazel

Family	Scientific name	Common name
Crassulaceae	*Dudleya cymosa ssp. cymosa*	canyon live forever
Crassulaceae	*Sedum spathulifoium*	Pacific stonecrop
Cucurbitaceae	*Marah fabaceus*	california manroot
Cupressaceae	*Calocedrus decurrens*	incense cedar
Cupressaceae	*Cupressus sempervirens (Horticultural)*	Italian cypress
Cyperaceae	*Cyperus eragrostis*	tall flat-sedge
Cyperaceae	*Eleocharis macrostachya*	common spikerush
Cyperaceae	*Schoenoplectus acutus*	common three square
Cyperaceae	*Schoenoplectus americanus*	chairmaker's bulrush
Dennstaedtiaceae	*Pteridium aquilinum*	bracken fern
Dryopteridaceae	*Athyrium filix-femina var. cyclosorum*	lady fern
Dryopteridaceae	*Dryopteris arguta*	coast wood fern
Equisetaceae	*Equisetum arvense*	common horsetail
Equisetaceae	*Equisetum telmateia ssp. Braunii*	giant horsetail
Ericaceae	*Arbutus menziesii*	Pacific madrone
Ericaceae	*Arctostaphylos glandulosa*	Eastwood manzanita
Ericaceae	*Arctostaphylos glauca*	big berry manzanita
Ericaceae	*Arctostaphylos tomentosa ssp. crustacea*	brittleleaf manzanita
Ericaceae	*Arctostaphylos viscida*	white-leaf manzanita
Euphorbiaceae	*Croton setigerus*	turkey mullein
Fabaceae	*Cytisus scoparius*	Scotch broom
Fabaceae	*Lathyrus tingitanus*	Tangier pea
Fabaceae	*Lathyrus vestitus var. vestitus*	wild pea
Fabaceae	*Lotus corniculatus*	birdfoot deervetch
Fabaceae	*Lotus humistratus*	short podded trefoil
Fabaceae	*Lotus purshianus var. purshianus*	Spanish clover
Fabaceae	*Lotus scoparius*	deerweed
Fabaceae	*Lotus wrangelianus*	Chilean trefoil
Fabaceae	*Lupinus albifrons var. albifrons*	silver bush lupine
Fabaceae	*Lupinus bicolor*	miniature lupine
Fabaceae	*Lupinus microcarpus var. densiflorus*	chick lupine
Fabaceae	*Lupinus nanus*	sky lupine
Fabaceae	*Lupinus succulentus*	succulent lupine
Fabaceae	*Medicago polymorpha*	bur clover
Fabaceae	*Medicago sativa*	alfalfa
Fabaceae	*Melilotus indicus*	annual sweetclover
Fabaceae	*Pickeringia montana*	Chaparral pea
Fabaceae	*Rupertia physodes*	California tea
Fabaceae	*Trifolium dubium*	shamrock
Fabaceae	*Trifolium hirtum*	rose clover
Fabaceae	*Trifolium incarnatum*	crimson clover
Fabaceae	*Trifolium wildenovii*	tomcat clover
Fabaceae	*Vicia cracca*	bird vetch
Fabaceae	*Vicia sativa*	spring vetch
Fabaceae	*Vicia sativa ssp sativa*	common vetch
Fabaceae	*Vicia villosa*	hairy vetch
Fagaceae	*Lithocarpus densiflorus*	tanoak

Family	Scientific name	Common name
Fagaceae	*Quercus agrifolia*	coast live oak
Fagaceae	*Quercus berberidifolia*	scrub oak
Fagaceae	*Quercus chrysolepis*	canyon live oak
Fagaceae	*Quercus douglasii*	blue oak
Fagaceae	*Quercus durata*	leather oak
Fagaceae	*Quercus wislizenii*	interior live oak
Fagaceae	*Quercus wislizenii* var. *frutescens*	bush interior live oak
Fissidentaceae	*Fissidens limbatus*	fissidens moss
Garryaceae	*Garrya elliptica*	coast silk tassel
Gentianaceae	*Centaurium muehlenbergii*	Muehlenbeg's centaury
Geraniaceae	*Erodium botrys*	broadleaf filaree
Geraniaceae	*Erodium cicutarium*	redstem filaree
Geraniaceae	*Geranium dissectum*	cutleaf geranium
Geraniaceae	*Geranium molle*	dovefoot geranium
Grossulariaceae	*Ribes californicum*	hillside gooseberry
Grossulariaceae	*Ribes malvaceum*	chaparral currant
Grossulariaceae	*Ribes sanguineum*	flowering red currant
Hippocastanaceae	*Aesculus californica*	California buckeye
Hydrophyllaceae	*Eriodictyon californicum*	yerba santa
Hydrophyllaceae	*Nemophila heterophylla*	canyon nemophila
Hydrophyllaceae	*Nemophila menziesii*	baby blue eyes
Hydrophyllaceae	*Nemophila parviflora*	smallflower nemophila
Hydrophyllaceae	*Phacelia campanularia*	desert bells
Hydrophyllaceae	*Phacelia cicutaria*	caterpillar phacelia
Hypericaceae	*Hypericum calycinum*	Aaron's beard
Iridaceae	*Iris douglasiana*	Doulgas' iris
Iridaceae	*Iris fernaldii*	Fernald's iris
Iridaceae	*Sisyrinchium bellum*	blue-eyed grass
Juglandaceae	*Juglans californica var hindsii*	Northern California black walnut
Juglandaceae	*Juglans regia (horticultural)*	English walnut
Juncaceae	*Juncus effusus*	common rush
Juncaceae	*Juncus patens*	spreading rush
Juncaceae	*Juncus xiphioides*	irisleaf rush
Juncaceae	*Luzula comosa*	woodland rush
Lamiaceae	*Lepechinia calycina*	white pitcher sage
Lamiaceae	*Monardella villosa ssp. villosa*	coyote mint
Lamiaceae	*Nepeta cataria*	catnip
Lamiaceae	*Pogogyne seraphylloides*	thyme leaf mesamint
Lamiaceae	*Salvia columbariae*	chia
Lamiaceae	*Salvia leucophylla*	purple sage
Lamiaceae	*Salvia mellifera*	black sage
Lamiaceae	*Satureja douglasii*	yerba buena
Lamiaceae	*Scutellaria tuberosa*	blue skullcap
Lamiaceae	*Stachys albens*	cobwebby hedge nettle
Lamiaceae	*Stachys bullata*	California hedgenettle
Lamiaceae	*Stachys pycnantha*	short spike hedge nettle

Family	Scientific name	Common name
Lauraceae	*Umbellularia californica*	California bay
Lemnaceae	*Lemna sp*	pondweed
Liliaceae	*Brodiaea elegans*	harvest brodiaea
Liliaceae	*Calochortus albus*	white fairy lantern
Liliaceae	*Calochortus luteus*	yellow mariposa lily
Liliaceae	*Calochortus superbus*	superb mariposa lily
Liliaceae	*Calochortus venustus*	butterfly Mariposa lily
Liliaceae	*Chlorogalum pomeridianum*	soap plant
Liliaceae	*Dichlostemma capitatum*	blue dicks
Liliaceae	*Disporum hookeri*	drops of gold
Liliaceae	*Disporum smithii*	coast fairy bells
Liliaceae	*Fritillaria affinis*	checker lily
Liliaceae	*Lilium pardalinum*	tiger lily
Liliaceae	*Smilacina racemosa*	large false Solomon's seal
Liliaceae	*Smilacina stellata*	little false solomon's seal
Liliaceae	*Trillium chloropetalum*	common trillium
Liliaceae	*Triteleia laxa*	Ithuriel's spear
Liliaceae	*Veratrum californicum var californicum*	corn lily
Liliaceae	*Zigadenus fremontii*	death camas
Liliaceae	*Zigadenus venenosus var venenosus*	death camas
Linaceae	*Linum grandiflorum*	flowering flax
Lythraceae	*Lythrum hyssopifolium*	Hyssop's loosestrife
Malvaceae	*Malacothamnus fasciculatus*	chaparral bushmallow
Malvaceae	*Malacothamnus fremontii*	fremont's bushmallow
Malvaceae	*Malva parviflora*	cheeseweed
Mniaceae	*Leucolepis acanthoneuron*	leucolepis umbrella moss
Myricaceae	*Myrica californica*	California wax myrtle
Myrtaceae	*Eucalyptus camaldulensis*	red gum
Myrtaceae	*Eucalyptus globulus*	blue gum
Neckeraceae	*Neckera douglasii*	Douglas neckera
Nyctaginaceae	*Mirabilis californica*	California four o'clock
Oleaceae	*Olea europa (horticultural)*	European olive
Onagraceae	*Camissonia ovata*	sun cup
Onagraceae	*Clarkia concinna ssp. automixa*	Santa Clara red ribbons
Onagraceae	*Clarkia purpurea ssp. quadrivulnera*	winecup clarkia
Onagraceae	*Clarkia unguiculata*	woodland clarkia
Onagraceae	*Epilobium brachycarpum*	annual fireweed
Onagraceae	*Epilobium canum*	California fuschia
Onagraceae	*Epilobium ciliatum var. ciliatum*	fringed willowherb
Orchidaceae	*Corallorhiza striata*	striped coralroot
Orchidaceae	*Epipactis helleborine*	helloborine
Orchidaceae	*Piperia elegans*	elegant rein orchid
Orobanchaceae	*Orobanche bulbosa*	chaparral broomrape
Orobanchaceae	*Orobanche fasciculata*	clustered broomrape
Papaveraceae	*Eschscholzia californica*	California poppy

Family	Scientific name	Common name
Papaveraceae	*Stylomecon heterophylla*	wind poppy
Pinaceae	*Cedrus deodara*	Deodar cedar
Pinaceae	*Pinus contorta*	lodgepole pine
Pinaceae	*Pinus pinea*	Italian stone pine
Pinaceae	*Pinus sabiniana*	grey pine
Pinaceae	*Pseudotsuga menziesii*	Douglas-fir
Plantaginaceae	*Plantago erecta*	California plantain
Plantaginaceae	*Plantago lanceolata*	English plantain
Plantaginaceae	*Plantago major*	common plantain
Platanaceae	*Platanus racemosa*	western sycamore
Poaceae	*Aira caryophylla*	silver hairgrass
Poaceae	*Arrhenatherum eliatus*	tall oatgrass
Poaceae	*Avena barbata*	slender wild oats
Poaceae	*Avena fatua*	common wild oats
Poaceae	*Brachypodium distachyon*	false brome
Poaceae	*Briza minor*	little quaking grass
Poaceae	*Bromus carinatus*	California brome
Poaceae	*Bromus catharticus*	rescue grass
Poaceae	*Bromus diandrus*	ripgut brome
Poaceae	*Bromus hordeaceus*	soft chess
Poaceae	*Bromus japonicus*	Japanese brome
Poaceae	*Bromus madritensis ssp. rubens*	foxtail brome
Poaceae	*Bromus sterilis*	poverty brome
Poaceae	*Bromus vulgaris*	Columbia brome
Poaceae	*Cortaderia selloana*	pampas grass
Poaceae	*Cynodon dactylon*	bermuda grass
Poaceae	*Cynosurus echinatus*	hedgehog dogtail grass
Poaceae	*Dactylis glomerata*	orchard grass
Poaceae	*Elymus glaucus*	blue wildrye
Poaceae	*Elymus multisetas*	big squirreltail grass
Poaceae	*Festuca arundinacea*	tall fescue
Poaceae	*Festuca occidentalis*	western fescue
Poaceae	*Festuca rubra*	red fescue
Poaceae	*Gastridium ventricosum*	nit grass
Poaceae	*Hordeum marinum ssp gussoneanum*	Mediterranean barley
Poaceae	*Hordeum murinum ssp. leporinum*	foxtail barley
Poaceae	*Leymus triticoides*	creeping wild rye
Poaceae	*Lolium multiflorum*	Italian ryegrass
Poaceae	*Melica californica*	California melic grass
Poaceae	*Melica imperfecta*	small flowered melica
Poaceae	*Nassella lepida*	small flowered needlegrass
Poaceae	*Nassella pulchra*	purple needle grass
Poaceae	*Panicum capillare*	witchgrass
Poaceae	*Phalaris aquatica*	Harding grass
Poaceae	*Phalaris californica*	California canarygrass
Poaceae	*Piptatherum miliaceum*	smilograss

Family	**Scientific name**	**Common name**
Poaceae	*Poa annua*	annual bluegrass
Poaceae	*Polypogon monspeliensis*	rabbitsfoot grass
Poaceae	*Taeniantherum caput-medusae*	Medusa-head grass
Poaceae	*Vulpia microstachys*	three-weeks fescue
Poaceae	*Vulpia myuros*	rattail fescue
Polemoniaceae	*Eriastrum abramsii*	Abram's woollystar
Polemoniaceae	*Navarretia heterodoxa*	Calistoga pincushion plant
Polemoniaceae	*Navarretia squarrosa*	skunkbush
Polygonaceae	*Eriogonum fasciculatum*	california buckwheat
Polygonaceae	*Eriogonum giganteum var. giganteum* (planted)	Santa Catalina Island buckwheat
Polygonaceae	*Eriogonum nudum*	naked buckwheat
Polygonaceae	*Polygonum arenastrum*	common knotweed
Polygonaceae	*Rumex conglomeratus*	clustered dock
Polygonaceae	*Rumex crispus*	curly dock
Polygonaceae	*Rumex pulcher*	fiddle dock
Polypodiaceae	*Polypodium californicum*	California polypody
Portulacaceae	*Calandrinia ciliata*	red maids
Portulacaceae	*Claytonia parviflora*	miner's lettuce
Portulacaceae	*Claytonia perfoliata*	miner's lettuce
Portulacaceae	*Claytonia siberica*	candyflower
Primulaceae	*Anagallis arvensis*	scarlet pimpernell
Primulaceae	*Trientalis latifolia*	star-flower
Pteridaceae	*Adiantum aleuticum*	five-finger fern
Pteridaceae	*Adiantum jordanii*	California maiden-hair fern
Pteridaceae	*Pellaea andromedifolia*	coffee fern
Pteridaceae	*Pentagramma triangularis*	gold back fern
Ranunculaceae	*Actaea rubra*	baneberry
Ranunculaceae	*Aquilegia formosa*	western columbine
Ranunculaceae	*Clematis lasiantha*	chaparral clematis
Ranunculaceae	*Delphinium californicum ssp. californicum*	coast larkspur
Ranunculaceae	*Delphinium nudicale*	red larkspur
Ranunculaceae	*Ranunculus californicus*	common buttercup
Ranunculaceae	*Ranunculus canus*	Great Valley buttercup
Ranunculaceae	*Thalictrum fendleri var fendleri*	Fendler's meadow rue
Rhamnaceae	*Ceanothus cuneatus*	buckbrush
Rhamnaceae	*Ceanothus integerrimus*	deer brush
Rhamnaceae	*Ceanothus leucodermis*	chaparral whitethorn
Rhamnaceae	*Ceanothus oliganthus*	hairy ceanothus
Rhamnaceae	*Rhamnus californicus*	coffeeberry
Rhamnaceae	*Rhamnus crocea*	redberry
Rhamnaceae	*Rhamnus tomentella*	hoary coffeeberry
Rosaceae	*Adenostema fasciculatum*	chamise
Rosaceae	*Cercocarpus betuloides*	birch-leaf mountain mahogany

Family	Scientific name	Common name
Rosaceae	*Fragaria vesca*	woodland strawberry
Rosaceae	*Heteromeles arbutifolia*	toyon
Rosaceae	*Holodiscus discolor*	Ocean spray
Rosaceae	*Physocarpus capitatus*	Pacific ninebark
Rosaceae	*Prunus emarginata*	bitter cherry
Rosaceae	*Prunus ilicifolius*	holly-leaf cherry
Rosaceae	*Rosa californica*	wild rose
Rosaceae	*Rosa gymnocarpa*	wood rose
Rosaceae	*Rubus discolor*	western raspberry
Rosaceae	*Rubus parviflorus*	western thimbleberry
Rosaceae	*Rubus ursinus*	California blackberry
Rosaceae	*Sanguisorba minor ssp. muricata*	small burnet
Rubiaceae	*Galium aparine*	common bedstraw
Rubiaceae	*Galium porrigens*	climbing bedstraw
Rubiaceae	*Galium tricornutum*	rough bedstraw
Salicaceae	*Populus balsamifera ssp. trichocarpa*	black cottonwood
Salicaceae	*Populus fremontii*	Fremont's cottonwood
Salicaceae	*Salix babylonica*	weeping willow
Salicaceae	*Salix gooddingii*	Gooding's black willow
Salicaceae	*Salix laevigata*	red willow
Salicaceae	*Salix lasiolepis*	arroyo willow
Salicaceae	*Salix lucida ssp. lasiandra*	shining willow
Saxifragaceae	*Lithophragma heterophylla*	hillside woodland star
Scophulariaceae	*Pedicularis densiflorus*	Indian warrior
Scrophulariaceae	*Antirrhinum kellogii*	Kellogg's snapdragon
Scrophulariaceae	*Castilleja affinis*	indian paintbrush
Scrophulariaceae	*Castilleja densiflora ssp. densiflora*	dense owl's clover
Scrophulariaceae	*Castilleja exserta*	purple owl's clover
Scrophulariaceae	*Castilleja foliolosa*	woolly paintbrush
Scrophulariaceae	*Collinsia heterophylla*	Chinese houses
Scrophulariaceae	*Cordylanthus rigidus ssp. rigidus*	rigid bird's beak
Scrophulariaceae	*Keckiella cordifolia*	climbing penstemon
Scrophulariaceae	*Kickxia elatine*	sharp leaved fluellin
Scrophulariaceae	*Linaria maroccana*	Moroccan toad flax
Scrophulariaceae	*Mimulus aurantiacus*	bush monkey flower
Scrophulariaceae	*Mimulus cardinalis*	cardinal monkey flower
Scrophulariaceae	*Mimulus guttatus*	seep monkey flower
Scrophulariaceae	*Penstemon centranthifolius*	scarlet bugler
Scrophulariaceae	*Penstemon heterophyllus ssp. heterophyllus*	foothill penstemon
Scrophulariaceae	*Scrophularia californica*	beeplant
Scrophulariaceae	*Veronica anagallis-aquatica*	water speedwell
Scrophulariaceae	*Veronica persica*	speedwell
Solanaceae	*Datura stramonium*	jimson weed
Solanaceae	*Solanum elaeagifolium*	silverleaf nightshade
Solanaceae	*Solanum umbelliferum*	blue witch nightshade
Sterculiaceae	*Fremontodendron californica*	flannel-bush

Family	Scientific name	Common name
Taxaceae	*Torreya californica*	California nutmeg
Taxodiaceae	*Sequoia sempervirens*	redwood
Thymelaeaceae	*Dirca occidentalis*	western leatherwood
Typhaceae	*Typha angustifolia*	narrow-leafed cattail
Urticaceae	*Urtica dioica*	stinging nettle
Verbenaceae	*Verbena lasiostachys*	common vervain
Violaceae	*Viola ocellata*	twoeyed violet
Lichens		
Parmeliaceae	*Evernia prunastri*	oakmoss
Parmeliaceae	*Hypogymnia* sp.	tube lichen
Parmeliaceae	*Parmelia* sp.	none
Parmeliaceae	*Platismatia* sp.	ragbag
Parmeliaceae	*Usnea rubicunda*	red beard lichen
Ramalinaceae	*Ramalina menziesii*	lace lichen

APPENDIX C. Representative Site Photographs

Top: Overview of North Quarry

Bottom: Revegetated slope, WMSA

Photographs taken May 13, 2008

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Top: Chaparral and oak woodland habitats northwest of the North Quarry
Bottom: Oak woodland habitat east of the North Quarry

Photographs taken Sept. 28, 2006, July 11, 2008

wra
ENVIRONMENTAL CONSULTANTS

Top: Settling pond
Bottom: Active Quarry, North Quarry

Photographs taken Sept. 28, 2006

wra ENVIRONMENTAL CONSULTANTS

Top: Step pools in Permanente Creek, upstream (west) of the Project Area

Bottom: Permanente Creek in the western portion of the Permanente Property

Photographs taken May 15, 2008 and Sept. 28, 2006

WRA ENVIRONMENTAL CONSULTANTS

APPENDIX D. CRLF Survey Results and Habitat Assessment

Jennings 2006A

RANA RESOURCES
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RanaResources@aol.com

#12,312b
November 26, 2006

Dr. Robert Terry Huffman
The Huffman-Broadway Group, Inc.
828 Mission Avenue
San Rafael, CA 94901-3209

Dear Terry:

This letter is my monitoring report regarding sediment removal in Pond #13A, 13B, and 17 on the Hanson Permanente Cement Plant. I served as the biological monitor for California red-legged frogs (*Rana draytonii*) while sediment was removed from Pond #13B on 26, 27, 30 October, Pond #13A on 30 October, and Pond #17 on 01, 02, and 03 November 2006. I conducted pre-construction surveys during the day on 24 and 25 October and at night on 23 and 24 October. I also provided a training session with the workers on 24 October. No California red-legged frogs were observed in the areas adjacent to the three sediment ponds during the monitoring period and thus no frogs were injured or harmed. Equipment problems resulted in only partial removal of sediment in pond #13A and #13B. Sediment was completely removed from Pond #17.

Please let me know if you have any questions on the above. Thanks again for allowing me to be involved with this project.

Sincerely,

Mark R. Jennings

Mark R. Jennings
President and
Herpetologist/Fisheries Biologist

Jennings 2006B

2006 CALIFORNIA RED-LEGGED FROG (*Rana draytonii*) SURVEYS AT THE HANSON PERMANENTE CEMENT FACILITY, CUPERTINO, CALIFORNIA

Prepared by:

Mark R. Jennings
Rana Resources
P.O. Box 2185
Davis, CA 95617-2185

For

Terry Huffman
The Huffman-Broadway Group, Inc.
828 Mission Avenue
San Rafael, CA 94901-3209

December 30, 2006

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EXECUTIVE SUMMARY

Protocol surveys were conducted for California red-legged frogs (CRLFs; *Rana draytonii*) on 21 February; 25 March; 02, 11, and 29 April; 06 May; 31 July; and 08 August 2006, at the Hanson Permanente Cement Facility in the vicinity of Cupertino, California, to determine the use of in-stream and off-stream sediment settling ponds by this species. As with previous surveys of the facility grounds, CRLFs were found to not only inhabit Permanente Creek, but they also inhabited Pond #13, 14, 21, and 22. No CRLFs were found in Pond #04A, 04B, 04C, 05, 09, 10, 11, 13A, 13B, 16, 17, 18, 19, and 20. Instead, Pacific treefrogs (*Hyla regilla*) were found to inhabit and breed in all ponds examined, as well as many of the watercourses between the sediment ponds. Additionally, Coast Range newts (*Taricha torosa torosa*) were found to breed in Pond #13, and 14, as well as Permanente Creek. CRLFs were observed to successfully breed only in Pond #14 and 21 as well as the watercourse downstream of Pond #20. These data indicate that CRLFs continue to live and reproduce on the Hanson Permanente Cement Facility property in harmony with current operations. The proposed removal of sediment from Pond #13A, 13B, and 17—where CRLFs were not observed—will have no adverse effects on the CRLF population inhabiting this part of the Permanente Creek drainage.

INTRODUCTION

The Hanson Permanente Cement Facility is located in Santa Clara County, in the vicinity of Cupertino, California (Figure 1). The facility surrounds the lower reaches of the Permanente Creek drainage with 18 current settling ponds installed to remove suspended sediments from the water that is drained from quarry and other facility operations. The resulting water from the sediment ponds runs through rock filters before being discharged into Permanente Creek (except for pond 14, which is a standard retention basin that allows all sediments to settle prior to water flowing through a weir and joining Permanente Creek). Because certain settling ponds need to be cleaned out from time to time in order to keep them functional, protocol surveys were conducted to during 2006 determine if they were being used by the federally threatened California red-legged frog (CRLF; *Rana draytonii*). These surveys follow previous surveys conducted for the

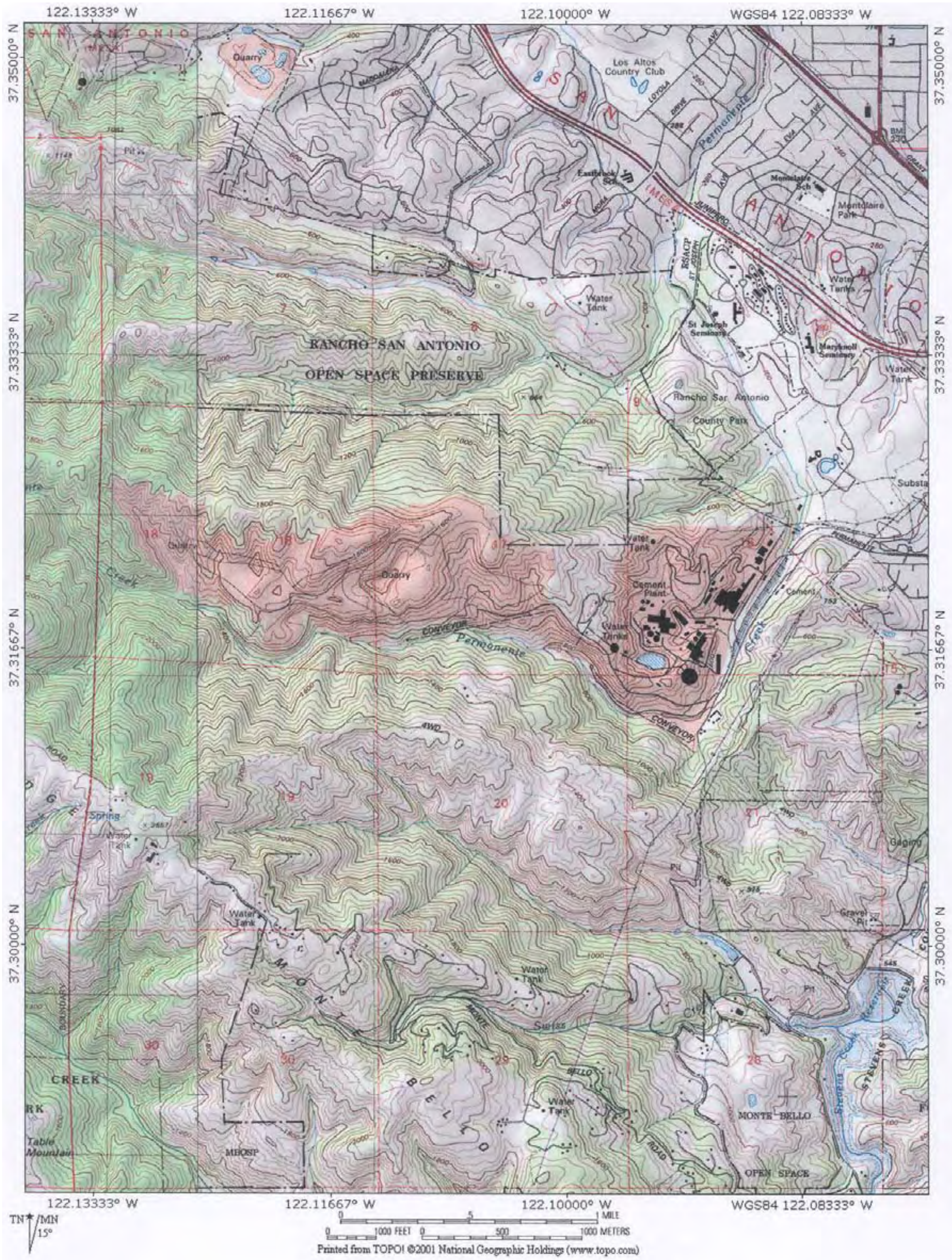

Figure 1. Location of the Hanson Permanente Cement Facility.

species during 2005. Per recent taxonomic changes with frog species in California, I follow Jennings (2004) and Shaffer et al. (2004) and use the scientific name "*Rana draytonii*" for the CRLF. In almost all other documents and field guides, this frog is stated as the subspecies "*Rana aurora draytonii*" (e.g., see Stebbins 2003).

STUDY AREA

The Hanson Permanente Cement Facility is an approximately 3,650-acre piece of land that lies just southwest of the intersection of I-280 and Hwy 85 in Santa Clara County (Figure 1). The facility is along the lower reaches of Permanente Creek and contains various buildings, rock crushers, storage yards, sand and rock quarries, paved roads, railroad tracks, and aggregate conveyors located over a wide area. A total of 18 settling ponds are used to remove excess sediment from water received from facility and quarry operations. The resulting water in these settling ponds is discharged into Permanente Creek (Figure 2). These settling ponds also have vegetation present and are used by a wide variety of wildlife including Coast Range newts (*Taricha torosa torosa*), Pacific treefrogs (*Hyla regilla*), California toads (*Bufo boreas halophilus*), and CRLF (Jennings, pers. observ.). The surrounding hillsides and flats have mixed oak (*Quercus* spp.) woodlands, with scattered chaparral and other vegetation. The settling ponds contain cattails (*Typha* sp.) and bulrushes (*Scirpus* sp.), as well as scattered patches of willows (*Salix* sp.) and Himalayan blackberries (*Rubus discolor*). Willows and Himalayan blackberries are common along the main Permanente Creek channel.

MATERIALS AND METHODS

The surveys for the CRLF followed guidelines as set forth by the U.S. Fish and Wildlife Service (U.S. Fish and Wildlife Service 2005). All settling ponds were surveyed during daylight hours on 21 February, 25 March, 06 May, and 31 July 2006, and at night on 25 March; 02, 11, and 29 April; and 08 August 2006. Surveys were conducted as per protocol survey standards for the CRLF (U.S. Fish and Wildlife Service 2005) and my long-term experience with this species (e.g., see Jennings and Hayes 1994). A flashlight

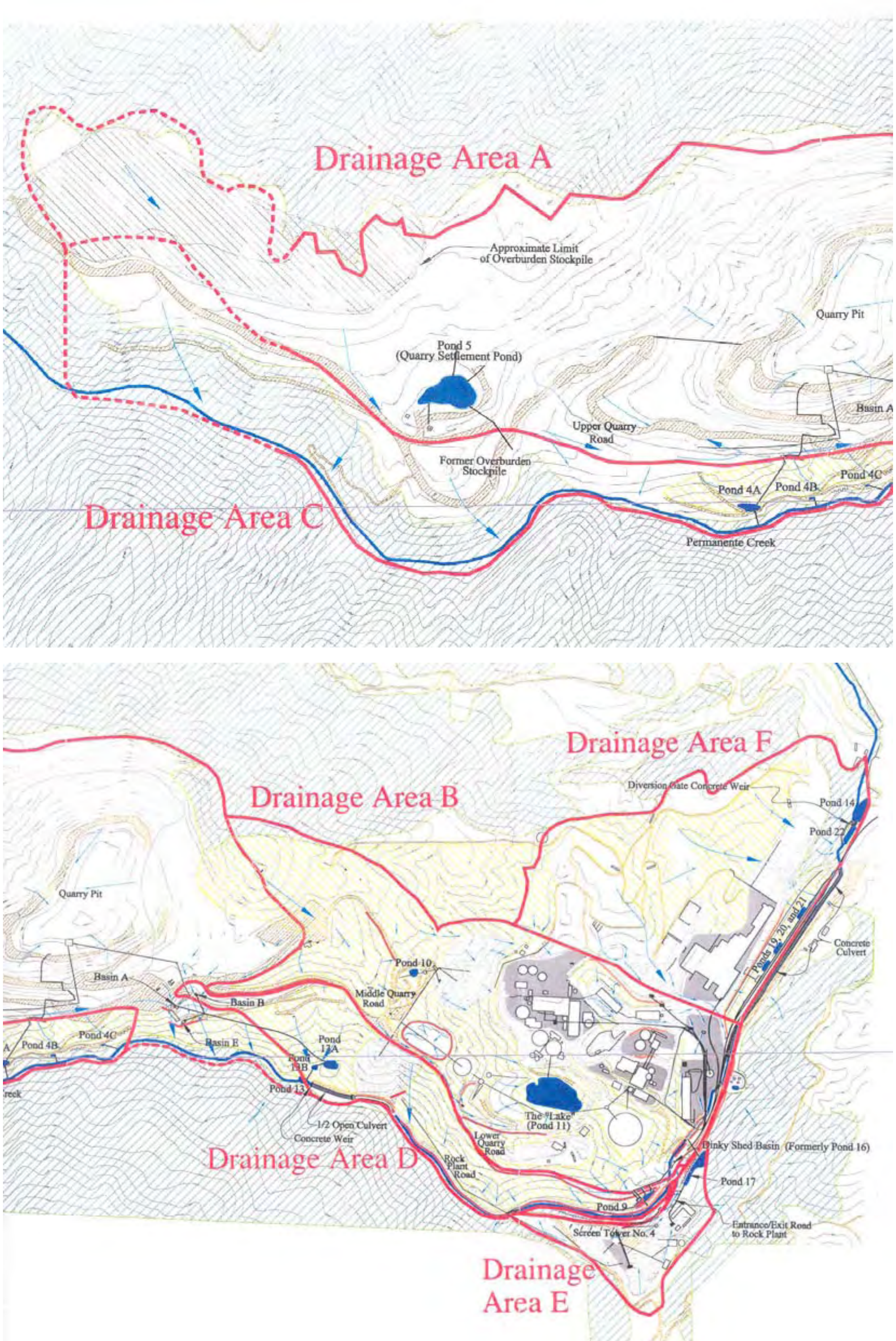

Figure 2. Location of settling ponds on the Hanson Permanente Cement Facility grounds. The top and bottom maps represent the western and eastern portions of the property.

was used to locate the eye shines of frogs during nighttime hours and I repeatedly listened for calling male CRLFs using the identifications provided by Davidson (1995).

RESULTS AND DISCUSSION

CRLFs were found only in Permanente Creek and Pond #13, 14, 21, and 22. No CRLFs were found in Pond #04A, 04B, 04C, 05, 09, 10, 11, 13A, 13B, 16, 17, 18, 19, and 20. Instead, Pacific treefrogs were found to inhabit and breed in all ponds examined, as well as many of the watercourses between the sediment ponds. Additionally, Coast Range newts were found to breed in Pond #13, and 14, as well as Permanente Creek. CRLFs were observed to successfully breed only in Pond #14 and 21 as well as the watercourse downstream of Pond #20. Each of these locations was found to have calling male CRLFs, as well as larvae and metamorphs.

The reason that CRLFs are probably not found in more of the settling ponds is due to the shallow nature of most of these water bodies. They are designed to trap sediment and this quickly results in water depths below 1 foot in depth (or drying completely on a regular basis). The resulting mud flats or cattail thickets were found to contain numerous raccoon (*Procyon lotor*) footprints and I observed raccoons almost every time during my nighttime surveys. The presence of so many CRLF predators on a regular basis probably mediates against juvenile or adult CRLFs dispersing into these shallow water habitats.

Additionally, a number of these sediment ponds are isolated from where CRLFs are known to be present. The long distance movement of CRLFs overland is probably very hazardous with all the natural predators present within the facility grounds.

In summary, these data indicate that CRLFs continue to live and reproduce on the Hanson Permanente Cement Facility property in harmony with current operations. Because CRLFs do not use Pond #13A, 13B, and 17, the proposed removal of sediment from these settling ponds have no adverse effects on the CRLF population inhabiting this part of the Permanente Creek drainage.

LITERATURE CITED

Davidson, C. 1995. Frog and toad calls of the Pacific Coast. Library of Natural Sounds, Cornell Laboratory of Ornithology, Ithaca, New York. 27 pages + 1 cassette.

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Jennings 2007

2007 CALIFORNIA RED-LEGGED FROG (*Rana draytonii*) SURVEYS AT THE HANSON PERMANENTE CEMENT FACILITY, CUPERTINO, CALIFORNIA

Prepared by:

Mark R. Jennings
Rana Resources
P.O. Box 2185
Davis, CA 95617-2185

For

Terry Huffman
The Huffman-Broadway Group, Inc.
828 Mission Avenue
San Rafael, CA 94901-3209

August 06, 2007

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EXECUTIVE SUMMARY

Protocol surveys were conducted for California red-legged frogs (CRLFs; *Rana draytonii*) on 30 March; 06, 13, and 22 April; 05, and 12 May; 07 July; and 04 August 2007, at the Hanson Permanente Cement Facility in the vicinity of Cupertino, California, to determine the use of in-stream and off-stream sediment settling ponds by this species. As with previous surveys of the facility grounds, CRLFs were found to not only inhabit Permanente Creek, but they also inhabited Pond #13, 14, 21, and 22. No CRLFs were found in Pond #04A, 04B, 04C, 05, 09, 10, 11, 13A, 13B (dry by July), 16, 17 (dry by July), 18, 19, and 20. Instead, Pacific treefrogs (*Hyla regilla*) were found to inhabit and breed in all ponds examined, as well as many of the watercourses between the sediment ponds. Additionally, Coast Range newts (*Taricha torosa torosa*) were found to breed in Pond #13, 14, and 22, as well as Permanente Creek. CRLFs were observed to successfully breed only in Pond #14 and 21 as well as the watercourse downstream of Pond #20. These data indicate that CRLFs continue to live and reproduce on the Hanson Permanente Cement Facility property in harmony with current operations. The proposed removal of sediment from Pond #13A (dry since July), 13B, and 17 (dry since July)—where CRLFs were not observed—will have no adverse effects on the CRLF population inhabiting this part of the Permanente Creek drainage.

INTRODUCTION

The Hanson Permanente Cement Facility is located in Santa Clara County, in the vicinity of Cupertino, California (Figure 1). The facility surrounds the lower reaches of the Permanente Creek drainage with 18 current settling ponds installed to remove suspended sediments from the water that is drained from quarry and other facility operations. The resulting water from the sediment ponds runs through rock filters before being discharged into Permanente Creek (except for pond 14, which is a standard retention basin that allows all sediments to settle prior to water flowing through a weir and joining Permanente Creek). Because certain settling ponds need to be cleaned out from time to time in order to keep them functional, protocol surveys were conducted to during 2007

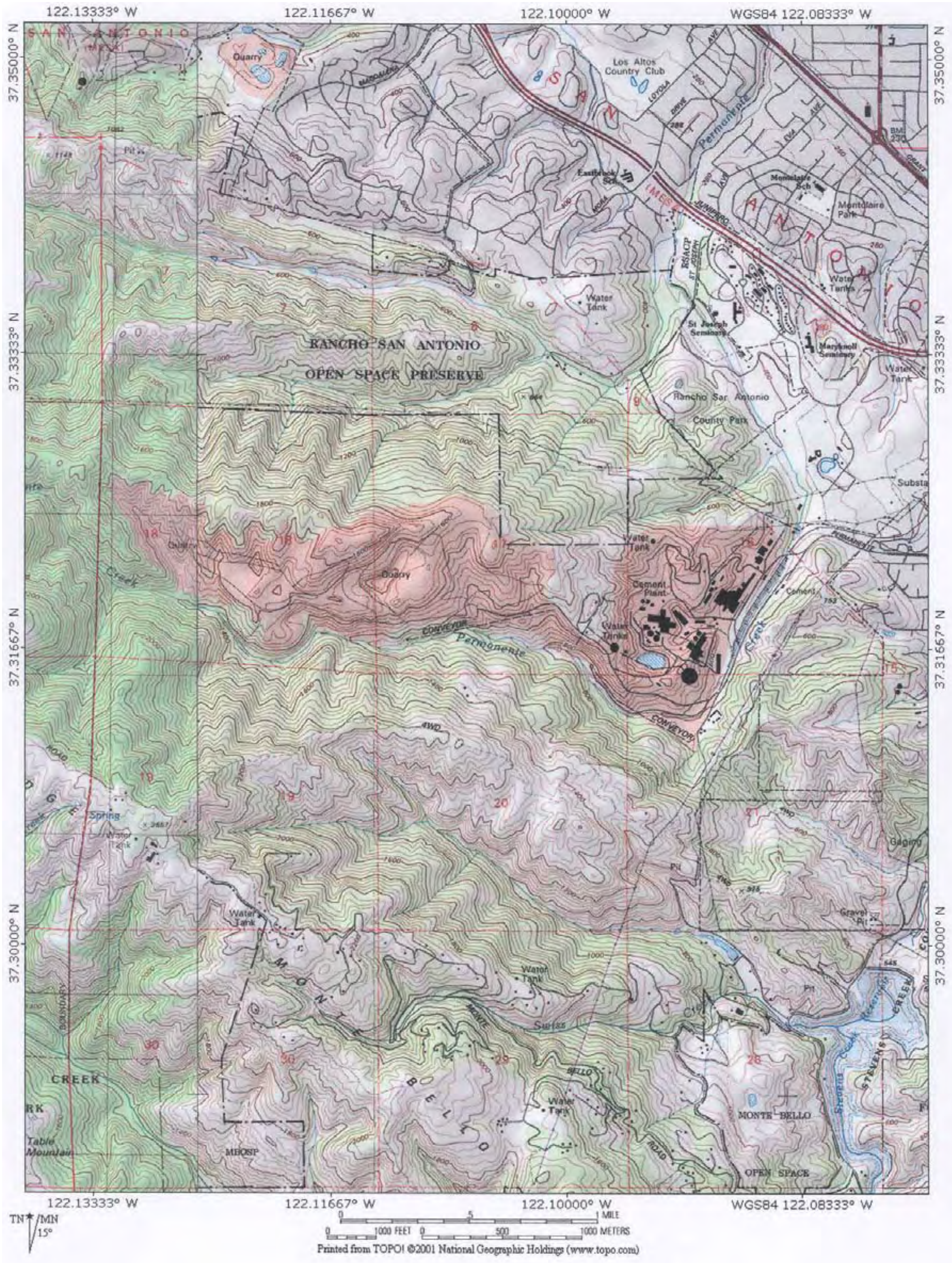


Figure 1. Location of the Hanson Permanente Cement Facility.

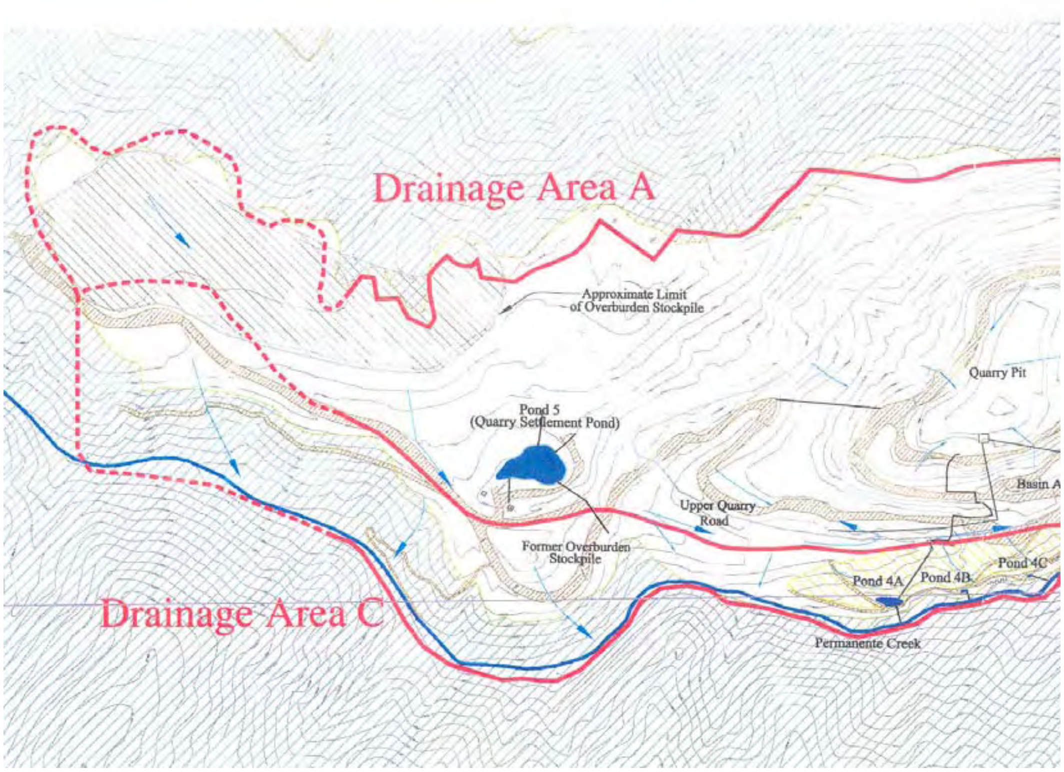
determine if they were being used by the federally threatened California red-legged frog (CRLF; *Rana draytonii*). These surveys follow previous protocol surveys conducted for the species during 2006 (Jennings 2007). Per recent taxonomic changes with frog species in California, I follow Jennings (2004) and Shaffer et al. (2004) and use the scientific name "*Rana draytonii*" for the CRLF. In almost all other documents and field guides, this frog is stated as the subspecies "*Rana aurora draytonii*" (e.g., see Stebbins 2003).

STUDY AREA

The Hanson Permanente Cement Facility is an approximately 3,650-acre piece of land that lies just southwest of the intersection of I-280 and Hwy 85 in Santa Clara County (Figure 1). The facility is along the lower reaches of Permanente Creek and contains various buildings, rock crushers, storage yards, sand and rock quarries, paved roads, railroad tracks, and aggregate conveyors located over a wide area. A total of 18 settling ponds are used to remove excess sediment from water received from facility and quarry operations. The resulting water in these settling ponds is discharged into Permanente Creek (Figure 2). These settling ponds also have vegetation present and are used by a wide variety of wildlife including Coast Range newts (*Taricha torosa torosa*), Pacific treefrogs (*Hyla regilla*), California toads (*Bufo boreas halophilus*), and CRLF (Jennings, pers. observ.). The surrounding hillsides and flats have mixed oak (*Quercus* spp.) woodlands, with scattered chaparral and other vegetation. The settling ponds contain cattails (*Typha* sp.) and bulrushes (*Scirpus* sp.), as well as scattered patches of willows (*Salix* sp.) and Himalayan blackberries (*Rubus discolor*). Willows and Himalayan blackberries are common along the main Permanente Creek channel.

MATERIALS AND METHODS

The surveys for the CRLF followed guidelines as set forth by the U.S. Fish and Wildlife Service (U.S. Fish and Wildlife Service 2005). All settling ponds were surveyed during daylight hours on 30 March, 22 April, and 22 July 2007, and at night on 06 and 13 April; 05, and 12 May; and 04 August 2007. Surveys were conducted as per protocol survey



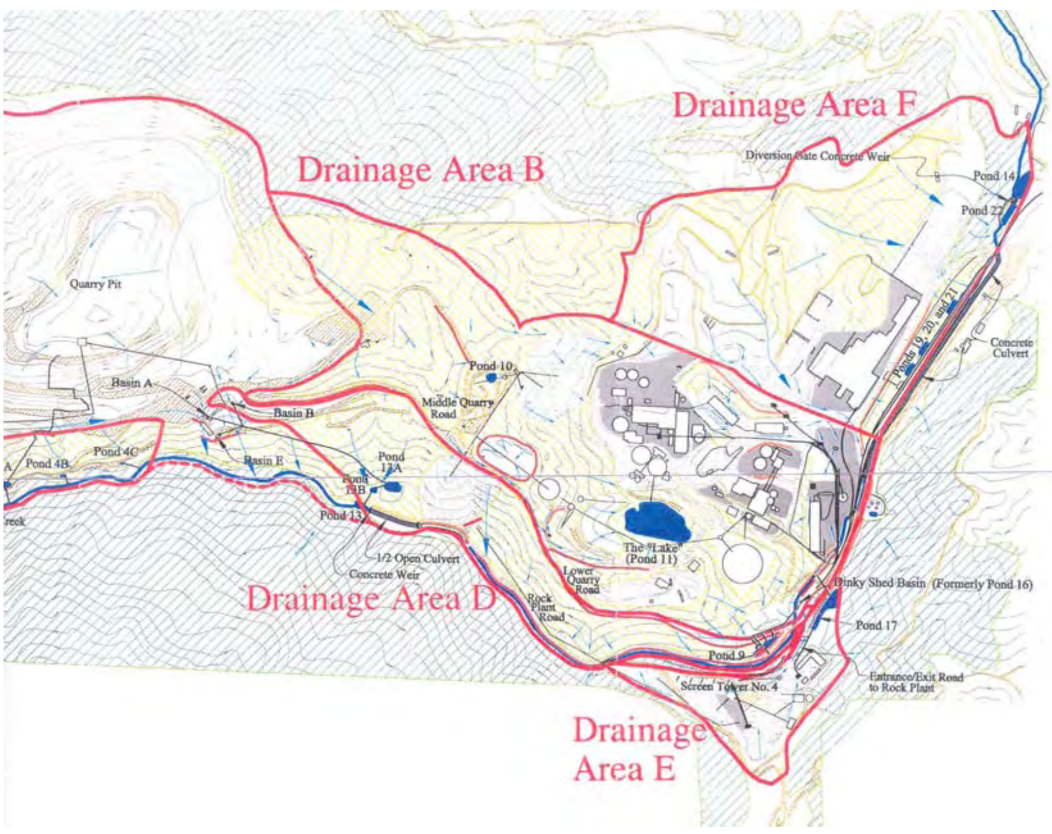


Figure 2. Location of settling ponds on the Hanson Permanente Cement Facility grounds. The top and bottom maps represent the western and eastern portions of the property.

standards for the CRLF (U.S. Fish and Wildlife Service 2005) and my long-term experience with this species (e.g., see Jennings and Hayes 1994). A flashlight was used to locate the eye shines of frogs during nighttime hours and I repeatedly listened for calling male CRLFs using the identifications provided by Davidson (1995).

RESULTS AND DISCUSSION

CRLFs were found only in Permanente Creek and Pond #13, 14, 21, and 22. No CRLFs were found in Pond #04A, 04B, 04C, 05, 09, 10, 11, 13A, 13B (dry by July), 16, 17 (dry by July), 18, 19, and 20. Instead, Pacific treefrogs were found to inhabit and breed in all ponds examined, as well as many of the watercourses between the sediment ponds. Additionally, Coast Range newts were found to breed in Pond #13, 14 and 22, as well as Permanente Creek. CRLFs were observed to successfully breed only in Pond #14 and 21 as well as the watercourse downstream of Pond #20. Each of these locations was found to have calling male CRLFs, as well as larvae and metamorphs.

The reason that CRLFs are probably not found in more of the settling ponds is due to the shallow nature of most of these water bodies. They are designed to trap sediment and this quickly results in water depths below 1 foot in depth (or drying completely on a regular basis as occurred with Pond #13B and 17). The resulting mud flats or cattail thickets were found to contain numerous raccoon (*Procyon lotor*) footprints and I observed raccoons almost every time during my nighttime surveys. The presence of so many CRLF predators on a regular basis probably mediates against juvenile or adult CRLFs dispersing into these shallow water habitats.

Additionally, a number of these sediment ponds are isolated from where CRLFs are known to be present. The long distance movement of CRLFs overland is probably very hazardous with all the natural predators present within the facility grounds.

In summary, these data indicate that CRLFs continue to live and reproduce on the Hanson Permanente Cement Facility property in harmony with current operations.

Because CRLFs do not use Pond #13A, 13B, and 17, the proposed removal of sediment from these settling ponds have no adverse effects on the CRLF population inhabiting this part of the Permanente Creek drainage.

LITERATURE CITED

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U.S. Fish and Wildlife Service. 2005. Revised guidance on site assessments and field surveys for the California red-legged frog [dated August, 2005]. 26 p. (typewritten).

Jennings 2008A

RANA RESOURCES
P.O. 2185
Davis, CA 95617-2185

(530) 753-2727
RanaResources@aol.com

#13,712b
August 21, 2008

Mr. Robert Perrera
Huffman-Broadway Group, Inc.
828 Mission Avenue
San Rafael, CA 94901

Dear Robert:

Per your request, I surveyed for California red-legged frogs (CRLF; *Rana draytonii*) at night on 30 July 2008 in the various sedimentation basins (Ponds), aquatic habitats, and in Permanente Creek proper at the Hanson Permanente Cement Facility near Cupertino.

I conducted one night survey following the current guidance outlined in the U.S. Fish and Wildlife Service *Revised Guidance on Site Assessments and Field Surveys for the California Red-legged Frog* dated August 2005. I examined all aquatic habitats and found CRLFs to be present in Pond #22 (where 2 adults were observed) and Pond #14 (where 12 adults were observed).

Ponds #13A, #13B, and #16 were observed to be dry, while Ponds #19 #20, and #21 contained very low levels of water due to the drought and lateness of the summer. Suitable riparian habitat, cover and living conditions for CRLF were present at Ponds #4a, #13, #19, #20 and #21 and along Permanente Creek.

Pond #9 and Pond #17 were found to contain many Coast Range newts (*Taricha torosa torosa*), despite the large amount of sediment present in both of these water bodies. Newts were also common in Pond #4a and #13, and in Permanente Creek proper. I did not observe any CRLFs or California toads (*Bufo boreas halophilus*) in Pond #9 or Pond #17. Presumably I would have observed them had they been present due to the relative lack of riparian vegetation at both locations and good visibility.

Pond #11 was found to contain water, but the lack of riparian vegetative cover around the edge and the poor water quality precludes the presence of CRLFs and other amphibians.

Pacific treefrogs (*Hyla regilla*) were common residents at all the aquatic habitats (except for Pond #11) that contained water. Since it was late in the season, I did not hear the Pacific treefrogs breeding calls but I did find their larvae. Additionally, I observed several raccoons (*Procyon lotor*) on the property at night and observed one foraging near the Facility entrance in broad daylight.

In closing, CRLFs are generally found at locations where they have been observed during past surveys in 2006 and 2007 and that they have not colonized other Ponds or aquatic habitats. Therefore, proposed sediment removal in settling ponds 9, 13A, 13B and 17 should be able to proceed without any harm to the resident CRLF population as long as adequate biological monitoring and educational measures are taken.

Please let me know if you have any questions or need additional information.

Sincerely,

Mark R. Jennings
President and
Herpetologist/Fisheries Biologist

Jennings 2008B

RANA RESOURCES
P.O. 2185
Davis, CA 95617-2185

(530) 753-2727
RanaResources@aol.com

#13,726
August 31, 2008

Dr. Robert Terry Huffman
The Huffman-Broadway Group, Inc.
828 Mission Avenue
San Rafael, CA 94901-3209

Dear Terry:

This letter is my monitoring report regarding sediment removal in Pond #9, #13A, #13B, and #17 on the Hanson Permanente Cement Facility grounds. You, Robert Perrera, Tom Yocum, and I served as a team of biological monitors for California red-legged frogs (*Rana draytonii*) while sediment was continually removed from Ponds on 20 and 21 December 2007 by Top Grade Construction crews working around the clock. You, Tom, and I conducted pre-construction surveys during the night of 19 December 2007. I also provided a training session with the two major crews of workers on 20 December 2007 and bilingual brochures on California red-legged frogs were given to each individual worker. No California red-legged frogs were observed in the areas adjacent to the four sediment ponds during the monitoring period and thus no frogs were injured or harmed.

Please let me know if you have any questions on the above. Thanks again for allowing me to be involved with this project.

Sincerely,

Mark R. Jennings
President and
Herpetologist/Fisheries Biologist

Jennings 2008C

RANA RESOURCES
P.O. 2185
Davis, CA 95617-2185

(530) 753-2727
RanaResources@aol.com

#13,830
October 28, 2008

Dr. Robert Terry Huffman
The Huffman-Broadway Group, Inc.
828 Mission Avenue
San Rafael, CA 94901-3209

Dear Dr. Huffman:

This letter represents the 2008 monitoring report regarding sediment removal in Pond #9, #13A, #13B, and #17 on the Hanson Permanente Cement Facility grounds. I oversaw the removal of sediment from the ponds during 06-10, 13-17, and 25 October 2008 in the capacity as a biological monitor to minimize construction impacts to California red-legged frogs (*Rana draytonii*). The sediment was removed by Mark Coulter of Coulter Gradall, Inc., who worked from just after sun up to around 6:00 PM each day. A pre-construction survey was conducted by me during the night of 05 October 2008. I also provided a training session with the Gradall operator, the dump truck operators (for Hanson Permanente), and the Environmental Manager and Rock Plant Foreman (for Hanson Permanente). Bilingual brochures on California red-legged frogs were given to each individual in the training session. No California red-legged frogs were observed in the areas adjacent to the four sediment ponds during the monitoring period and thus no frogs were injured or harmed.

Please let me know if you have any questions on the above. Thanks again for allowing me to be involved with this project.

Sincerely,

Mark R. Jennings

Mark R. Jennings
President and
Herpetologist/Fisheries Biologist

INSERVICE PRESENTATIONS GIVEN AT
~~THE AVALON PROJECT SITE~~ Hanson Permanente Cement Facility

Date: 10/06/08

Biological Monitor: Mark R. Jennings

Name	Date	Company
1). Mark Munoz	10-6-08	Lehigh
2). Mark Coulter	10-6-08	~~Le~~ Coulter Grading
3). Juan Villa	10-6-08	LEHIGH
4). Scott Renfrew	10/6/08	LEHIGH
5).		
6).		
7).		
8).		
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Jennings 2009A

RANA RESOURCES
P.O. Box 2185
Davis, CA 95617-2185

RanaResources@aol.com

#14,428a
August 25, 2009

Mr. Robert Perrera
The Huffman-Broadway Group, Inc.
828 Mission Avenue
San Rafael, CA 94901

Dear Robert:

This letter is my summary of our California red-legged frog (*Rana draytonii*; CRLF) preconstruction surveys and CRLF training to construction personnel on the Hanson 3 Project. Night preconstruction surveys were conducted by me on Ponds 4, 9, and 17 during the evening of 09 August 2009 after it became dark. Day preconstruction surveys were conducted by Robert Perrera of The Huffman-Broadway Group, at the same ponds during the morning of 10 August 2009. Additionally, CRLF training was given to the construction crew (see the attached signature sheet) by Robert Perrera and the field supervisor (Scott Renfrew) on 10 August 2009 and an educational brochure containing color photographs of CRLF and a description of their habitat were given to each individual attending this meeting. No CRLFs were observed in or around the ponds during preconstruction surveys and, according to the field supervisor, no CRLFs were observed during Pond maintenance activities.

Thanks again for allowing me to be involved with this project. Please feel free to contact me if you have any questions regarding the above.

Sincerely,

Mark

Mark R. Jennings
President & Herpetologist/Fisheries Biologist

Jennings 2009B

ATTORNEY CLIENT PRIVEDGED

RANA RESOURCES
P.O. Box 2185
Davis, CA 95617-2185

RanaResources@aol.com

#14,596
November 22, 2009

Mr. Robert Perrera
The Huffman-Broadway Group, Inc.
828 Mission Avenue
San Rafael, CA 94901

Dear Robert:

This letter is my summary of my California red-legged frog (*Rana draytonii*; CRLF) preconstruction surveys, CRLF training to Campanella Construction personnel, and biological monitoring of sediment removal on Pond #13 on the Hanson 3 Project. As prescribed in our protocol, day and night preconstruction surveys for CRLF were conducted by me on both 15 and 16 November 2009. Surveys were conducted during the afternoon (between 3:00 PM and 4:00 PM) and after it became dark (between 9:00 PM and 10:00 PM). No frogs or other amphibians (except Coast Range newts (*Taricha torosa*)) were observed, although the weather conditions of 45°F-54°F (air temperature), partly cloudy-clear sky, and no moon present, were suitable for CRLF to be active.

On the morning of 17 November 2009 at 7:00 AM, CRLF training was given to the construction crew of 2 individuals from Campanella Construction by me and an educational brochure containing color photographs of CRLF and a description of their habitat were given to each individual attending this meeting. Subsequently, we then proceeded to Pond #13 where I supervised the removal of red alder (*Alnus rubra*) and willow (*Salix* sp.) trees <3 inches BH and the lopping of trees larger than this diameter within the boundary of the project site where sediment was to be removed. These trees were growing around the edge of the pond and had to be either removed or topped to a height of approximately 5 feet in order to allow the removal of sediment from the pond by mechanical equipment. We were also able to leave 6 large alder trees intact and most of a large willow tree intact within the project site. During the removal and topping of the trees, I also monitored the removal of sediment and cattails (*Typha* sp.) by Mark Coulter in a Gradall until 2:30 PM on 17 November and 6:00 AM-2:00 PM on18 November 2009. Gary Deghi of The Huffman-Broadway Group, Inc., continued the monitoring of sediment removal from 6:00 AM-5:00 PM on 19 November 2009 when the work was completed. No CRLFs were observed during the removal of vegetation or sediment, although I did rescue one adult Coast Range newt from the project site on 18 November. The newt was immediately released (unharmed) upstream of the sediment removal activities.

Thus, no CRLF were observed during this operation and the sediment was successfully removed from Pond #13. The tree branches and trees that were cut and piled next to the entrance road to the pond will be removed sometime next week before they start decomposing and providing potential future cover for any wildlife species.

Thanks again for allowing me to be involved with this project. Please feel free to contact me if you have any questions regarding the above.

Sincerely,

Mark R. Jennings

Mark R. Jennings
President & Herpetologist/Fisheries Biologist

Jennings 2010

HABITAT ASSESSMENT FOR THE CALIFORNIA RED-LEGGED FROG (*Rana draytonii*), ON PORTIONS OF PERMANENTE CREEK AND MONTE BELLO CREEK, SANTA CLARA COUNTY, CALIFORNIA

Prepared by:

Mark R. Jennings
Rana Resources
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Davis, CA 95617-2185

For

WRA, Inc.
2169-G East Francisco Blvd.
San Rafael, CA 94901

February 14, 2010

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Appendices

EXECUTIVE SUMMARY

A habitat assessment was conducted for the California red-legged frog (CRLF; *Rana draytonii*) on 28 January and 10 February 2009 on a portion of Permanente Creek (above Pond 4A between PASR 9-10), a small intermittent pond [= "Ridge-Top Pond"] on the hillside southwest of the Rock Plant, and the upper reaches of Monte Bello Creek (MASR 4 to the property boundary) on a part of Lehigh Southwest Cement Company's approximately 3,510-acre Permanente Quarry Property ("Quarry Property"), in the vicinity of Cupertino, California, to determine if the species was potentially present or could utilize this area. The results of the habitat assessment are as follows:

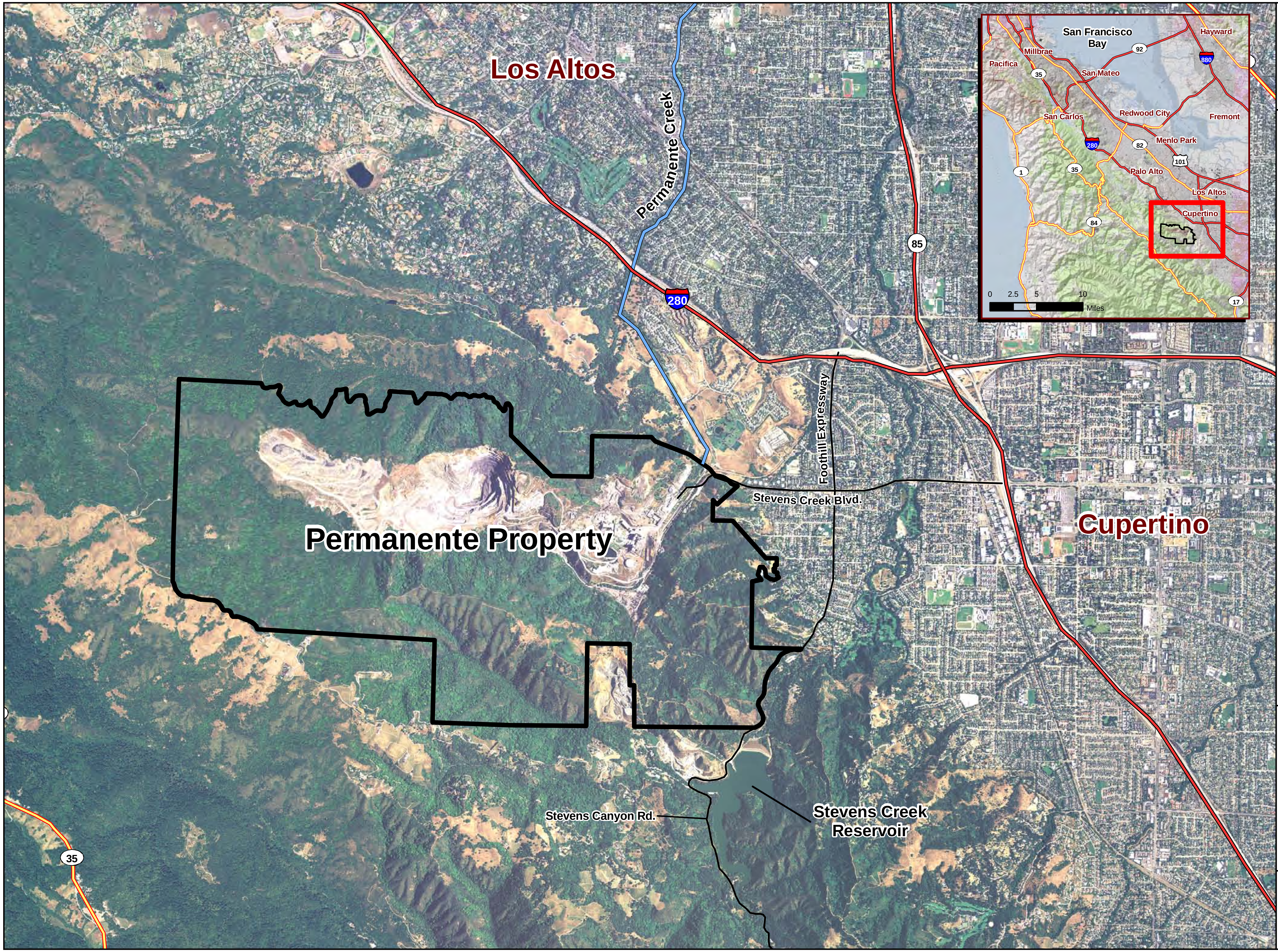
- Examination of Permanente Creek between PASR 9 and 10 indicates that the area is much too ephemeral (i.e.: holds water less than 3 months out of the year) to support suitable habitat for CRLF. Although there is a known population of CRLF in Permanente Creek near the entrance of the Quarry Property (i.e.: in Pond 14 and adjacent aquatic areas that are located within and adjacent to PASR 1), there is no evidence that CRLF have inhabited any of the other stream or pond habitats upstream of this location within the Permanente Creek system. This appears to be due to the intermittent nature of many of the aquatic habitats present and the presence of a large number of raccoons (*Procyon lotor*) on the Quarry Property.
- Examination of Ridge-Top Pond southwest of the Rock Plant reveals that this feature is too ephemeral (even during above average years of rainfall) to support suitable aquatic habitat for CRLF. It is also effectively isolated by terrain and distance from known CRLF habitats on the Quarry Property.
- Examination of Monte Bello Creek within the Quarry Property showed that the aquatic habitat is marginal for CRLF due to the pools on the stream being 2-feet deep or less. However, biologists from WRA, Inc., recently observed a CRLF within this stream, about 850 meters upstream from the property line on 07 May 2009; thus confirming the presence of this species in the drainage. There is no evidence to show that CRLF move between the known population locations in the Permanente Creek system and parts of Monte Bello Creek due to the steepness of the terrain, long distances between aquatic habitats, the ephemeral nature of the

intervening creeks and ponds, and other overland barriers which would preclude potential overland movement between the two drainage systems.

INTRODUCTION

The Lehigh Southwest Cement Company's Permanente Quarry Property (Quarry Property) is located in Santa Clara County, in the vicinity of Cupertino, California (Figure 1). The Quarry Property surrounds the upper portion of Permanente Creek drainage between PASR 1 and PASR 15 with 18 current settling ponds installed both instream and in upland areas to remove suspended sediments from the water drained from the quarry pit and other quarry operations. The resulting water enters the sediment ponds before being discharged into Permanente Creek. The instream ponds (Ponds 12, 14, and 22 [Figure 2a]) allow sediments to settle prior to water flowing over concrete weirs at the downstream end of these features. These instream ponds are in various states of functionality. Pond 14 is a large open water pond with a wetland fringe dominated by cattails (*Typha* sp.) and bulrushes (*Scirpus* sp.) and other emergent vegetation. Pond 22 has been filled to capacity with sediment and is dominated by emergent vegetation within the interior and riparian vegetation along the exterior banks. Pond 13 currently has a partial, but reduced state of functionality due to the accumulation of sediment.

Previous studies have documented the presence of a breeding population of the California red-legged frog (CRLF; *Rana draytonii*) on the part of Permanente Creek near the entrance of the facility (i.e.: in Pond 14 and adjacent aquatic areas that are located below PASR 2) (Figure 2a; Jennings 2006, 2007). However, no CRLF have been observed during previous yearly protocol surveys of ponds on the Quarry Property and other aquatic habitats upstream of PASR 1 to PASR 15 (Jennings 2006) and PASR 1 to PASR 10 (Jennings 2007). The following habitat assessment of three separate aquatic habitats was conducted to determine potential suitability for CRLF in support of the Biological Resources Assessment conducted by WRA (2010). These locations include a portion of the upper part of Permanente Creek above Pond 4 between PASR 9-10 (Figure 2b), a small intermittent pond [=Ridge-Top Pond] on the hillside southwest of the Rock Plant



WRA ENVIRONMENTAL CONSULTANTS

Lehigh Permanente Quarry
Santa Clara County, CA

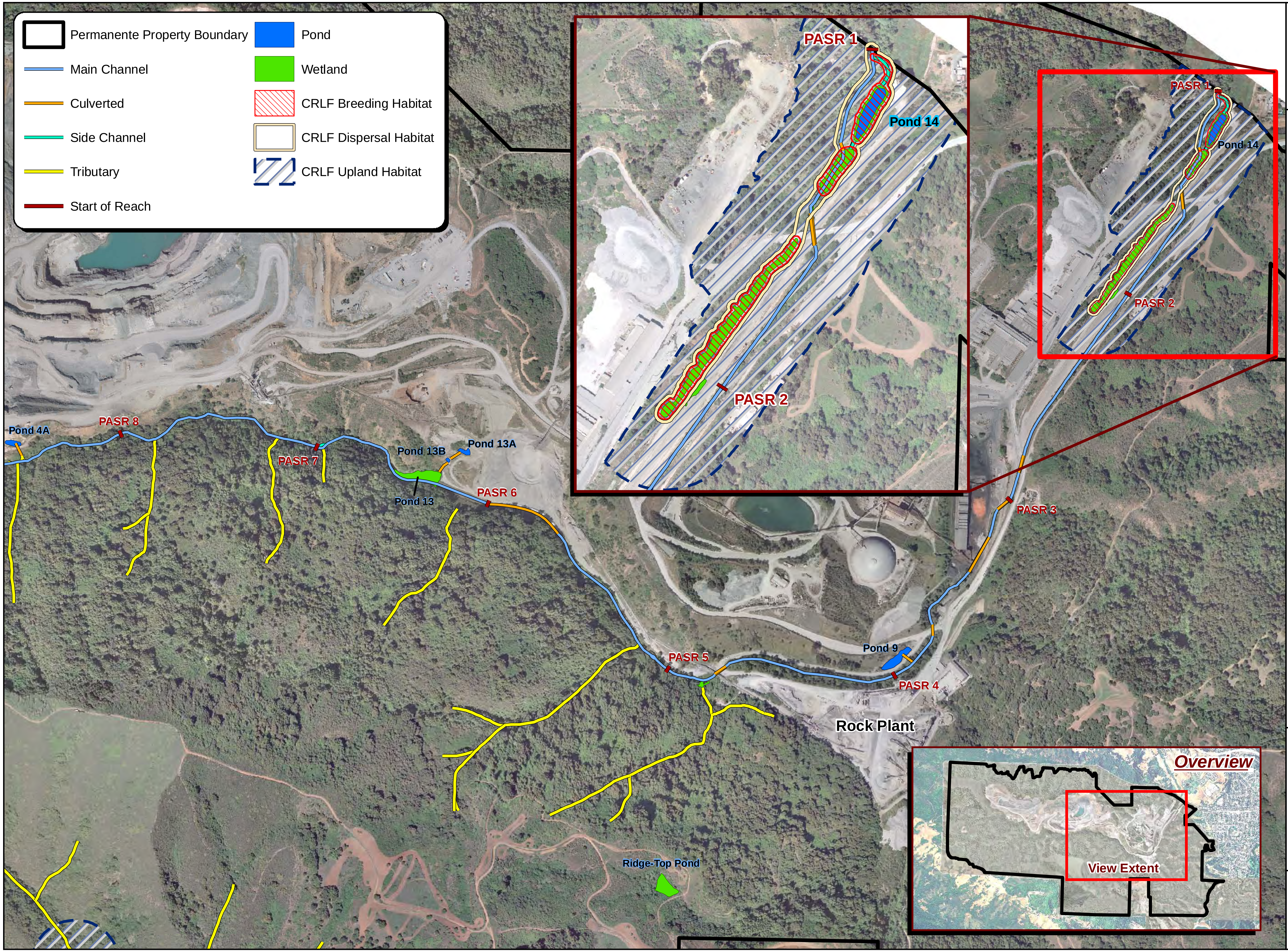
Figure 1.

Permanente Property
Location Map

N
W E
S

0 0.25 0.5 1
Miles

Date: May 2010
Map By: Michael Rochelle
Image: 2005 NAIP
Filepath: I:\Acad2000\16000\16143\gis\Arcmap\Delineation\Property Wide\Location.mxd



ENVIRONMENTAL CONSULTANTS

Lehigh Permanente Quarry
Santa Clara County, California

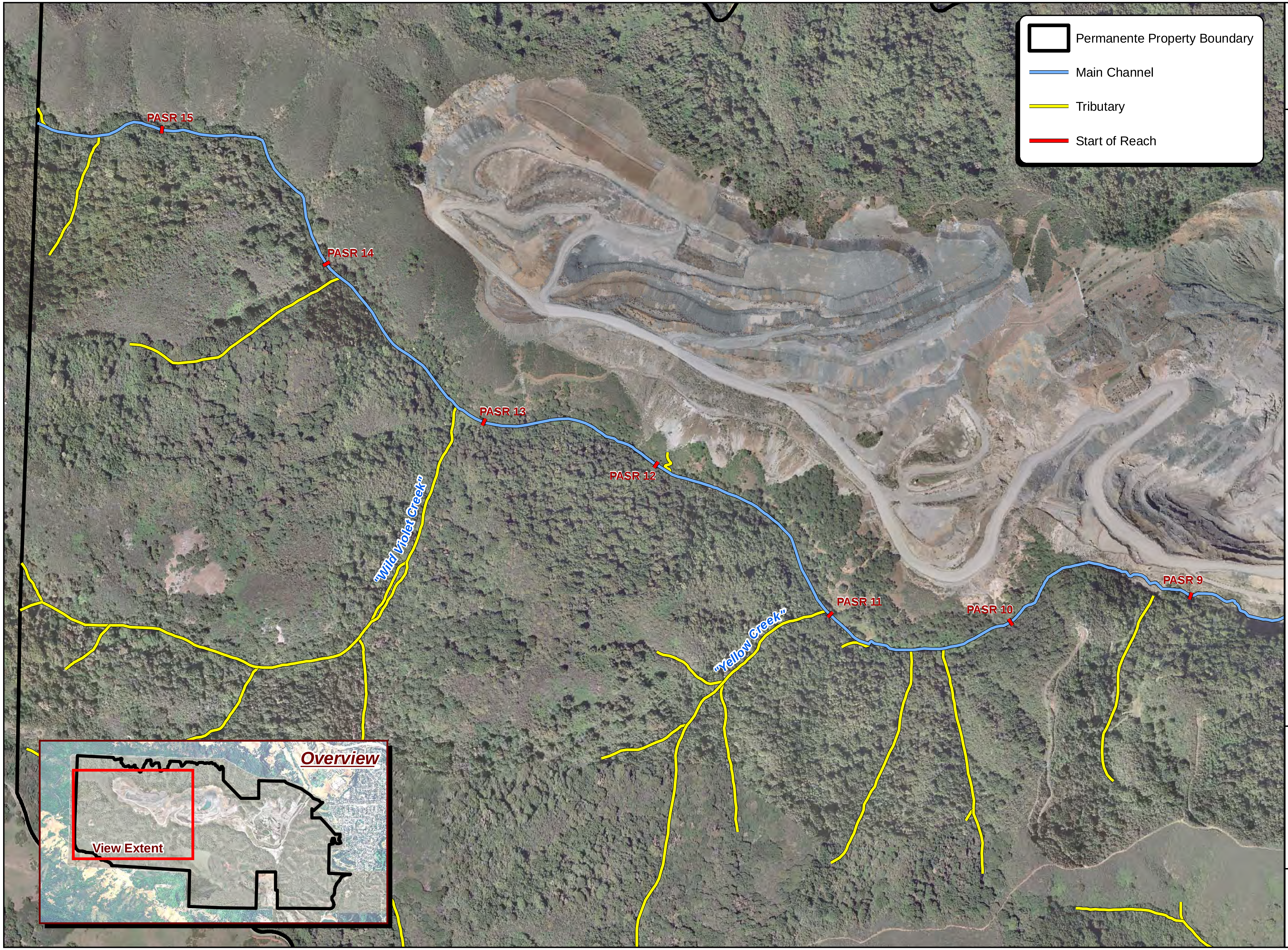
Figure 2a.

Permanente Creek East CRLF Habitat Assessment Map

N
W E
S

0 250 500 1,000
Feet

Date: May 2010
Map By: Michael Rochelle
Aerial: April 2007
Filepath: I:\Acad2000\16000\16143\gis\Arcmap\Aquatic\CRLF\Perm1.mxd



wra
ENVIRONMENTAL CONSULTANTS

Lehigh Permanente Quarry
Santa Clara County, California

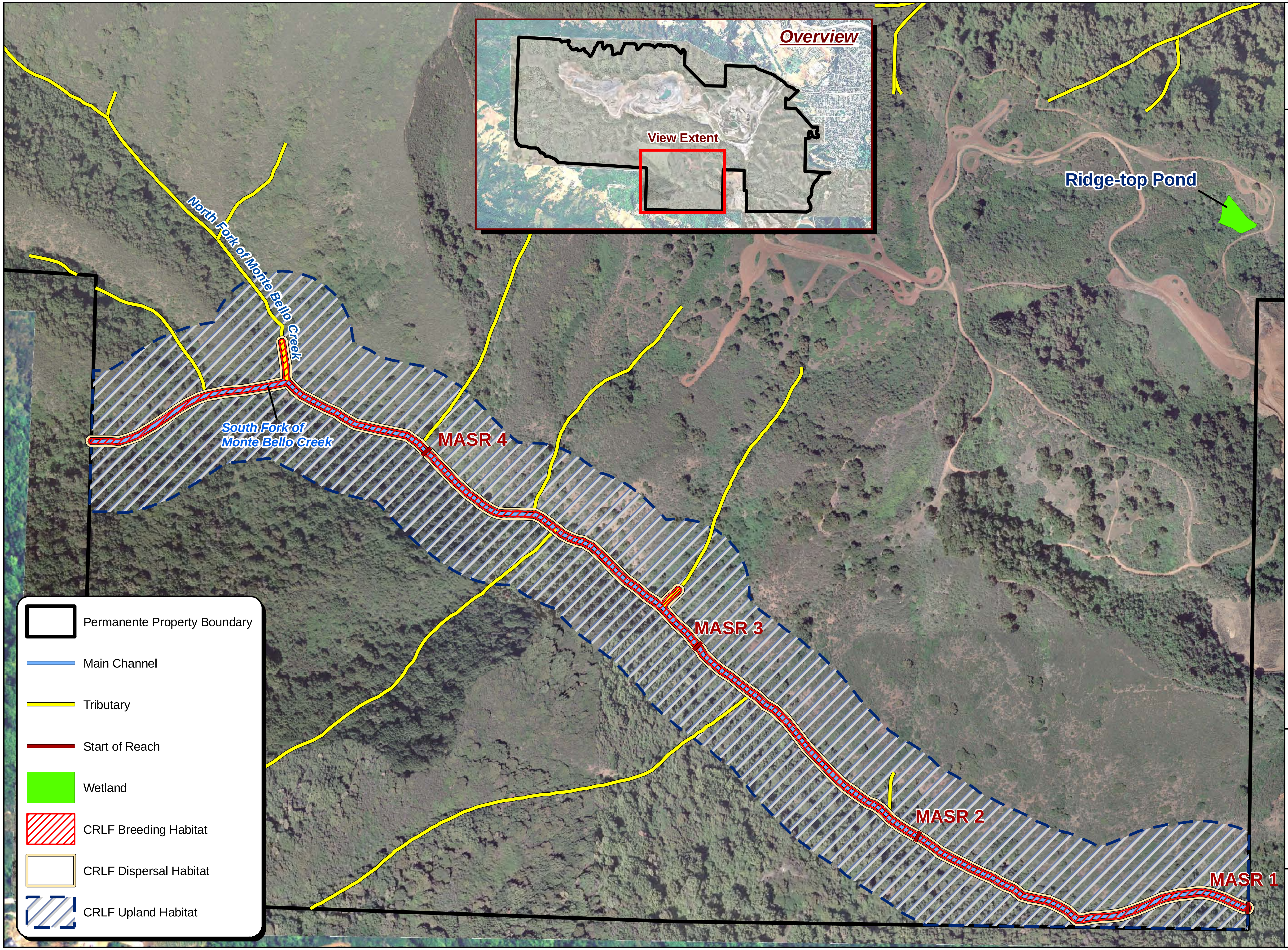
Figure 2b.

Permanente Creek West CRLF Habitat Assessment Map

N
W E
S

0 250 500 1,000
Feet

Date: May 2010
Map By: Michael Rochelle
Aerial: April 2007
Filepath: I:\Acad2000\16000\16143\gis\Arcmap\Aquatic\CRLF\Perm2.mxd



ENVIRONMENTAL CONSULTANTS

Lehigh Permanente Quarry
Santa Clara County, California

Figure 2c.

Monte Bello Creek
CRLF Habitat
Assessment Map

N
W E
S

0 150 300 600
Feet

Date: May 2010
Map By: Michael Rochelle
Aeiral: April 2007
Filepath: I:\Acad2000\16000\16143\gis\Arcmap\Aquatic\CRLF Assessment\Montebello.mxd

(Figure 2c), and Monte Bello Creek from MASR 4 to the Quarry Property boundary (Figure 2c). Each habitat assessment was conducted to determine whether any actual or potential breeding, feeding, movement corridors, and estivation/hibernation habitats are present for CRLF.

Per recent taxonomic changes with frog species in California, I follow Jennings (2004) and Shaffer et al. (2004) and use the scientific name "*Rana draytonii*" for the CRLF. In almost all other documents and field guides, this frog is stated as the subspecies "*Rana aurora draytonii*" (e.g., see Stebbins 2003). The scientific and common names of other amphibians and reptiles mentioned in this report follow Jennings (2004), except for very recent taxonomic changes in the families Bufonidae and Ranidae. In these cases, the older generic name is placed in parenthesis.

STUDY AREA

Lehigh Southwest Cement Company's Permanente Quarry Property (Quarry Property) is an approximately 3,510-acre property that lies southwest of the intersection of I-280 and Hwy 85 in Santa Clara County (Figure 1). The facility is located along much of the upper Permanente Creek drainage and a portion of the upper Monte Bello Creek drainage and contains various buildings, rock crushers, storage yards, rock quarrying areas, paved roads, railroad tracks, and aggregate conveyors located over a wide area. Approximately 18 settling ponds are used to remove excess sediment from water received from the quarry pit and other quarry operations to maintain high water quality and adhere to regulatory standards. The resulting water in these settling ponds is discharged into Permanente Creek proper (Figures 2a and 2b).

Permanente Creek is fed through a series of springs and intermittent tributaries and trends generally west to east, roughly through the center of the Quarry Property (Figures 2a and 2b). The creek is crossed by three major quarry access roads that are used for site access and transport of materials and equipment between onsite facilities. In general, the upstream, western-most 1/3 of Permanente Creek on the Quarry Property follows a natural course. The central 1/3 of the creek has been subjected to historical disturbance, including fill, realignment and road crossings, associated with early mining activities. The downstream, eastern 1/3 of the creek, after flowing into settling Pond 13, flows through numerous culverts, channelized segments and impoundments before exiting in the northeast corner of the Quarry Property (Figure 2a).

Permanente Creek receives water from ongoing quarry activities including annual dewatering of the main quarry pit. These flows enter Permanente Creek after sediments are allowed to settle in Pond 4A (Figure 2a). Due to a binary pumping system (i.e. either on or off), releases of water into Permanente Creek are subject to frequent starting and stopping due to an automated pumping regime that is dependent on water levels in the main quarry pit. Because of the quarry pit input, Permanente Creek flows almost year-round in segments below Pond 4A.

Immediately upstream from Pond 4A (PASR 8-9), a section Permanente Creek approximately 1,850 feet long (depending on time of year) is dry for all but a few weeks in a given water year when flows peak as a result of storm flows. Upstream of the referenced “dry section,” one begins to notice a few isolated pools of water in the stream channel that hold water for longer periods of time during the year. Upstream of PASR 10, one encounters flows in the stream channel that remain perennial to the confluence of Permanente Creek and “Wild Violet Creek” (just upstream of PASR 12; Figure 2b). Above this confluence, Permanente Creek becomes ephemeral and intermittent. Wild Violet Creek is ephemeral and intermittent for all but the northernmost 350 feet (closest to the confluence). The calcareous nature of the bedrock present in the area gives rise to a number of sinks and springs within the channel of Permanente Creek and tributaries, and in places, flows can be transported under the surface during the dry season.

Generally, tributaries that drain into Permanente Creek are extremely flashy in nature and rarely convey surface flow except during high flow events. The slope to the south of Permanente Creek is densely vegetated and the soils are dominated by various loams which are highly permeable.

Monte Bello Creek originates from a series of seeps and intermittent tributaries from the north side of Monte Bello Ridge (Figure 2c). The main stem, also dubbed the "South Fork," flows northeast until it meets the "North Fork" (upstream of MASR 4) which originates on the property (Figure 2c). The North Fork is largely intermittent and ephemeral. It contributes surface flow only seasonally and is estimated to less than 10 percent of the overall flow at the confluence during storm events. From the confluence, the main stem is perennial and trends southeast until it leaves the facility at MASR 1 and drains into a series of large, in-stream, detention basins on the neighboring property. Within the Quarry Property, Monte Bello Creek has no roadways and is largely intact with naturally vegetative slopes (Figure 2c).

Tributaries to Monte Bello Creek on the Quarry Property range from ephemeral to intermittent. They do not display an ordinary high-water (OHW) mark, nor do they support riparian vegetation. Calcareous limestone is also common in the tributaries to Monte Bello Creek, although no pools are present within these tributaries that hold water long enough to support breeding amphibians.

Ridge-Top Pond is located on a hillside southwest of the Rock Plant (Figures 2a and 2c). It is less than an acre in size and contains a dense cover of introduced spiny cockleburs (*Xanthium spinosum*). The uplands around this location are largely composed of chaparral species. The pond appears to have been originally created by putting up a small earthen dam in a drainage channel and therefore is an historical feature which is not part of Quarry Property's current stormwater management system.

A total of 20 distinct biological plant communities are located on the facility grounds. These include: 1) ruderal herbaceous grassland (e.g., *Avena* spp., *Bromus* spp., *Cenaurea* spp.), 2) mixed scrub (e.g., *Baccharis pilularis*, *Artemisia californica*, *Eriogonum fasciculatum*), 3) northern mixed chaparral (e.g., *Ceanothus* spp., *Arctostaplylos glandulosa*, *Heteromeles arbutiofolia*) , 4) chamise chaparral (e.g., *Adenostoma fasciculatum*), 5) oak chaparral (e.g., *Quercus* spp.), 6) poison oak scrub (e.g., *Toxicodendron diversilobum*), 7) non-native annual grassland (e.g., *Avena* spp. *Bromus* spp.), 8) California bay forest (e.g., *Umbellularia californica*), 9) California buckeye woodland (e.g., *Aesculus californica*), 10) rock outcrop, 11) revegetated areas, 12) active quarry, 13) disturbed areas,14) settling ponds and operational water features, 15) wetland (e.g., *Typha angustifolia*), 16) willow riparian forest and scrub (e.g., *Salix* spp.), 17) sycamore alluvial woodland (e.g., *Platanus racemosa*), 18) white alder riparian forest (e.g., *Alnus rhombifolia*), 19) oak woodland (e.g., *Quercus* spp.), and 20) streams and ponds. The most common habitat types encountered on the property (besides active quarry, reclaimed, and disturbed areas) are oak woodland, California bay forest, chamise chaparral, northern mixed chaparral, oak chaparral, ruderal herbaceous grassland, and poison oak scrub.

The settling ponds on the Quarry Property, are, depending on the pond, used by a wide variety of wildlife including California newts (*Taricha torosa*), Pacific treefrogs (*Hyla regilla*), western toads (*Anaxyrus* (*Bufo*) *boreas*), and in some locations within PASR1, CRLF. Some of the settling ponds contain cattails and bulrushes, as well as scattered patches of willows (*Salix* sp.) and Himalayan blackberries (*Rubus discolor*). Willows and Himalayan blackberries are common along the main Permanente Creek channel near the entrance of the Quarry Property at PASR 1. Scattered clumps of white alders (*Alnus rhombifolia*) are present within the mainstream of Permanente Creek and Monte Bello Creek.

This habitat assessment was conducted in a portion of Permanente Creek (upstream of Pond 4A between reach PASR 9 and 10) where it flows through a rocky area adjacent to the quarry pit. There is evidence of a number of former machinery and concrete building parts (along with quarry rock) in the stream channel that were apparently deposited here at various times during earlier periods of quarry activity. As mentioned earlier, although streamflow in this part of Permanente Creek is only present during the winter and early spring months (after sufficient rainfall), a few scattered willows are present in the rocky stream channel. The uplands to the north are largely covered with pieces of rock and gravel and ruderal vegetation. Large trees such as oaks are scarce here due to the extreme steepness (>70%) and instability of the uplands.

Prior to 2006, general biological surveys were conducted on the Quarry Property and reported CRLF at locations where they were subsequently noted again by me (Jennings 2006, 2007). In 2006, I examined the Permanente Creek drainage from PASR 1-15 and all the known settling ponds and conducted a habitat assessment and protocol CRLF survey at each location (Jennings 2006). Subsequently in 2007, I conducted protocol surveys for CRLF in all the extant settling ponds and aquatic habitats along Permanente Creek from PASR 1-10 that I thought might potentially harbor this species (Jennings 2007). To date, CRLF have only been found at the ponds and aquatic habitats in the vicinity of PASR 1.

MATERIALS AND METHODS

This habitat assessment for the CRLF followed guidelines as set forth by the U.S. Fish and Wildlife Service (U.S. Fish and Wildlife Service 2005). Ridge-Top Pond was examined by Dr. Michael N. Josselyn and me on 28 January 2009. The upper portions of Permanente Creek (between PASR 9-10) and Monte Bello Creek (MASR 4 to the property boundary) were examined by Rob Schell and me on 10 February 2009. Standard data sheets were filled out (see Appendix A).

CALIFORNIA RED-LEGGED FROG OVERVIEW

Federal listing status: Threatened. State listing status: Species of Special Concern.
On 15 January 1992, the CRLF was petitioned for listing as an endangered species by the U.S. Fish and Wildlife Service (Sorensen 1993) based on a 70% range reduction and continued threats to surviving populations (Miller 1994). The frog was subsequently listed as Threatened by the U.S. Fish and Wildlife Service on 23 May 1996 (Miller et al. 1996), with further recent revisions to critical habitat and management of this species (U.S. Fish and Wildlife Service 2006).

The CRLF is a large brown to reddish-brown frog that attains lengths up to 3.25-5.5 inches from the tip of the snout to the end of its vent. These frogs have prominent dorsolateral folds and diffuse moderate-sized dark brown to black spots that sometimes have light centers (Storer 1925, Jennings and Hayes 1994). The distribution of red or red-orange pigment is highly variable, but usually restricted to the belly and the undersurfaces of the thighs, legs and feet (Jennings and Hayes 1994). Frogs in southern California often have red only on the undersurfaces of the feet (Jennings pers. observ.). There are prominent dorsolateral folds, which are yellow or orange-colored in juveniles (Stebbins 2003). The groin has a distinct black mottling on a white or yellow background. The iris is dark brown with iridophores on the upper and lower portions of the iris (Jennings and Hayes 1994).

Larvae range in length from 0.55-3.15 inches in total length and have up to 2-3 upper and 3-4 lower tooth rows (Stebbins 2003). Newly hatched tadpoles generally are blackish in color, gradually changing to a brown background color with darker marbling or spots after a week or two of growth (Storer 1925).

This amphibian is the largest native frog in the state. There are data to support elevating the CRLF to a full species separate from the northern red-legged frog (*Rana aurora*) [see Hayes and Miyamoto 1984, Hayes and Kremples 1986, Green 1985]. The large zone of intergradation along the Pacific slope of the North Coast Range reported by Hayes and Kremples (1986) has been greatly contracted to a point in mid-Mendocino County by recent biochemical studies (Shaffer et al. 2004).

Life History and Ecology

CRLF are pond-dwelling amphibians that generally live in the vicinity of permanent aquatic habitats including livestock ponds and pools in perennial streams (Jennings and Hayes 1994). The most optimal habitat is characterized by dense, shrubby riparian vegetation associated with deep (>2.3 feet), still, or slow-moving water (Hayes and

Jennings 1988, Jennings 1988). The shrubby riparian vegetation that structurally seems to be most suitable for this frog is that provided by arroyo willow (*Salix lasiolepis*), although cattails and bulrushes also can provide suitable habitat (Jennings 1988). Although CRLF are found in ephemeral streams and ponds, populations cannot be maintained where all surface water disappears (Jennings and Hayes 1994). This frog is infrequent or absent in habitats where introduced aquatic predators such as green sunfish (*Lepomis cyanellus*), Louisiana red-swamp crayfish (*Procambarus clarkii*) and bullfrogs (*Lithobates* (*Rana*) *catesbeianus*) are present (Hayes and Jennings 1986, 1988), probably because the larval stages are susceptible to such predators (Jennings and Hayes 1994).

Reproduction occurs at night in permanent ponds or the slack water pools of streams during the winter and early spring (late November-through April) after the onset of warm rains (Storer 1925, Hayes and Jennings 1988, Jennings and Hayes 1994). Males generally appear at breeding sites from 2-4 weeks before females (Storer 1925). At breeding sites, males typically call in small mobile groups of 3-7 individuals that attract females (Jennings and Hayes 1994). Females amplex with males and attach egg masses containing approximately 2,000-6,000 eggs to an emergent vegetation brace at depths usually from 3-4 inches deep (Storer 1925). Eggs hatch after 6-14 days (depending on the prevailing water temperature), and the resulting larvae require 3.5-7 months to attain metamorphosis (Storer 1925). Some tadpoles may also over winter (Fellers et al. 2001a). Juvenile frogs are about 1 inch (25.4 millimeters) long at metamorphosis and commonly sun themselves during the day at the edge of the riparian zone next to the breeding site. As they grow, they gradually shift from diurnal and nocturnal periods of activity, to largely nocturnal activity (Hayes and Tennant 1986). During periods of rainfall, both juveniles and a few adults may disperse away from breeding sites and may be found some distance (up to 0.5 mile) away from the nearest water (Jennings, unpubl. data). Frogs found in the coastal drainages appear to be rarely inactive, whereas those found in interior sites probably hibernate (Storer 1925). Frogs generally reach sexual maturity in their second year for males and third year for females (Jennings and Hayes 1985). During extended periods of drought, frogs may take 3-4 years to reach sexual maturity

(Jennings and Hayes 1994). Based on limited field data, CRLF appear to live about 8-10 years in the wild (Jennings, unpubl. data).

CRLF have declined largely due to habitat loss and the introduction of non-native aquatic predators such as green sunfish, red-swamp crayfish and bullfrogs (Jennings and Hayes 1994). It is possible that a pathogen also helped to eliminate frog populations in southern California during the 1970s (Fellers et al. 2001b). Recent work suggests that nitrate/nitrite pollution (Marco et al. 1999) and pesticide drift (Davidson et al. 2001, 2002) also may be responsible for frog declines in California.

CRLF were historically found west of the Sierra Nevada crest from mid-Mendocino County and the vicinity of Redding, south into northwestern Baja California (Jennings 1995). Within the Quarry Property, there are recent records of CRLF in the aquatic habitats adjacent to Permanente Creek on the lowest parts of the facility grounds (i.e: Pond 14 and adjacent areas that are located downstream of PASR 2; Jennings 2006, 2007) and this population continues to breed and survive in the aquatic habitats where it has been observed. However, no CRLF have been observed upstream of these locations in the more marginal habitats of the portions of Permanente Creek upstream of PASR 2 and surrounding settling ponds.

RESULTS AND DISCUSSION

Based on my habitat assessment and examination of the three study areas, I have reached the following conclusions:

Permanente Creek, between PASR 9-10, lacks suitable aquatic and upland habitats for CRLF. This is due to the lack of water in the stream here for most of the year. Water appears to only be present in the stream channel at this location during the rainy season, which would mean that this section of Permanente Creek is dry for approximately 9 months out of the year. The lack of water presence for much of the year also explains why the stream channel lacks a fringe of riparian vegetation along this same reach.

Additionally, this location is at least a half-mile from known CRLF habitats (within PASR 1) and there are many barriers (e.g., roads, piped drainages, buildings, etc.) between PASR 1 and PASR 9-10 that would preclude overland movement and colonization. Also, raccoons (*Procyon lotor*) are abundant in the area and presumably would predate any frog they encountered in upland habitats or shallow aquatic areas. This, in my professional opinion, CRLF are absent from the portion of Permanente Creek within PASR 9-10.

The Ridge-Top Pond also appears to lack suitable aquatic and upland habitats for CRLF. This is due to the lack of water at the site for approximately 9 months out of the year (even during periods of above average rainfall), and the absence of a fringe of riparian vegetation. Additionally, the Ridge-Top Pond is at least a half mile from known CRLF habitats (at PASR1) and there are many barriers (e.g., roads, piped drainages, buildings, etc.) between these locations. Likewise, raccoons are also abundant in the area and presumably would predate any CRLF they encountered in upland habitats or shallow water areas. Thus, in my professional opinion, CRLF are absent from that portion of the Ridge-Top Pond.

Monte Bello Creek appears to contain suitable, but marginal habitat for CRLF due to the pools on the stream being 2-feet deep or less. Biologists from WRA, Inc., observed a CRLF within this stream, about 850 meters upstream from the property line on 07 May 2009 (R. Schell, pers. comm.) indicating the presence of the species in the Monte Bello Creek drainage. In my professional opinion, and based on the marginal habitat for CRLF within the portion of the drainage examined, the presence of this individual is from a breeding location somewhere within the Monte Bello Creek system. The individual is not believed to have come from the Permanente Creek system due to the steepness of the terrain, the long distance between suitable aquatic habitats, the ephemeral nature of the intervening creeks and ponds, and other overland barriers which preclude overland movement between the two creek systems.

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APPENDIX A

Completed California Red-Legged Frog Habitat Assessment Data Sheets

California Red-Legged Frog Habitat Site Assessment Data Sheet

Site Assessment reviewed by ________ (FWS Field Office) ________ (date) ________ (biologist)

Date of Site Assessment: 01/28/2009 (mm/dd/yyyy)

Site Assessment Biologists: Jennings, Mark (Last name) (first name) Josselyn, Mike (Last name) (first name)

________ (Last name) (first name) ________ (Last name) (first name)

Site Location: Santa Clara, Hanson Permanente Cement Facility, Small Pond south of Rock Plant
(County, General location name, UTM Coordinates or Lat./Long. or T-R-S)

****ATTACH A MAP** (include habitat types, important features, and species locations)**

Proposed project name: Hanson Permanente Cement Facility
Brief description of proposed action:
Determine if small intermittent pond is suitable CRLF habitat

1) Is this site within the current or historic range of the CRF (circle one)? YES NO

2) Are there known records of CRF within 1.6 km (1 mi) of the site (circle one)? YES NO
If yes, attach a list of all known CRF records with a map showing all locations.

GENERAL AQUATIC HABITAT CHARACTERIZATION

(if multiple ponds or streams are within the proposed action area, fill out one data sheet for each)

POND:

Size: < 1 acre Maximum depth: 4 feet

Vegetation: emergent, overhanging, dominant species: covered with a dense stand of spiny cocklebur

Substrate: Sand, silt

Perennial or Ephemeral (*circle one*). If ephemeral, date it goes dry: Probably by May 1st of each year.

California Red-Legged Frog Habitat Site Assessment Data Sheet

STREAM:

Bank full width: ____________

Depth at bank full: ____________

Stream gradient: ____________

Are there pools (circle one)? YES NO

If yes,

Size of stream pools: ____________

Maximum Depth of stream Pools: ____________

Characterize non-pool habitat: run, riffle, glide, other: ____________

Vegetation: emergent, overhanging, dominant species: ____________

Substrate: ____________

Bank description: ____________

Perennial or Ephemeral (*circle one*). If ephemeral, date it goes dry: ____________

Other aquatic habitat characteristics, species observations, drawings, or comments:

Intermittent pond is located on a hillside above the Rock Plant. Very isolated and was human created by creating an earthen dam across a small drainage. Was completely dry during our visit at the end of January. Probably holds water for about 3 months at most. Lacks much vegetation except for cockleburs. Is not considered CRLF habitat.

Raccoon tracks noted on road to the location.

Necessary Attachments:

1. All field notes and other supporting documents
2. Site photographs.
3. Maps with important habitat features and species locations

California Red-Legged Frog Habitat Site Assessment Data Sheet

Site Assessment reviewed by ____________ ____________ ____________
(FWS Field Office) (date) (biologist)

Date of Site Assessment: 02/10/2009
(mm/dd/yyyy)

Site Assessment Biologists: Jennings, Mark (Last name) (first name) Schell, Rob (Last name) (first name)

____________ (Last name) (first name) ____________ (Last name) (first name)

Site Location: Santa Clara, Hanson Permanente Cement Facility, upper portion of Permanente Creek next to open pit quarry.
(County, General location name, UTM Coordinates or Lat./Long. or T-R-S)

****ATTACH A MAP** (include habitat types, important features, and species locations)******

Proposed project name: Hanson Permanente Cement Facility
Brief description of proposed action: To put a proposed expansion bridge across the creek channel.

1) Is this site within the current or historic range of the CRF (circle one)? YES NO

2) Are there known records of CRF within 1.6 km (1 mi) of the site (circle one)? YES NO
If yes, attach a list of all known CRF records with a map showing all locations.

GENERAL AQUATIC HABITAT CHARACTERIZATION

(if multiple ponds or streams are within the proposed action area, fill out one data sheet for each)

POND:
Size: ____________ Maximum depth: ____________

Vegetation: emergent, overhanging, dominant species: ____________

Substrate: ____________

Perennial or Ephemeral (*circle one*). If ephemeral, date it goes dry: ____________

California Red-Legged Frog Habitat Site Assessment Data Sheet

STREAM:

Bank full width: 4 ft.

Depth at bank full: 2 ft.

Stream gradient: 8%

Are there pools (circle one)? YES NO

If yes,

Size of stream pools: 4 ft. x 4 ft.

Maximum Depth of stream Pools: 2 ft.

Characterize non-pool habitat: run, riffle, glide, other: Can't tell because the creek is completely dry here

Vegetation: emergent, overhanging, dominant species: Mostly rock with coyote brush, western poison oak, scattered blackberries, and an occasional willow bush.

Substrate: Mostly rock with some gravel. Many pieces of old concrete and metal machinery.

Bank description: Steep -- edge of quarry where rocks and boulders dumped over the side in the past. Upstream is shaded by larger oaks.

Perennial or Ephemeral (*circle one*). If ephemeral, date it goes dry: by May 1st

Other aquatic habitat characteristics, species observations, drawings, or comments:

Stream was completely dry during our visit in February. Probably doesn't hold water for very long as most run off from the nearby quarry is directed to Quarry Ponds #5 and 4 A. Raccoons are common in the area. Their tracks were observed around Quarry Pond #4 A. Area not considered CRLF habitat. No frogs seen in any of the Quarry ponds or Permanente Creek downstream of Quarry to buildings during yearly surveys of 2005, 2006, and 2007.

Necessary Attachments:

1. All field notes and other supporting documents
2. Site photographs.
3. Maps with important habitat features and species locations

California Red-Legged Frog Habitat Site Assessment Data Sheet

Site Assessment reviewed by ______ (FWS Field Office) ______ (date) ______ (biologist)

Date of Site Assessment: 02/10/2009 (mm/dd/yyyy)

Site Assessment Biologists: Jennings, Mark (Last name) (first name) Schell, Rob (Last name) (first name)

______ (Last name) (first name) ______ (Last name) (first name)

Site Location: Santa Clara, Hanson Permanente Cement Facility Montebello Creek
(County, General location name, UTM Coordinates or Lat./Long. or T-R-S)

****ATTACH A MAP** (include habitat types, important features, and species locations)**

Proposed project name: Hanson Permanente Cement Facility
Brief description of proposed action:
Determine habitat suitability for CRLF in Montebello Creek.

1) Is this site within the current or historic range of the CRF (circle one)? YES NO

2) Are there known records of CRF within 1.6 km (1 mi) of the site (circle one)? YES NO
If yes, attach a list of all known CRF records with a map showing all locations.

GENERAL AQUATIC HABITAT CHARACTERIZATION

(if multiple ponds or streams are within the proposed action area, fill out one data sheet for each)

POND:
Size: 3 feet Maximum depth: 2 feet

Vegetation: emergent, overhanging, dominant species: Overstory of Oaks, California Bay and willows. Some blackberries and tules at spots.

Substrate: lots of bedrock and boulders, Some gravels

Perennial or **Ephemeral** (*circle one*). If ephemeral, date it goes dry: ______

California Red-Legged Frog Habitat Site Assessment Data Sheet

STREAM:
Bank full width: 4 feet
Depth at bank full: 2 feet
Stream gradient: 10%

Are there pools (circle one)? YES NO
If yes,
Size of stream pools: 3 feet
Maximum Depth of stream Pools: 2 feet

Characterize non-pool habitat: run, riffle, glide, other: 30% Run, 10% Riffle, 10% Glide, 50% Pools. Springs present along and off stream.

Vegetation: emergent, overhanging, dominant species: Overstory of Oaks, California Bay, and Willows. A few alders. Some blackberries and tules in spots.

Substrate: Mostly bedrock and boulders. Some gravel.

Bank description: Steep, with Oaks, Coyote brush, and Poison Oak.

Perennial or Ephemeral (*circle one*). If ephemeral, date it goes dry: __________

Other aquatic habitat characteristics, species observations, drawings, or comments:
Creek appears to be marginal habitat for CRLF because of the shallow nature of the plunge pools. Area is frequented by raccoons and a few wading birds. Protocol surveys need to be conducted to determine if CRLF's are present or not.

Necessary Attachments:

1. All field notes and other supporting documents
2. Site photographs.
3. Maps with important habitat features and species locations

APPENDIX E. Permanente Aquatic Technical Report

Permanente Aquatic Technical Report
Lehigh Permanente Quarry

SANTA CLARA COUNTY, CALIFORNIA

Prepared For:
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Date:
May 2010

ENVIRONMENTAL CONSULTANTS

EXECUTIVE SUMMARY

WRA, Inc. collected biological and physical data on Permanente Creek and Monte Bello Creek and their major tributaries within the 3,510-acre Lehigh Permanente Quarry property between January and May, 2009. WRA evaluated physical attributes that relate to habitat quality such as water temperature, frequency of riffles, runs and pools, channel width and depth, in-stream cover and substrate composition. WRA also inventoried fish, amphibian and invertebrate communities that rely on these watersheds using current accepted scientific methods.

The results of this study indicate the following:

- Overall physical habitat quality within Permanente and Monte Bello Creeks is high, and supports a diversity of benthic macroinvertebrates, a natural and diverse amphibian assemblage and a self-sustaining population of Rainbow Trout, notwithstanding historic and ongoing mining activities.

- Physical habitat quality in Permanente Creek varies depending on location. The upper reaches of Permanente Creek are largely unaltered and represent a perennial cold-watered stream with the highest diversity of benthic macroinvertebrates, a diverse amphibian assemblage and self-sustaining Rainbow Trout measured in this study. The middle reaches tend to be dry except for the wettest times of year and are too ephemeral to allow benthic macroinvertebrates to colonize, or for fish or amphibians to carry out phases critical to their life history. The lower reaches are marked by augmented flows in addition to groundwater-input base flows. The physical habitat in the lower reaches is altered from natural conditions, containing a trapezoidal concrete channel and in-stream sedimentation control ponds.

- Monte Bello Creek is not significantly altered within the Lehigh Permanente Quarry property. Monte Bello Creek supports a native amphibian assemblage whose densities increase along a gradient traveling in a downstream to upstream direction. Benthic macroinvertebrate sampling indicates that Monte Bello Creek supports a diverse community of aquatic insects throughout the watershed. No fish exist in Monte Bello Creek as a result of suspected downstream barriers. The Main Stem and South Fork of Monte Bello Creek are wholly perennial, and convey a majority of the surface flow through the system. The North Fork of Monte Bello Creek is ephemeral and intermittent, and during the wettest periods of the year contributes at most approximately 10% of the total surface water to the Main Stem.

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Table 1. Acronyms Used in Report

ASR	Aquatic Survey Reach
BMI	Benthic Macroinvertebrate
BRA	Biological Resource Assessment
CFS	Cubic Feet per Second
CRLF	California Red-legged Frog
CSBP	California Stream Bioassessment Procedure
LWD	Large Woody Debris
MASR	Monte Bello Aquatic Survey Reach
MBMI	Monte Bello Benthic Macroinvertebrate sampling location
MCS	Monte Bello Cross Section location
MFS	Monte Bello Fish Sample reach location
PASR	Permanente Aquatic Survey Reach
PBMI	Permanente Benthic Macroinvertebrate sampling location
PCS	Permanente Cross Section location
PFS	Permanente Fish Sample reach location
SHRM	California Department of Fish and Game California Salmonid Steam Habitat Restoration Manual
SL	Standard Length - fish measurement (tip of the snout to the posterior end of the last vertebra)

1.0 INTRODUCTION

From January through May 2009, WRA, Inc. performed an assessment of the aquatic resources within the Permanente Creek and Monte Bello Creek watersheds on the approximately 3,510 acre Lehigh Permanente Quarry property (Property), in Santa Clara County, California (Figure 1). The purpose of the assessment was to collect information on existing aquatic fauna, habitat, and physical parameters to determine the stream habitat quality within the Property.

This report describes the condition of the existing habitat, reports long term temperature data and the results of focused surveys for fish, amphibians and benthic macroinvertebrates. The study was conducted between January and May and represents the seasonal high-flow period in this system.

This aquatic assessment provides detailed information on the distribution of aquatic species and habitats within the Property. This assessment is not an official protocol level survey for listed species that may be required for project approval by local, state, or federal agencies. This assessment is based on information available at the time of the study and on site conditions that were observed during late winter and early spring of 2009.

Figures and graphs pertaining to the results section of this report will be referenced in the text and are appended to the end of this report in Appendix B. For the purpose of this study, Property refers to the approximately 3,510 acre Lehigh Permanente Quarry property, and the Study Area refers to aquatic stream habitat within the Lehigh Permanente Quarry property.

1.1 Study Area Description

The Study Area is comprised of aquatic stream habitats within the Lehigh Permanente Quarry property (including in-stream sedimentation basins) and tributaries that are capable of supporting aquatic life. The capability of supporting aquatic life is defined as any aquatic body that contains adequate flow or inundation for sufficient duration to allow aquatic organisms to access, occupy and complete a component of their lifecycle (i.e. spawning fish, metamorphosis of amphibian larvae, or colonization by aquatic invertebrates). Aquatic surveys were focused in areas, known through previous site visits, to be perennially wetted. Refer to the Biological Resource Assessment (BRA) prepared by WRA, Inc. (2010) for a more thorough description of the Lehigh Permanente property.

1.1.1 Permanente Creek

The headwaters of Permanente Creek originate to the west of the Study Area. It is fed through a series of springs and intermittent tributaries. Permanente Creek trends generally west to east, roughly through the center of the Property before turning north and flowing for approximately nine miles eventually emptying into San Francisco Bay. Approximately 5 miles (26,000 linear feet) of the main stem of Permanente Creek within the Property was included in the survey effort. The in-stream sedimentation basins labeled in Figures 2a and 2b as Pond 14, Pond 22, and Pond 13 are also included in this study. Several other sedimentation basins lie adjacent to Permanente Creek. These operational features collect runoff and discharge into Permanente

Creek when conditions are appropriate. Refer to the BRA for a more thorough description of Permanente Creek and the Lehigh Permanente Quarry property surrounding the creek.

A major tributary to Permanente Creek is Wild Violet Creek which drains a large portion of the southwest corner of the Property. Wild Violet Creek is ephemeral and intermittent for all but the northernmost 350 feet (closest to the confluence). No tributaries, save for Wild Violet Creek, are considered to be habitat for aquatic organisms. Generally, tributaries that drain into Permanente Creek are ephemeral and rarely convey surface flow except during high flow events.

1.1.2 Monte Bello Creek

Monte Bello Creek originates from an unverified water source (presumed to be a combination of irrigation runoff and natural seeps) to the south of the Property on the north side of Monte Bello Ridge. The main stem, also dubbed the "South Fork", flows northeast until it meets the "North Fork" which originates on the Property. The North Fork is largely intermittent and ephemeral. It contributes surface flow seasonally and is estimated to less than 10 percent of the overall flow at the confluence. From the confluence, the main stem is perennial and trends southeast until it leaves the Property and drains into a series of large, in-stream, detention basins on the neighboring property. Monte Bello Creek drains into Steven's Creek Reservoir which in turn empties into Steven's Creek which trends north along Highway 85 and out to San Francisco Bay through Mountain View.

Monte Bello Creek is not regulated within the Study Area, and it is not believed to be managed upstream of the Study Area. There are no access roads to or stream crossings of Monte Bello Creek within the Study Area. A historic road travels parallel to the creek along the south bank for a short distance near the downstream Study Area boundary, but had not been utilized by vehicle traffic in some years. Further assessment of Monte Bello Creek and the detention basins on the neighboring property was not performed because permission was not granted to access these areas by the land owner.

2.0 METHODS

Permanente Creek was broken into sixteen, 1,650 foot (500 meter) long Aquatic Survey Reaches (Figure 2a and 2b), beginning at the downstream (northeast) Study Area boundary (PASR1) and counting upstream incrementally to the upstream (west) edge of the Study Area.

Monte Bello Creek was broken into four, 1,650 foot (500 meter) Aquatic Survey Reaches (MASR 1-4), beginning at the downstream Study Area boundary (MASR1) and counting upstream along the main stem incrementally to the upstream extent within the Study Area.

The locations of sample points and survey reaches in relation to the Aquatic Survey Reaches can be found in Table 2, and Figures 2a, 2b, and 2c.

Table 2. Locations of Sample Points and Survey Reaches in Relation to Aquatic Survey Reaches.

Watershed	Aquatic Survey Reach Number	Hobo Loggers (HOBO)	Fish Sampling (PFS / MFS)	Benthic Macroinvertebrate (PMBI / MBMI)	Cross Sections (PCS / MCS)
Permanente	1	HOBO 4	PFS 1	PBMI 1	PCS 1, PCS 2, PCS 3, PCS 4
	2		PFS 2		
	3	HOBO 5		PBMI 2	PCS 5
	4		PFS 3, PFS 4		PCS 6
	5	HOBO 6	PFS 5		PCS 7, PCS 8
	6		PFS 6		PCS 9
	7		PFS 7	PBMI 3	PCS 10
	8	HOBO 7			PCS 11, PCS 12
	9				PCS 13
	10		PFS 8	PBMI 4	PCS 14
	11	HOBO 8			PCS 15
	12		PFS 9		PCS 16
	13				PCS 17

Watershed	Aquatic Survey Reach Number	Hobo Loggers (HOBO)	Fish Sampling (PFS / MFS)	Benthic Macroinvertebrate (PMBI / MBMI)	Cross Sections (PCS / MCS)
Monte Bello	1				
	2		MFS 1	MBMI 1	MCS 1
	3	HOBO 1	MFS 2		
	4	HOBO 2, HOBO 3		MBMI 2	MCS 2, MCS 3

2.1 Physical Habitat

2.1.1 Water Temperature

To determine water temperature conditions within Permanente and Monte Bello Creeks, five (5) digital data loggers (*HOBO Water Temp Pro v2*) were installed in Permanente Creek and three (3) more in Monte Bello Creek. Each logger was cased in a 6 inch section of 2 inch diameter PVC pipe with a butt-cap at one end. Each logger was sunk with a 2-pound weight and tethered to a fixed point using 16-gauge galvanized steel wire. Details of each loggers' placement is described below (Figure 2a, 2b, 2c).

The loggers ("Hobos") were calibrated and programmed to record water temperature at 30 minute intervals beginning on January 23, 2009. Data was uploaded from the loggers on May 28, 2009, however the loggers remain deployed to record thermal conditions during the hotter summer months. Daily averages were calculated from each location and graphed along with precipitation data and air temperature data recorded at a permanent weather station in Santa Clara, approximately 8 miles east of the Study Area. These data are presented in Section 3.1.1 below.

All eight water temperature logger locations are described below and shown in Figures 2a, 2b, 2c, and Table 2.

Hobo1: Monte Bello Creek - within MASR3 - approximately 3,950 feet (1,200 meters) upstream from the Property line.
Hobo2: Monte Bello Creek - within MASR4 - approximately 5,100 feet (1,550 meters) upstream from the Property line.

Hobo3: South Fork Monte Bello Creek - within MASR4 - approximately 5,900 feet (1,800 meters) upstream from the Property line (approximately 230 feet (70 meters) upstream from the confluence with North Fork Monte Bello Creek.

Hobo4: Permanente Creek - within PASR1 - at the confluence with the main stem Permanente Creek (Pond 14 diversion) and the Pond 14 outfall channel.

Hobo5: Permanente Creek - within PASR3 - immediately adjacent to the “Dinky Shed” - approximately 410 feet (125 meters) downstream of the Pond 9 outflow.

Hobo6: Permanente Creek - within PASR5 - approximately 70 feet (20 meters) downstream of the enclosed culvert.

Hobo7: Permanente Creek - within PASR8 - approximately 200 feet (60 meters) downstream of the Pond 4A outflow.

Hobo8: Permanente Creek - within PASR11 - approximately 460 feet (140 meters) upstream of the Kaiser Homestead.

2.1.2 Habitat Typing

Habitat typing surveys were conducted by two biologists in accordance with the methodology presented in the California Department of Fish and Game California Salmonid Stream Habitat Restoration Manual (SHRM). The inventory sampled approximately 10 percent of the habitat units within the surveyed length. All habitat units in the survey were classified by habitat type and their lengths were measured. Habitat types encountered for the first time were fully measured for all the parameters and characteristics and recorded on the SHRM habitat inventory form. Additionally, out of every ten habitat units listed on the field form, one is randomly selected to be fully measured. Because pool habitat tends to serve as a more important habitat feature for fish species, pools were measured for all the parameters and characteristics more frequently than the prescribed 10 percent protocol.

Four levels of classification used to describe physical fish habitat. Each higher level in the sequence includes more descriptive categories of habitat types. For this survey, habitat types were inventoried to a modified Level III/IV category. In a Level IV classification, which is the most thorough classification of stream habitat types listed in SHRM, there are a total of 24 unique habitat features used for the habitat inventory. A modified Level III/IV classifies the three major habitat units (riffle, pool, and flatwater) into:

- Riffle types are based off of surface gradient (riffle or cascade), with riffles categorized by gradient and cascades categorized by gradient and substrate type;
- Pool types are based off their location in the stream channel (main channel and lateral scour) and their cause of formation (plunge and step pools);
- Flatwater was only characterized as a run.

To reduce the complexity of the habitat analysis and to prevent significant variation if additional habitat typing surveys are performed in later years, only nine of the 24 unique habitat features were used. The main reduction in habitat units used in this survey was due to the simplification of pool type classification (using only four of 15 types) and using only one of five flatwater habitat types.

There are eleven components to the SHRM inventory form:

Flow and Water Quality - collected concurrently, and presented in a separate report entitled Hydrologic Investigation (Golder Associates, May 2010).

Channel Type - conducted according to the classification system developed and revised by David Rosgen (1994). Methodology is described in the SHRM.

Temperatures - water and air temperatures were measured and recorded every tenth habitat unit while habitat typing.

Habitat Unit Type - uses the 24 habitat classification types defined by in the SHRM. As previously described, only nine of the 24 habitat types were utilized for this survey.

Embeddedness - the depth of cobbles in pool tail-out areas is measured by the percent of the cobble that is surrounded or buried by fine sediment.

Shelter Rating - composed of those elements within a stream channel that provide juvenile salmonids protection from predation, reduce water velocities so fish can rest and conserve energy, and allow separation of territorial units to reduce density related competition for prey.

Substrate Composition - ranges from small silt/clay to large boulder and bedrock elements.

Canopy - recorded using modified handheld spherical densiometers as described in the SHRM.

Bank Composition and Vegetation - dominant types of both the right and left banks for each fully-described unit were selected from the habitat inventory form. Additionally, the percent of each bank covered by vegetation (including downed trees, logs, and rootwads) was recorded.

Large Woody Debris Count - all pieces partially or entirely below the elevation of bankfull discharge are counted and recorded.

Average Bankfull Width - measured and recorded at the first appropriate velocity crossover that occurs after the beginning of a new stream survey page (ten habitat units). These widths are presented as an average for the channel type reach.

2.2 Fish Assemblage

Several methodologies were employed to determine the fish assemblage within the Permanente and Monte Bello watersheds. Fish assemblage is defined as a group of fish species contained within a given water body. Permanente Creek was surveyed using fish sample reaches, snorkel surveys, and incidental observations. Monte Bello Creek was surveyed using fish sample reaches, stream bank observations and incidental observations. The following methods are outlined below, with the exception of incidental detections which are defined in section 2.5.

2.2.1 Fish Sampling

Two biologists conducted seine net sampling within a total of eleven (11) fish sample reaches created within Permanente and Monte Bello Creek. Nine (9) fish sample reaches were established on Permanente Creek and two (2) fish sample locations on Monte Bello Creek, see Figures 2a, 2b and 2c.

Each fish sample reach covered approximately 100 feet (31 meters), and sampled various habitat features that were inventoried during the habitat typing survey (i.e. pool, riffle, run). Block nets were placed upstream and downstream of the sample reach to contain fish within the reach, then two biologists sampled the reach using a seine net (10'x4'x1/8"). If geomorphic or in-stream cover prevented the seine net from being hauled, a modified "kick down" method was employed. Two sampling efforts took place on February 11 and 12 and May 6, 7 and 12, were completed in both watersheds to sample fish across varying flow conditions.

Number of individuals, species and relevant physiological data was recorded. All measurements of fish were taken in standard length (SL) as defined by Murphy and Willis (1996). Size classes are defined based on the Moyle (2002) description of average growth rates of Rainbow Trout in coldwater streams; with fry measuring less than two inches SL, juveniles measuring two inches to 4.7 inches SL, and adults measuring greater than 4.7 inches SL.

2.2.2 Snorkel Survey

A snorkel survey (fish count) was conducted once peak flows had receded. On Permanente Creek, reaches PASR1 through PASR8 were surveyed on April 14 and 15; reaches PASR10 through PASR12 were surveyed on April 22, 2009. PASR9 was not surveyed due to the extensive dry portion within this reach and the shallow depths that dominated this low gradient section. Two biologists followed a modified Hankin-Reeves methodology which classifies the streams into a number of habitat types and then randomly samples each habitat type (Koehler 2005). Habitat type classification was conducted prior to the snorkel survey, and was outlined in section 2.1.2. Stream reaches within the Permanente and Monte Bello watersheds with suitable habitat were surveyed beginning at the downstream Study Area boundary moving upstream, with the recording biologist trailing behind the primary observer. A minimum of 328 feet (100 meters), or 20 percent of each ASR, was surveyed. Surveys were concluded when fish were no longer observed, the stream channel went dry, a barrier to spawning migration was reached, or the Study Area boundary was reached.

Fish numbers were standardized to the average distance surveyed in each ASR and the resulting enumeration and composition data are presented in Section 3.2.2 below.

2.2.3 Stream Bank Observation

A stream bank observation was utilized in the Monte Bello Creek watershed as an alternative to the snorkel surveys described above. This methodology was chosen due to the shallow water condition within Monte Bello Creek. This survey was carried out concurrently with the Permanente Creek snorkel survey to determine the presence or absence of fish within Monte Bello Creek. Two biologists followed the SHRM methodology by walking the length of all ASRs within Monte Bello Creek and scanning for fish visually while wearing polarized glasses. Based of the SHRM, this methodology of observation of fish from the stream bank or other vantage point is a commonly used technique to determine presence or absence of fish.

2.3 Amphibians

A tandem double observer nocturnal visual encounter survey (VES) methodology was used to survey for amphibians within suitable aquatic habitats within the Study Area.

Permanente and Monte Bello Creeks were divided into 1,650 foot (500 meter) Aquatic Survey Reaches (PASR and MASR respectively). Each reach was walked at least once. The primary observer used a combination of head-lamp and flashlight to identify animals within the stream and immediately adjacent banks. The secondary observer would follow the primary observer and record data as well as scan the banks of the stream within and up to 16 feet (5 meter) of the stream edge. Each animal was identified to species, lifestage, and sex (if possible).

Two nocturnal VES surveys were conducted in order to account for various species differences in breeding behavior and ecological requirements. The first VES series was conducted on February 24, 25, and March 3, 2009. Surveys began one hour after sunset and concluded at least one hour before sunrise. Alternating “odd numbered” reaches were walked during the first survey series (MASR1, MASR3, PASR1, PASR3, PASR5, etc.). The second VES series was conducted on May 12, 13, and 14, 2009. Similarly to the first surveys, opposite alternating “even numbered” reaches were walked (MASR2, MASR4, PASR2, PASR4, PASR6, etc.). PASR1 was surveyed during both VES series, on February 24 and again on May 12, 2009. At the start of VES surveys, PASR1 was the only reach within the Study Area known to be inhabited by Federally Threatened California Red-legged Frog (CRLF); (*Rana draytonii*). As such, the surveys were structured to capture both the presence of CRLF in various lifestages. Yellow Creek and Wild Violet Creek were not included in VES surveys, however incidental observations from these tributaries are shown in Tables 11 and 12.

The number of detections made during VES were standardized to 100 minutes of survey effort per 1,650 (500 meter) survey reach. Standardized detections were rounded to the nearest whole non-zero number (e.g. 0.4 detections = 1 detection).

2.4 Benthic Macroinvertebrates

Between April 14, 2009 and April 16, 2009, WRA Biologists collected 18 benthic macroinvertebrate samples (BMI) at six sites (four sites along Permanente Creek and two sites along Monte Bello Creek) in accordance with the California Stream Bioassessment Procedure (CSBP 2003) for non point source assessments. The CSBP is a regional adaptation of the national U.S. Environmental Protection Agency's (EPA) Rapid Bioassessment Protocols for wadeable streams (Barbour et al. 1999), authored by the California Department of Fish and Game.

2.4.1 Physical Habitat Quality

The physical habitat was scored at each BMI sample location. Ten (10) parameters were scored according to the descriptions in Barbour et al. (1999):

Epifaunal substrate/available cover - the relative quantity and variety of natural structures in the stream, such as cobble (riffles), large rocks, fallen trees, logs and branches, and undercut banks, available as refugia, feeding, or sites for spawning and nursery functions of aquatic macrofauna.

Embeddedness - the extent to which rocks (gravel, cobble, and boulders) and snags are covered or sunken into the silt, sand, or mud of the stream bottom.

Velocity/Depth Combinations - included for high-gradient streams under this parameter as an important feature of habitat diversity.

Sediment Deposition - the amount of sediment that has accumulated in pools and the changes that have occurred to the stream bottom as a result of deposition.

Channel Flow Status - the degree to which the channel is filled with water.

Channel Alteration - Channel alteration is a measure of large-scale changes in the shape of the stream channel.

Frequency of Riffles or Bends - a way to measures the the heterogeneity occurring in a stream.

Bank Stability -a measure of whether the stream banks are or have the potential to eroded.

Bank Vegetative Protection - a measure of the amount of vegetative protection afforded to the stream bank and the near-stream portion of the riparian zone.

Riparian Vegetative Zone Width - requires measures the width of natural vegetation from the edge of the stream bank out through the riparian zone.

2.4.2 Benthic Macroinvertebrates

BMI samples were collected from six sites. At each site, three randomly chosen transects running perpendicular to the flow of the stream were sampled. Three locations representing the habitats along the transect were sampled within a 2 ft area upstream of a 1 ft wide D-frame kick-net with 0.5 mm mesh. The duration of sampling ranged from 60-120 seconds, depending on the amount of boulder and cobble-sized substrates that required rubbing by hand. This composite sample was transferred into a wide-mouth jar containing alcohol as a preservative.

All six sample locations are described below and are shown in Figures 2a, 2b, and 2c and Table 2.

PBMI 1: Permanente Creek - Pond 14 diversion. Approximately 200 feet upstream from the Property Boundary.
PBMI 2: Permanente Creek - Downstream of the Rock Plant
PBMI 3: Permanente Creek - Approximately 1000 feet downstream of Pond 4A discharge.
PBMI 4: Permanente Creek - Approximately 300 feet upstream of the Kaiser Homestead.

MBMI 1: Monte Bello Creek - Approximately 2500 feet upstream of the Property boundary
MBMI 2: Monte Bello Creek - Approximately 200 feet downstream of the South Fork - North Fork confluence.

All BMI samples remained under the custody of WRA and were processed by WRA biologists. Organisms were removed from the sample and placed in a petri dish for identification under a stereomicroscope. All invertebrates were separated from the surrounding detritus and transferred to vials containing 70 percent ethanol. BMIs were then identified to a standard taxonomic level, typically family level for arthropods and order or class for non-arthropods using standard taxonomic keys (McCafferty 1999, Merritt and Cummins 1996, Voshell 2002).

A description of the biological metrics used to describe characteristics of the BMI community is shown in Table 3 below. Some of the biological metrics are used universally and some are more regional having evolved over recent years of use in California streams. They have been categorized into the following types (Barbour et al. 1999):

Richness Measures - reflects the taxonomic diversity of the aquatic assemblage where increasing diversity correlates with increasing health of the assemblage and suggests that niche space, habitat and food sources are adequate to support survival and propagation of a variety of species.

Composition Measures - reflects the relative contribution of the population of individual taxa to the total fauna.

Tolerance/Intolerance Measures - reflects the relative sensitivity of the community to aquatic perturbations. The taxa used are usually pollution tolerant and intolerant, but are generally nonspecific to the type of stressors. Percent Hydropsychid Cassidflies and Baetid mayflies are regional metrics that have evolved to be particularly useful in California. The metric values usually increase as the effects of pollution in the form of organics and sedimentation increases.

Functional Feeding Groups - provides information on the balance of feeding strategies in the aquatic assemblage. The functional feeding group composition is a surrogate for complex processes of trophic interaction, production and food source availability.

Table 3. Bioassessment metrics used to describe characteristics of the benthic macroinvertebrate (BMI) community collected from Permanente and Monte Bello Creeks.

Biological Metric	Description
Richness Measures	
Taxa Richness	Total number of individual taxa
EPT Taxa	Number of taxa in the Ephemeroptera (mayfly), Plecoptera (stonefly) and Trichoptera (caddisfly) insect orders
Ephemeroptera Taxa	Number of mayfly taxa (families)
Plecoptera Taxa	Number of stonefly taxa (families)

Trichoptera Taxa	Number of caddisfly taxa (families)
Composition Measures	
EPT Index	Percent composition of mayfly, stonefly and caddisfly larvae.
Modified EPT Index	EPT Index minus the more tolerant Hydropsychids and Baetids.
Shannon Diversity Index	General measure of sample diversity that incorporates richness and evenness (Shannon and Weaver 1963)
Tolerance/Intolerance Measures	
Tolerance Value	Value between 0 and 10 weighted for abundance of individuals designated as pollution tolerant (higher values) and intolerant (lower values)
Percent Intolerant Organisms	Percent of organisms in sample that are highly intolerant to impairment as indicated by a tolerance value of 0, 1 or 2
Percent Tolerant Organisms	Percent of organisms in sample that are highly tolerant to impairment as indicated by a tolerance value of 8, 9 or 10.
Percent Hydropsychidae	Percent of organisms in the caddisfly family Hydropsychidae.
Percent Baetidae	Percent of organisms in the caddisfly family Baetidae
Percent Dominant Taxa	Percent composition of the single most abundant taxon
Functional Feeding Groups	
Percent Gatherer - Collectors	Percent of macrobenthos that collect or gather fine particulate matter.
Percent Filterers - Collectors	Percent of macrobenthos that filter fine particulate matter.
Percent Scrapers	Percent of macrobenthos that graze upon periphyton*.
Percent Predators	Percent of macrobenthos that feed on other organisms.
Percent Shredders	Percent of macrobenthos that shreds coarse particulate matter.
*Periphyton is a complex mixture of algae, cyanobacteria, heterotrophic microbes, and detritus that is attached to submerged surfaces in most aquatic ecosystems.	

2.5 Incidental Detections

In the course of conducting surveys, detections of non-target species were recorded, including several species that were not detected in the course of the targeted surveys. These incidental detections are presented and described in Section 3.2 and 3.3 below.

3.0 SURVEY RESULTS

The following sections describe the results of the studies outlined in section 2.0 above.

3.1 Physical Results

3.1.1 Water Temperature

Water temperature is a critical component of defining suitable habitats for fish, amphibians and benthic macroinvertebrates. Thermal thresholds for Rainbow Trout as described by Moyle (2002) were used to assess temperature suitability for juvenile Rainbow Trout rearing habitat.

Permanente Creek

Water temperature monitoring indicated widely varying temperature conditions between the 5 Hobo locations within Permanente Creek. Hobo location 7 (Hobo7) recorded both thermal extremes within Permanente Creek. The maximum daily temperature recorded in the creek was 24°C (75°F), and the minimum daily temperature recorded in the creek was 3.9°C (39°F).

Figure 3 shows the mean daily temperatures at five (5) Hobo locations along Permanente Creek overlaid with atmospheric data collected at California Weather Database Station CIMIS #69 in San Jose, California.

Monte Bello Creek

Water temperature monitoring indicated relatively uniform temperature conditions across the three Hobo locations in Monte Bello Creek. Maximum daily temperature recorded in the creek was 16.4°C (61.5°F) at station HOBO2 and the minimum daily temperature recorded was 5.4°C (41.7°F) also at station HOBO2.

Figure 4 shows the mean daily temperatures at three Hobo locations along Monte Bello Creek overlaid with atmospheric data collected at California Weather Database Station CIMIS #69 in San Jose, California.

3.1.2 Habitat Typing

Permanente Creek

The habitat inventory of Permanente Creek took place from April 6 though April 8 and on April 15, 2009. 21,410 feet (6,527 meters) of Permanente Creek was typed beginning at the downstream Property boundary working upstream. Habitat typing was concluded at the confluence of Permanente and Wild Violet Creeks. The habitat inventory took place between PASR1-PASR13. PASR14 and above were considered uninhabitatable to fish species and provided only marginal habitat for amphibian species.

Rosgen channel typing was conducted by the URS Corporation (URS) as part of their geomorphic survey, conducted during the same 2009 survey period. In total, 16 cross sections were taken. Rosgen channel type for PASR1-PASR13 is provided in Table 4.

Table 4. Rosgen Channel Types for Permanente Aquatic Survey Reaches, Provided by URS

Aquatic Survey Reach	Total Length (ft)	Rosgen Channel Type(s)***	Comments
PASR1	2,103.2*	G4, F4	Includes Side Channel below Pond 14 and Pond 14
PASR2	1,640.4	N/A	Concrete lined channel
PASR3	1,640.4	A4	
PASR4	1,640.4	A4	
PASR5	1,640.4	B4c, A3	
PASR6	1707.3**	A3	
PASR7	1640.4	B2a	
PASR8	1640.4	B3	
PASR9	1640.4	B3/B3a, B4c	
PASR10	1640.4	D4/6	Gravel and silt/clay are the dominant substrate
PASR11	1640.4	A4	
PASR12	1640.4	B4	
PASR13	1640.4	A4	

* - PASR1 has a side channel (length 462.8 ft) incorporated in the survey reach.
**- PASR6 has a side channel (length 66.9 ft) incorporated in the survey reach.
***Rosgen Channel Types:

- A = steep, narrow, cascading, step-pool, high energy debris transporting and usually associated with depositional soils.
- B = moderately entrenched, riffle dominated, infrequently spaced pools, very stable plan and profile, stable banks, moderate gradients and low width-to-depth ratios.
- C = low gradient, meandering, point-bar, riffle/pool, alluvial, broad a well defined floodplain.
- D = multiple channels with longitudinal and transverse bars, very wide with eroding banks.
- F = highly entrenched, meandering riffle/pool, low gradient with a high width-to-depth ratio.
- G = entrenched "gully" step-pool dominated, moderate gradients with low width-to-depth ratios.

Channel types that have a substrate classification number of six associated with them are dominated by bedrock. A two depicts boulder dominated substrate, three indicates a primarily cobble dominated system and a four channel type exhibits gravel as the primary substrate.

Additionally, a channel type that has a lower case letter following the substrate classification number indicates that the reach exhibits some of the characteristics of that category type.

Temperature

Water temperatures taken by field crews during the habitat typing survey period ranged from 7.5° to 16°C (46° to 61°F), and air temperature ranged from 9.5° to 25°C (49° to 77°F).

Habitat Unit Type

The frequency of Level II habitat type occurrences along Permanente Creek amount to 35 percent pool units, 20 percent flatwater units, 40 percent riffle units, 4 percent culvert units and 1 percent dry units (Figure 5). Based on the total length of this survey, Level II habitat units consist of 17 percent pool units, 29 percent flatwater units, 37 percent riffle units, 8 percent culvert units and 9 percent dry units (Figure 6).

Nine (9) level IV habitat types were identified and used. The most abundant habitat types (by frequency of occurrence) were 21 percent Low Gradient Riffle units, 20 percent Run units, and 17 percent Mid-Channel Pool units (Figure 7). The dominant habitat types (by total length) were Run units (29 percent), Low Gradient Riffle units (22 percent), and High Gradient Riffle units (13 percent).

Ninety-six pools were identified along Permanente Creek. Main channel pools comprised 71.9 percent of pools encountered with scour pools making up the remaining 28.1 percent (Figure 8). Main channel pools comprise 83 percent of the total length of all pools. Permanente Creek pools are relatively shallow, with only 1 of the 31 (3 percent) pools measured having a depth of two feet or greater.

Shelter Rating

Shelter ratings for each habitat unit is expressed using a scale from 0-300. A pool with a shelter rating of 100 is desirable. Riffle habitats had a mean shelter rating of 72, flatwater habitats had a mean shelter rating of 47, and pool habitats had a mean shelter rating of 133. Of the pool types, main channel pools had a mean shelter rating of 118 and scour pools had a mean shelter rating of 172.

Within Permanente Creek on a whole, bubble curtains provide the dominant in-stream cover, and the second most dominant form of cover for the creek is terrestrial vegetation. Figure 9 details pool cover composition along Permanente Creek.

Substrate Composition

Table 5 summarizes dominant substrates by habitat type. Figure 10 depicts the dominant substrate observed in pool tail-outs.

Table 5. Dominant Substrates By Habitat Type in Permanente Creek

Habitat Type*	Total Habitat Units	Habitat Units Fully Measured	Percent Total Dominant						
			Silt/Clay	Sand	Gravel	Small Cobble	Large Cobble	Boulder	Bedrock/ Calcified Substrate
Low Gradient Riffle (LGR)	57	14	0	7	21	36	0	0	36
High Gradient Riffle (HGR)	45	12	0	0	25	25	8	0	42
Cascade (CAS)	8	5	20	20	0	0	0	20	40
Bedrock Sheet (BRS)	1	1	0	0	0	0	0	0	100
Run (RUN)	55	16	31	0	50	6	0	0	13
Mid-channel Pool (MCP)	48	18	17	22	28	11	0	0	22
Step Pool (STP)	21	6	0	33	33	0	0	0	33
Corner Pool (CRP)	3	0	0	0	0	0	0	0	0
Plunge Pool (PLP)	24	9	11	11	33	22	0	0	22
Culvert (CUL)	12	0	0	0	0	0	0	0	0
*Dry sections of the creek are not incorporated in this table.									

Canopy

The mean percent canopy cover along the surveyed length of Permanente Creek was 77 percent. Hardwood trees comprise 100 percent of the canopy cover along Permanente Creek (Figure 11). On average, 23 percent of the canopy along Permanente Creek was described as open. Individual reach analysis for inventoried habitat features for Permanente Creek is provided in Appendix A.

Monte Bello Creek

The habitat inventory of Monte Bello Creek took place from April 6 though April 8 and on April 15, 2009. 6,674 feet (2,034 meters) of Monte Bello Creek was typed beginning at the downstream Study Area boundary and working upstream. Rosgen channel typing was completed at three cross section locations by WRA. The results of the Rosgen typing and how they pertain to the aquatic survey reaches is provided in Table 6.

Table 6. Rosgen Channel Types for Monte Bello Aquatic Survey Reaches

Aquatic Survey Reach	Total Length (feet)	Rosgen Channel Type(s)*	Comments
MASR1	1,640.4	B4	
MASR2	1,640.4	B4	
MASR3	1,640.4	A2/B2	Channel type A characteristics except for greater width-to-depth ratio typical of B.
MASR4	1,743.1	B1/A1	Channel type B characteristics except higher gradient slope typical of A.
*Rosgen Channel Types: · A1/A2 = steep, narrow, cascading, step-pool, high energy debris transporting and usually associated with depositional soils and boulder or bedrock dominated substrate. · B = moderately entrenched, riffle dominated, infrequently spaced pools, very stable plan and profile, stable banks, moderate gradients and low width-to-depth ratios with gravel or bedrock dominated substrate.			

Temperature

Water temperatures taken by field crews during the habitat typing surveys ranged from 8° to 10°C (48° to 50°F), and air temperature ranged from 10.5° to 12°C (51° to 54°F).

Habitat Unit Type

The Level II habitat occurrence frequency within Monte Bello Creek amounted to 19 percent flatwater units, 41 percent riffle units, 41 percent pool units (Figure 12). Based on total length of Level II habitat types, 21 percent were flatwater units, 43 percent were riffle units and 36 percent were pool units (Figure 13).

Seven level IV habitat types were identified in Monte Bello Creek. The most abundant habitat types (by frequency of occurrence) were high gradient riffle units (28 percent), run units (19 percent), and plunge pool and step pool units (14 percent) (Figure14). The dominant habitat types (by percent total length) high gradient riffle units (34 percent), step pool units (21 percent) and run units (20 percent).

Sixty (60) pools were identified along Monte Bello Creek. Main channel pools were most abundant at 65 percent frequency, and comprising 75 percent of all pools by length (Figure 15). Monte Bello pools are relatively shallow, with only 1 of 18 (6 percent) pools measured for depth having a depth of two feet or greater.

Shelter Rating

Shelter ratings for each habitat unit is expressed using a scale from 0-300. A pool with a shelter rating of 100 is desirable. Riffle habitat types had a mean shelter rating of 37, flatwater habitat types had a mean shelter rating of 13, and pool habitat had a mean shelter rating of 80. Main channel pools had a mean shelter rating of 66; scour pools had a mean shelter rating of 98.

Within Monte Bello Creek, bubble curtains are the dominant cover type, and the second most dominant for of cover within Monte Bello Creek is boulders. Figure 16 details pool cover types in Monte Bello Creek.

Substrate Composition

Table 7 summarizes dominant substrates by habitat type. Gravel was observed in 52 percent of pool-tail outs, and sand was observed in 29 percent of pool-tail outs (Figure 17).

Table 7. Summary of Dominant Substrates by Habitat Type in Monte Bello Creek

Habitat Type	Total Habitat Units	Habitat Units Fully Measured	Percent Total Dominant						
			Silt/Clay	Sand	Gravel	Small Cobble	Large Cobble	Boulder	Bedrock
Low Gradient Riffle (LGR)	8	3	0	33	33	33	0	0	0
High Gradient Riffle (HGR)	42	7	0	29	57	0	0	14	0
Cascade (CAS)	10	4	0	25	50	0	0	25	0
Run (RUN)	28	6	0	50	50	0	0	0	0
Mid-channel Pool (MCP)	19	5	0	80	20	0	0	0	0
Step Pool (STP)	20	5	0	40	60	0	0	0	0
Plunge Pool (PLP)	21	8	0	38	50	0	0	0	13

Canopy

The mean percent canopy cover for the surveyed length of Monte Bello Creek was 84 percent. Hardwood trees comprise 100 percent of the canopy cover along Monte Bello Creek. On average, 16 percent of the canopy along Monte Bello Creek was described as open. Figure 18 describes the canopy cover along Monte Bello Creek. Individual reach analysis for inventoried habitat features for Monte Bello Creek is provided in Appendix A.

3.2 Fish Assemblage Results

3.3.1 Fish Assemblage

Permanente Creek

Fish assemblage data for Permanente Creek was compiled from two fish sample surveys, a snorkel survey and incidental observations recorded during the reconnaissance, habitat typing, and two amphibian focused VES. A total of three fish species were documented within the surveyed reaches of Permanente Creek during the duration of this study; Rainbow Trout (*Oncorhynchus mykiss*), Sacramento Sucker (*Catostomus occidentalis*), and Western Mosquito Fish (*Gambusia affinis*).

Table 8 shows observed species according to ASR and rough species distribution within the Study Area. Solid squares represent species that were detected in a given reach during the fish assemblage survey which includes the fish sample reaches and the snorkel survey. Open squares represent detections that were made in a given reach in the course of performing non-fish focused surveys (i.e. habitat typing).

A survey conducted by URS in 2000 documented Rainbow Trout and Threespine Stickleback (*Gasterosteus aculeatus*) within Permanente Creek. That survey coincided with dewatering of Ponds 13 and 22 for maintenance purposes. Rainbow Trout ranging from 3.5 to 12 inches were recorded during that survey. URS also noted that upstream of Pond 13 (the area referenced in this report as PASR10 and PASR11) a greater diversity of Rainbow Trout age groups were present compared to other sections of the creek. These reaches are also where Threespine Stickleback were documented. However, this species was not observed during the course of this study. URS concluded that Permanente Creek supports a small self-sustaining population of resident native coastal Rainbow Trout, which is consistent with the findings of this study.

Refer to the BRA which discusses the potential for Steelhead in detail. The results of that assessment determined that Steelhead are unlikely to occur due to downstream barriers to upstream migration. Therefore, Rainbow Trout within the Study Area are not the Federally Threatened Steelhead which are anadromous.

Table 8. Presence of Fish Species by Reach in Permanente and Monte Bello Creeks.

Watershed		Permanente													Yellow Creek	Wild Violet Creek	Monte Bello			
Aquatic Survey Reach Number		1	2	3	4	5	6	7	8	9	10	11	12	13	1	1	1	2	3	4
Rainbow Trout *Oncorhynchus mykiss*	Adult	■	■	■				□		■	■	■	■	□						
	Juvenile	■		□			□			■	■	■	□							
	Fry										■	□	■	□						
Sacramento Sucker *Catostomus occidentalis*		■	□																	
Western Mosquitofish *Gambusia affinis*		■																		

■ - Positive detection made during Fish Assemblage Surveys
□ - Incidental Detection

Monte Bello Creek

Fish were surveyed for in Monte Bello Creek by conducting two rounds of fish sample surveys, a stream bank survey and the compilation of incidental observations recorded during reconnaissance, habitat typing, and two focused amphibian VES. No fish were observed within Monte Bello Creek in the Study Area. Because all survey method results were negative for fish, no fish assemblages are present in Monte Bello Creek.

3.2.1 Fish Sampling

Permanente Creek

Two sampling events took place at the 9 fish sample reaches within Permanente Creek on February 12 and May 5, 2009. The results the fish sample surveys are presented in Table 9 and Figure 19. Size classes of Rainbow Trout captured during fish sampling are provided in Table 10 and graphically in Figure 20. Figure 21 shows the age class breakdown of Rainbow Trout as percent of total catch.

Table 9. Permanente Creek Fish Sample Results.

Fish Sample Reach (PASR)	Date	Species	Number	Size Class*	Time	Water Temp (°C)	Air Temp (°C)	Reach Length (ft.)
PFS1 (PASR1)	2/12/09	Rainbow Trout	1	A	1030	9	7.5	100
		Rainbow Trout	3	J				
		Sacramento Sucker	3	4.5", 2 x6"				
	5/6/09	Rainbow Trout	1	A	1100	10.5	21	100
PFS2 (PASR2)	2/12/09	-	-	-	1200	10	10	130
	5/6/09	-	-	-	1220	16	26	130
PFS3 (PASR4)	2/12/09	-	-	-	1330	12.5	9	125
	5/6/09	Rainbow Trout	1	A	1300	16.5	24	125
PFS4 (PASR4)	2/12/09	-	-	-	1400	N/A	9	N/A
	5/6/09	-	-	-	1415	18	25	100
PFS5 (PASR5)	2/12/09	-	-	-	1430	7.5	9	100
	5/6/09	-	-	-	1500	18	23	100
PFS6 (PASR6)	2/12/09	-	-	-	1520	9	9	100
	5/6/09	-	-	-	1600	18	22	100
PFS7 (PASR7)	2/12/09	-	-	-	1620	8.5	7	100
	5/7/09	-	-	-	1530	18.5	21	100
PFS8 (PASR10)	2/11/09	Rainbow Trout	1	A	1340	9	6	130
		Rainbow Trout	1	F				
		Rainbow Trout	1	J				
	5/13/09	-	-	-	1700	12	24	130
PFS9 (PASR12)	2/11/09	Rainbow Trout	3	F	1605	8.5	-	100
		Rainbow Trout	1	J				
	5/13/09	Rainbow Trout	3	J	1730	11	21	100
		Rainbow Trout	1	A				
*Size Class	F = Fry		J = Juveniles			A = Adults		

3.2.2 Snorkel Surveys

Snorkel survey results are presented in Table 10 and Figure 22. Size classes of observed Rainbow Trout during the snorkel survey are provided graphically in Figure 23. Figure 24 provides the age class breakdown of Rainbow Trout observed based on the percent total detections.

Table 10. Permanente Creek Snorkel Survey Results.

Reach	Length Surveyed (ft)	Species	Rainbow Trout			Other Fish	Standardized Number*
			Fry (< 2" SL)	Juvenile (2 - 4.7" SL)	Adult (>4.7" SL)		
PASR1 - Side Channel and Pond 14	154	Sacramento Sucker	-	-	-	1	3
		Mosquito Fish	-	-	-	25	71
PASR1	557.6	Rainbow Trout	0	2	6	-	6
		Sacramento Sucker	-	-	-	4	3
PASR2	360.8	Rainbow Trout	0	0	0	-	0
PASR3	249.3	Rainbow Trout	0	0	1	-	2
PASR4	328	Rainbow Trout	0	0	0	-	0
PASR5	328	Rainbow Trout	0	0	0	-	0
PASR6	415	Rainbow Trout	0	0	0	-	0
PASR7	328	Rainbow Trout	0	0	0	-	0
PASR8	437	Rainbow Trout	0	0	0	-	0
PASR9	0	Rainbow Trout	NA	NA	NA	NA	NA
PASR10	564	Rainbow Trout	0	5	2	-	6
PASR11	894	Rainbow Trout	0	5	17	-	11
PASR12	987	Rainbow Trout	0	5	5	-	5
PASR13	246	Rainbow Trout	0	0	3	-	5
PASR14	328	Rainbow Trout	0	0	0	-	0

* Standardized number of fish observed for the mean 440 ft snorkel survey distance.

3.3 Amphibian Results

Section 3.3.1 presents amphibian presence and distribution within Permanente and Monte Bello Watersheds including detections during focused surveys and incidentally. Section 3.3.2 presents the results of the VES including distribution and relative density by ASR.

3.3.1 Amphibian Assemblage

Table 11 presents the observed aquatic amphibian species by reach. Aquatic amphibian species are those species whose life history requires aquatic habitat in order to complete their lifecycle. Table 12 presents the observed terrestrial amphibian species by reach. Terrestrial amphibian species are those that do not require aquatic habitats to complete their life cycle. Each of the terrestrial species below are in the family Plethodontidae, or lungless salamanders.

The following tables show which species were observed in each ASR. Solid squares represent species that were detected in a given reach during the course of nocturnal VES. Open squares represent incidental detections that were made in a given reach in the course of performing non amphibian focused surveys (i.e. habitat typing).

Only one special-status amphibian species was detected during the course of this study. The Federally Threatened California Red-legged Frog (*Rana draytonii*; CRLF) was first documented within the Study Area during a field survey conducted by Radian International in September 1997. This survey recorded four CRLF utilizing a pond approximately 100 feet due north from the Pond 14 diversion gate. This pool, described as being approximately five feet long by 10 feet wide and approximately three feet deep, has since been breeched by channel scour and no longer holds water.

Subsequent surveys conducted by URS in 2000 and Rana Resources in 2006, 2007 and 2008 have documented CRLF occupying Ponds 14 and 22. The results of the present study are consistent with recent reports prepared by Rana Resources (2006a, 2006b, 2007, 2008a, 2008b, 2008c). Within PASR1, CRLF adults, egg masses and larvae were detected in Pond 14. CRLF adults were observed in Pond 22, although no signs of breeding were observed in Pond 22 during the 2009 breeding period. Furthermore the channel associated with the Pond 14 outfall contains one pool that is nearly 3 feet deep. CRLF adults were consistently observed in this pool. CRLF larvae were also observed in the section of stream below Pond 14 to the confluence, including the plunge pool below the Pond 14 diversion gate and the aforementioned pool. These larvae are believed to have been washed down from Pond 14, and are not believed to represent breeding occurring in this section of stream. No CRLF were documented in any other Aquatic Survey Reach.

On May 7, 2009, WRA biologists documented a single sub-adult CRLF within the Monte Bello Creek Watershed, approximately 2,800 feet (850 meters) upstream from the Property boundary. The frog was in the uplands approximately 17 feet (5 meters) away from the stream channel on the south bank. A detailed CRLF habitat assessment of Monte Bello Creek was prepared by Dr. Mark Jennings of Rana Resources and is appended to WRAs Biological Resources Assessment report as Appendix D.

Table 11. Presence of Aquatic Amphibian Species by Reach and Lifestage.

Watershed		Permanente													Yellow Creek	Wild Violet Creek	Monte Bello			
Aquatic Survey Reach Number		1	2	3	4	5	6	7	8	9	10	11	12	13	1	1	1	2	3	4
California Red-legged Frog *Rana draytonii*	Adult	■																□		
	Larvae	■																		
	Egg	■																		
Pacific Tree [=Chorus] Frog *Hyla [=Pseudacris] regilla*	Adult	■		■		■	■						■							
	Larvae	■																		
California Giant Salamander *Dicamptodon ensatus*	Adult							■				□	■				■	□		■
	Larvae						■				■	■	■	■	□	□	■	■	■	■
California Newt *Taricha tarosa*	Adult	■		□		■	■	■	■	■	■	■	■	■	□	□	□	■		■
Rough-skinned Newt *Taricha granulosa*	Adult				■	■	■	■	■	■	■	■	■	■				■	■	■

Watershed		Permanente													Yellow Creek	Wild Violet Creek	Monte Bello			
Aquatic Survey Reach Number		1	2	3	4	5	6	7	8	9	10	11	12	13	1	1	1	2	3	4
Western [=Boreal] Toad *Bufo [=Anaxyrus] boreas*	Adult	□																		
	Larvae	■																		

■ - Positive detection made during Visual Encounter Surveys □ - Incidental Detection

Table 12. Presence of Terrestrial Amphibian Species by Reach

Watershed	Permanente													Yellow Creek	Wild Violet Creek	Monte Bello			
Aquatic Survey Reach Number	1	2	3	4	5	6	7	8	9	10	11	12	13	1	1	1	2	3	4
Ensatina Salamander *Ensatina eschscholtzii*	■						■				■	□				■			
Arboreal Salamander *Aneides lugubris*							□												
California Slender Salamander *Batrachoseps attenuatus*	■										■						□	□	■

■ - Positive detection made during Visual Encounter Surveys □ - Incidental Detection

3.3.2 Visual Encounter Survey Results

The following VES results are presented by watershed.

Permanente Creek

Overall, time-weighted detections of amphibians were highest in PASR1. No amphibian detections were made within PASR2. Approximately 50 percent of both PASR8 and PASR9 are dry for all but several weeks during the highest flows of the year.

Figure 25 presents the number of time-weighted amphibian detections by ASR in Permanente Creek. Figure 26 illustrates the species composition as a percentage of detections per reach along Permanente Creek.

Monte Bello Creek

Overall, time-weighted detections were highest in MASR4 with 173 detections, representing 64.1 percent of all amphibian detections within Monte Bello Creek. MASR2 had the second highest number of detections with 53 detections or 19.6 percent. MASR3 had 38 detections representing 14.1 percent, and MASR1 had 6 detections, representing 2.2 percent of all amphibian detections in Monte Bello Creek.

Figure 27 presents the number of time-weighted amphibian detections by ASR in Monte Bello Creek. Figure 28 illustrates the species composition as a percentage of detections per reach along Monte Bello Creek.

3.4 Benthic Macroinvertebrate Results

Physical habitat quality data are presented in Section 3.4.1 below. BMI data are presented in Section 3.4.2.

3.4.1 Physical Habitat Quality

Overall physical habitat quality at all six sample locations is very high (greater that 160). Furthermore, little variation in overall habitat quality is evident from the scores. Several sample locations received low scores in particular categories. Table 13 presents the summary table of the scored physical habitat parameters scored at each BMI sample location.

Table 13. Physical Habitat Quality Scores Based on CSBP Worksheet by Sample Location.

Stream Name	**Permanente**				**Monte Bello**	
Sample Number	**PMBI 1**	**PBMI 2**	**PBMI 3**	**PBMI 4**	**MBMI 1**	**MBMI 2**
Habitat Parameter						
Epifaunal Substrate / Available Cover	18	14	19	19	19	19
Embeddedness	12	13	1	12	13	15

Velocity/Depth Regimes	14	15	14	14	10	14
Sediment Deposition	19	19	18	16	17	18
Channel Flow Status	15	19	19	11	12	15
Channel Alteration	14	15	19	19	20	20
Frequency of Riffles (or bends)	19	19	18	16	19	15
Bank Stability	16	19	20	19	10	12
Vegetative Protection	20	17	20	20	20	20
Riparian Vegetative Zone Width	17	15	19	19	20	20
Physical Habitat Quality Score Total	**164**	**165**	**167**	**165**	**160**	**168**

3.4.2 Benthic Macroinvertebrate Results

Richness Measures

Overall taxa richness, Plecoptera taxa and Trichoptera taxa varied little between sample locations. Both samples taken from Monte Bello Creek had higher Ephemeroptera diversity than samples taken from Permanente Creek. Additionally, both samples collected from Monte Bello Creek and the upstream-most sample from Permanente Creek had high overall EPT diversity with the downstream-most sample in Permanente Creek having the lowest number of EPT taxa. Results of the BMI richness measure by location is presented in Table 14. Figure 29 shows BMI measures by sample location.

Table 14. Benthic Macroinvertebrate Richness Measures by Sample Location.

Stream Name	**Permanente Creek**				**Monte Bello Creek**	
Sample Number	**PMBI1**	**PBMI2**	**PBMI3**	**PBMI4**	**MBMI1**	**MBMI2**
Richness Measures						
Taxa Richness	20	24	24	26	19	26
EPT Taxa	8	11	10	12	12	13
Ephemeroptera Taxa	1	1	3	3	5	5
Plecoptera Taxa	1	1	2	3	1	3
Trichoptera Taxa	6	9	5	6	6	5

Composition Measures

Within Permanente Creek, overall EPT index was higher at sample locations PBMI2 and PBMI4 in comparison to sample locations PBMI1 and PBMI3. Both sample locations within Monte

Bello Creek have a higher composition of EPT taxa than within any sample location on Permanente Creek. However, when the more tolerant Hydropsychid caddisflies and Baetid mayflies are removed from the analysis, modified EPT composition at sample locations PBMI2, PBMI3, and PBMI4 are similar, while lower at PBMI1. Modified EPT composition along Monte Bello Creek remains higher than modified EPT composition along Permanente Creek. Figure 30 shows BMI composition measures by sample location.

Shannon Diversity Index is similar across all sample locations. This mimics the lack of variation observed in taxa richness, suggesting that all BMI samples were relatively uniform in overall diversity and evenness. Figure 31 shows Shannon Diversity Index values by sample location.

Table 15. Benthic Macroinvertebrate Composition Measures by Sample Location.

Stream Name	**Permanente Creek**				**Monte Bello Creek**	
Sample Number	**PMBI1**	**PBMI2**	**PBMI3**	**PBMI4**	**MBMI1**	**MBMI2**
Composition Measures						
EPT Index	40.0	45.8	41.7	46.2	63.2	50
Modified EPT Index	30.0	37.5	37.5	38.5	52.6	42.3
Shannon Diversity Index	1.9	2.0	1.5	2.4	1.4	1.6

Tolerance/intolerance Measures

Tolerance values are all +/- 0.5 of each other, suggesting little difference between sample locations, however tolerant versus intolerant organisms are different across sample locations. The percent of the sample dominated by one taxa was much higher in both of the samples taken in Monte Bello Creek than in Permanente Creek. Results for BMI tolerance measures is presented in Table 16. Figure 32 shows tolerance/intolerance values by sample location.

Table 16. Benthic Macroinvertebrate Tolerance/Intolerance Measures by Sample Location.

Stream Name	**Permanente Creek**				**Monte Bello Creek**	
Sample Number	**PMBI 1**	**PBMI 2**	**PBMI 3**	**PBMI 4**	**MBMI 1**	**MBMI 2**
Tolerance/Intolerance Measures						
Tolerance Value	5.3	5.6	5.7	5.2	5.2	5.2
Percent Intolerant Organisms	1	12	4	14	11	10
Percent Tolerant Organisms	7	24	3	6	0	1
Percent Hydropsychidae	10.2	11.7	0	0.5	3.4	2.0
Percent Baetidae	23.1	6.9	7.2	3.7	3.4	2.6

Percent Dominant Taxa	37	31	49	37	69	67

Functional Feeding Groups

Results of the BMI functional feeding group composition for each sample location is provided in Table 17. Figure 33 shows the composition of functional feeding groups as a percentage of organisms by sample location.

Table 17. Benthic Macroinvertebrate Functional Feeding Group Composition by Sample Location.

Stream Name	**Permanente Creek**				**Monte Bello Creek**	
Sample Number	**PMBI 1**	**PBMI 2**	**PBMI 3**	**PBMI 4**	**MBMI 1**	**MBMI 2**
Functional Feeding Groups						
Percent Gatherer-Collectors	61	41	57	51	79	74
Percent Filterers - Collectors	30	21	30	10	12	9
Percent Scrapers	0	7	0	10	2	5
Percent Predators	8	25	9	18	2	9
Percent Shredders	1	6	2	10	4	4

4.0 SUMMARY

WRA, Inc. collected biological and physical data on Permanente and Monte Bello Creeks and major tributaries within the 3,510-acre Lehigh Permanente Quarry property between January and May, 2009. Physical attributes that relate to habitat quality such as water temperature, frequency of riffles, runs and pools, channel width and depth, in-stream cover, substrate composition etc., were measured. Additionally, fish, amphibian and invertebrate communities that rely on these watersheds were inventoried according to current accepted scientific methods and are replicable over time.

Based on the results of this study, Permanente Creek can be broken into four biologically relevant reaches. The reach of Permanente from the downstream Property boundary to Pond 4A (PASR 8) is marked by an artificial flow regime in addition to groundwater-input base flows (Golder, 2010). While the physical habitat in this reach varies largely from natural to a trapezoidal concrete channel to two large in-stream sedimentation ponds, the aquatic fauna appears to be partially reliant on discharge flows from Pond 4A during the dry season.

The second reach is above the discharge at Pond 4A (PASR 8 - PASR10). This is the dry section of Permanente Creek that is much too ephemeral to allow benthic macroinvertebrates to colonize, or for fish or amphibians to carry out any phase of their life history. This dry section only conveys water during the wettest few weeks of the year, but during that short time, it may serve as a corridor for Rainbow Trout dispersing downstream that are known to breed between the upper end of the dry section and the confluence of Wild Violet Creek with Permanente Creek.

From the dry section to the confluence with Wild Violet Creek (PASR 10 - PASR 13), Permanente is a perennial cold-watered stream that supports a high diversity of benthic macroinvertebrates, a natural and diverse amphibian assemblage and a self-sustaining population of Rainbow Trout.

Above the confluence with Wild Violet Creek (PASR 13 - PASR 15), Permanente Creek becomes ephemeral and intermittent. During high flow periods, this portion of the creek is shallow, has no pools and supports little aquatic life. Only newts were observed above the confluence, no fish were found and very few benthic macroinvertebrates were observed. This section of the creek is high gradient with steep banks.

Monte Bello Creek is not significantly altered within the Study Area, and based on the results of this study, it can be divided into two distinct, biologically relevant reaches.

The Main Stem and South Fork are wholly perennial, and convey a majority of the surface flow through the system. Water temperatures remain consistently cool, although there are no fish in Monte Bello Creek within the Study Area as a result of downstream barriers. Monte Bello Creek supports a robust native amphibian assemblage whose numbers increase along a gradient traveling in a downstream to upstream direction. Furthermore, both benthic macroinvertebrate samples suggest that Monte Bello supports a diverse community of aquatic insects throughout the watershed.

The North Fork of Monte Bello Creek is ephemeral and intermittent. During the wettest periods of the year, it contributes, at most, approximately 10% of the total surface water to the Main Stem. Despite being approximately 2,000 feet long, the North Fork did not convey surface water for more than 300 feet upstream of the confluence with the Main Stem at any point during this study. No aquatic fauna were observed along the North Fork except for newts dispersing overland.

5.0 REFERENCES

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APPENDIX A. ADDITIONAL HABITAT DATA

Summary of Habitat Elements by Stream Reach for Permanente Creek

PASR1

Channel Types: G4, F4		Canopy Density (%): 70 Hardwood Component (%): 100	Pools by Stream Length (%): 31.4 Pool Frequency (%): 46.3
Reach Length (ft): 2,103.2			
Dry Channel Length (ft): 0		Dominant Bank Vegetation: Blackberry/poison oak Vegetation Cover (%): 76.8	<u>Residual Pool Depth (%)</u> < 2 ft deep: 80.0 2 to 2.9 ft deep: 20.0 3 to 3.9 ft deep: 0.0 >=4 ft deep: 0.0
Riffle/Flatwater Mean Width (ft): 5.8			
<u>Bankfull Width</u> Range (ft): 6.4 to 22.0 Mean (ft): 10.0		Dominant Shelter: Aquatic Vegetation	Mean Max Residual Pool Depth (ft): 1.1
		Occurrence of Large Woody Debris (%): 0.9	Mean Pool Shelter Rating: 93
Temp	Water (F): 54 to 61	Pool Substrate (%): Sand: 14.3, Gravel: 85.7	
	Air (F): 68 to 77	Embeddedness Value (%): (1) 0.0, (2) 33.3, (3) 66.7, (4) 0.0	

PASR2

Channel Types: N/A		Canopy Density (%): 57.5 Hardwood Component (%): 100	Pools by Stream Length (%): 19.1 Pool Frequency (%): 28.6
Reach Length (ft): 1,640.4			
Dry Channel Length (ft): 0		Dominant Bank Vegetation: No Vegetation Vegetation Cover (%): 19.4	<u>Residual Pool Depth (%)</u> < 2 ft deep: 100.0 2 to 2.9 ft deep: 0.0 3 to 3.9 ft deep: 0.0 >=4 ft deep: 0.0
Riffle/Flatwater Mean Width (ft): 7.5			
<u>Bankfull Width</u> Range (ft): N/A Dominant (ft): 9.0		Dominant Shelter: Aquatic Vegetation	Mean Max Residual Pool Depth (ft): 0.9
		Occurrence of Large Woody Debris (%): 0.0	Mean Pool Shelter Rating: 20
Temp	Water (F): 61	Pool Substrate (%): Sand: 100.0	
	Air (F): 70	Embeddedness Value (%): (1) 0.0, (2) 0.0, (3) 100.0, (4) 0.0	

PASR3

Channel Types: A4		Canopy Density (%): 82.3	Pools by Stream Length (%): 5.3
Reach Length (ft): 1,640.4		Hardwood Component (%): 100	Pool Frequency (%): 24.0
Dry Channel Length (ft): 0		Dominant Bank Vegetation: Blackberry/poison oak	Residual Pool Depth (%) < 2 ft deep: 100.0 2 to 2.9 ft deep: 0.0 3 to 3.9 ft deep: 0.0 >=4 ft deep: 0.0
Riffle/Flatwater Mean Width (ft): 6.0		Vegetation Cover (%): 70.0	
Bankfull Width Range (ft): N/A		Dominant Shelter: Bubble Curtain	Mean Max Residual Pool Depth (ft): 1.1
Dominant (ft): 12.0		Occurrence of Large Woody Debris (%): 0.0	Mean Pool Shelter Rating: 148
Temp	Water (F): 54 to 61	Pool Substrate (%): Gravel: 50.0, Small Cobble: 50.0	
	Air (F): 55 to 57	Embeddedness Value (%): (1) 0.0, (2) 25.0, (3) 25.0, (4) 50.0	

PASR4

Channel Types: A4		Canopy Density (%): 83.4	Pools by Stream Length (%): 9.8
Reach Length (ft): 1,640.4		Hardwood Component (%): 100	Pool Frequency (%): 28.0
Dry Channel Length (ft): 0		Dominant Bank Vegetation: Blackberry/poison oak	Residual Pool Depth (%) < 2 ft deep: 100.0 2 to 2.9 ft deep: 0.0 3 to 3.9 ft deep: 0.0 >=4 ft deep: 0.0
Riffle/Flatwater Mean Width (ft): 6.2		Vegetation Cover (%): 81.4	
Bankfull Width Range (ft): N/A		Dominant Shelter: Bubble Curtain	Mean Max Residual Pool Depth (ft): 1.05
Dominant (ft): 11.0		Occurrence of Large Woody Debris (%): 4.3	Mean Pool Shelter Rating: 143
Temp	Water (F): 55	Pool Substrate (%): Small Cobble: 100.0	
	Air (F): 55 to 57	Embeddedness Value (%): (1) 0.0, (2) 50.0, (3) 50.0, (4) 0.0	

PASR5

Channel Types: B4c, A3		Canopy Density (%): 86.1	Pools by Stream Length (%): 18.7
Reach Length (ft): 1,640.4		Hardwood Component (%): 100	Pool Frequency (%): 30.8
Dry Channel Length (ft): 0		Dominant Bank Vegetation: Hardwood Trees	Residual Pool Depth (%) < 2 ft deep: 100.0 2 to 2.9 ft deep: 0.0 3 to 3.9 ft deep: 0.0 >=4 ft deep: 0.0
Riffle/Flatwater Mean Width (ft): 7.2		Vegetation Cover (%): 62.8	
Bankfull Width Range (ft): 12.5 to 18.0 Dominant (ft): 18.0		Dominant Shelter: Bubble Curtain	Mean Max Residual Pool Depth (ft): 1.36
		Occurrence of Large Woody Debris (%): 0.0	Mean Pool Shelter Rating: 150
Temp	Water (F): 55 to 57	Pool Substrate (%): Sand: 33.3, Gravel: 33.3, Bedrock: 33.3	
	Air (F): 57 to 59	Embeddedness Value (%): (1) 0.0, (2) 0.0, (3) 33.3, (4) 66.7	

PASR6

Channel Types: A3		Canopy Density (%): 42.6	Pools by Stream Length (%): 24.3
Reach Length (ft): 1,707.3		Hardwood Component (%): 100	Pool Frequency (%): 41.2
Dry Channel Length (ft): 0		Dominant Bank Vegetation: Emergent Macrophytes	Residual Pool Depth (%) < 2 ft deep: 100.0 2 to 2.9 ft deep: 0.0 3 to 3.9 ft deep: 0.0 >=4 ft deep: 0.0
Riffle/Flatwater Mean Width (ft): 7.6		Vegetation Cover (%): 85.0	
Bankfull Width Range (ft): N/A Dominant (ft): 11.0		Dominant Shelter: Bubble Curtain	Mean Max Residual Pool Depth (ft): 1.0
		Occurrence of Large Woody Debris (%): 0.0	Mean Pool Shelter Rating: 215
Temp	Water (F): 55 to 57	Pool Substrate (%): Bedrock: 100.0	
	Air (F): 59 to 60	Embeddedness Value (%): (1) 0.0, (2) 0.0, (3) 0.0, (4) 100.0	

PASR7

Channel Types: B2a		Canopy Density (%): 79.4 Hardwood Component (%): 100	Pools by Stream Length (%): 39.0 Pool Frequency (%): 43.8
Reach Length (ft): 1,640.4			
Dry Channel Length (ft): 0		Dominant Bank Vegetation: Blackberry/poison oak Vegetation Cover (%): 54.5	<u>Residual Pool Depth (%)</u> < 2 ft deep: 100.0 2 to 2.9 ft deep: 0.0 3 to 3.9 ft deep: 0.0 >=4 ft deep: 0.0
Riffle/Flatwater Mean Width (ft): 8.7			
<u>Bankfull Width</u> Range (ft): N/A Dominant (ft): 12.5		Dominant Shelter: Bubble Curtain	Mean Max Residual Pool Depth (ft): 1.42
		Occurrence of Large Woody Debris (%): 1.9	Mean Pool Shelter Rating: 144
Temp	Water (F): 57 to 59	Pool Substrate (%): Gravel: 16.7, Bedrock: 83.3	
	Air (F): 55 to 57	Embeddedness Value (%): (1) 0.0, (2) 0.0, (3) 0.0, (4) 100.0	

PASR8

Channel Types: B3		Canopy Density (%): 78.6 Hardwood Component (%): 100	Pools by Stream Length (%): 12.2 Pool Frequency (%): 31.6
Reach Length (ft): 1,640.4			
Dry Channel Length (ft): 775.7		Dominant Bank Vegetation: Blackberry/poison oak Vegetation Cover (%): 71.4	<u>Residual Pool Depth (%)</u> < 2 ft deep: 100.0 2 to 2.9 ft deep: 0.0 3 to 3.9 ft deep: 0.0 >=4 ft deep: 0.0
Riffle/Flatwater Mean Width (ft): 7.0			
<u>Bankfull Width</u> Range (ft): N/A Dominant (ft): 15.0		Dominant Shelter: Bubble Curtain	Mean Max Residual Pool Depth (ft): 1.25
		Occurrence of Large Woody Debris (%): 0.0	Mean Pool Shelter Rating: 145
Temp	Water (F): 57	Pool Substrate (%): Silt/Clay: 50.0, Bedrock: 50.0	
	Air (F): 50 to 53	Embeddedness Value (%): (1) 0.0, (2) 0.0, (3) 0.0, (4) 100.0	

PASR9

<table>
<tr><td colspan="2">Channel Types: B3/B3a, B4c</td><td rowspan="2">Canopy Density (%): 78.3

Hardwood Component (%): 100</td><td rowspan="2">Pools by Stream Length (%): 1.1

Pool Frequency (%): 25.0</td></tr>
<tr><td colspan="2">Reach Length (ft): 1,640.4</td></tr>
<tr><td colspan="2">Dry Channel Length (ft): 1,070.0</td><td rowspan="2">Dominant Bank Vegetation: Blackberry/poison oak

Vegetation Cover (%): 71.7</td><td rowspan="2"><u>Residual Pool Depth (%)</u>
< 2 ft deep: 100.0
2 to 2.9 ft deep: 0.0
3 to 3.9 ft deep: 0.0
>=4 ft deep: 0.0</td></tr>
<tr><td colspan="2">Riffle/Flatwater Mean Width (ft): 7.0</td></tr>
<tr><td colspan="2" rowspan="2"><u>Bankfull Width</u>
Range (ft): 14.0 to 16.0

Dominant (ft): 16.0</td><td>Dominant Shelter: Terrestrial Vegetation</td><td>Mean Max Residual Pool Depth (ft): 0.7</td></tr>
<tr><td>Occurrence of Large Woody Debris (%): 16.7</td><td>Mean Pool Shelter Rating: 120</td></tr>
<tr><td rowspan="2">Temp</td><td>Water (F): 57</td><td colspan="2">Pool Substrate (%): Gravel: 100.0</td></tr>
<tr><td>Air (F): 53</td><td colspan="2">Embeddedness Value (%): (1) 0.0, (2) 100.0, (3) 0.0, (4) 0.0</td></tr>
</table>

PASR10

<table>
<tr><td colspan="2">Channel Types: D4/6</td><td rowspan="2">Canopy Density (%): 78.3

Hardwood Component (%): 100</td><td rowspan="2">Pools by Stream Length (%): 3.5

Pool Frequency (%): 22.2</td></tr>
<tr><td colspan="2">Reach Length (ft): 1,640.4</td></tr>
<tr><td colspan="2">Dry Channel Length (ft): 0</td><td rowspan="2">Dominant Bank Vegetation: Blackberry/poison oak

Vegetation Cover (%): 71.7</td><td rowspan="2"><u>Residual Pool Depth (%)</u>
< 2 ft deep: 100.0
2 to 2.9 ft deep: 0.0
3 to 3.9 ft deep: 0.0
>=4 ft deep: 0.0</td></tr>
<tr><td colspan="2">Riffle/Flatwater Mean Width (ft): 10.0</td></tr>
<tr><td colspan="2" rowspan="2"><u>Bankfull Width</u>
Range (ft): N/A

Dominant (ft): 85.0</td><td>Dominant Shelter: Terrestrial Vegetation</td><td>Mean Max Residual Pool Depth (ft): 1.3</td></tr>
<tr><td>Occurrence of Large Woody Debris (%): 16.7</td><td>Mean Pool Shelter Rating: 105</td></tr>
<tr><td rowspan="2">Temp</td><td>Water (F): 50 to 57</td><td colspan="2">Pool Substrate (%): Gravel: 100.0</td></tr>
<tr><td>Air (F): 52 to 53</td><td colspan="2">Embeddedness Value (%): (1) 0.0, (2) 100.0, (3) 0.0, (4) 0.0</td></tr>
</table>

PASR11

Channel Types: A4		Canopy Density (%): 83.6	Pools by Stream Length (%): 3.5
Reach Length (ft): 1,640.4		Hardwood Component (%): 100	Pool Frequency (%): 22.2
Dry Channel Length (ft): 0		Dominant Bank Vegetation: Blackberry/poison oak	<u>Residual Pool Depth (%)</u> < 2 ft deep: 100.0 2 to 2.9 ft deep: 0.0 3 to 3.9 ft deep: 0.0 >=4 ft deep: 0.0
Riffle/Flatwater Mean Width (ft): 5.1		Vegetation Cover (%): 42.9	
<u>Bankfull Width</u> Range (ft): N/A		Dominant Shelter: Bubble Curtain	Mean Max Residual Pool Depth (ft): 1.3
Dominant (ft): 8.7		Occurrence of Large Woody Debris (%): 7.9	Mean Pool Shelter Rating: 105
Temp	Water (F): 50	Pool Substrate (%): Gravel: 66.7, Bedrock: 33.3	
	Air (F): 50 to 52	Embeddedness Value (%): (1) 0.0, (2) 33.3, (3) 33.3, (4) 33.3	

PASR12

Channel Types: B4		Canopy Density (%): 82.5	Pools by Stream Length (%): 19.3
Reach Length (ft): 1,640.4		Hardwood Component (%): 100	Pool Frequency (%): 27.3
Dry Channel Length (ft): 0		Dominant Bank Vegetation: Blackberry/poison oak	<u>Residual Pool Depth (%)</u> < 2 ft deep: 100.0 2 to 2.9 ft deep: 0.0 3 to 3.9 ft deep: 0.0 >=4 ft deep: 0.0
Riffle/Flatwater Mean Width (ft): 6.7		Vegetation Cover (%): 56.7	
<u>Bankfull Width</u> Range (ft): N/A		Dominant Shelter: Bubble Curtain	Mean Max Residual Pool Depth (ft): 0.8
Dominant (ft): 10.5		Occurrence of Large Woody Debris (%): 0.0	Mean Pool Shelter Rating: 120
Temp	Water (F): 50	Pool Substrate (%): Gravel: 50.0, Small Cobble: 50.0	
	Air (F): 50 to 52	Embeddedness Value (%): (1) 0.0, (2) 50.0, (3) 50.0, (4) 0.0	

PASR13

Channel Types: A4 Reach Length (ft): 1,640.4	Canopy Density (%): 88.0 Hardwood Component (%): 100	Pools by Stream Length (%): 19.3 Pool Frequency (%): 27.3
Dry Channel Length (ft): 0 Riffle/Flatwater Mean Width (ft): 3.1	Dominant Bank Vegetation: Blackberry/poison oak Vegetation Cover (%): 25.5	Residual Pool Depth (%) < 2 ft deep: 100.0 2 to 2.9 ft deep: 0.0 3 to 3.9 ft deep: 0.0 >=4 ft deep: 0.0
Bankfull Width Range (ft): N/A Dominant (ft): 3.5	Dominant Shelter: Terrestrial Vegetation	Mean Max Residual Pool Depth (ft): 0.8
	Occurrence of Large Woody Debris (%): 0.0	Mean Pool Shelter Rating: 120
Temp: Water (F): 46 to 48	Pool Substrate (%): Sand: 50.0, Gravel: 50.0	
Temp: Air (F): 49 to 51	Embeddedness Value (%): (1) 0.0, (2) 0.0, (3) 100.0, (4) 0.0	

Summary of Habitat Elements by Stream Reach for Monte Bello Creek

MASR1

Channel Types: B4 Reach Length (ft): 1,640.4	Canopy Density (%): 79.9 Hardwood Component (%): 100	Pools by Stream Length (%): 35.4 Pool Frequency (%): 42.9
Dry Channel Length (ft): 0 Riffle/Flatwater Mean Width (ft): 7.0	Dominant Bank Vegetation: Blackberry/poison oak Vegetation Cover (%): 20.0	Residual Pool Depth (%) < 2 ft deep: 83.3 2 to 2.9 ft deep: 16.7 3 to 3.9 ft deep: 0.0 >=4 ft deep: 0.0
Bankfull Width Range (ft): N/A Dominant (ft): 9.1	Dominant Shelter: Bubble Curtain	Mean Max Residual Pool Depth (ft): 1.3
	Occurrence of Large Woody Debris (%): 0.0	Mean Pool Shelter Rating: 124
Temp: Water (F): 44 to 48	Pool Substrate (%): Sand: 50.0, Gravel: 33.3, Small Cobble: 16.7	
Temp: Air (F): 52 to 53	Embeddedness Value (%): (1) 16.7, (2) 16.7, (3) 66.7, (4) 0.0	

MASR2

<table>
<tr><td colspan="2">Channel Types: B3</td><td rowspan="2">Canopy Density (%): 84.9

Hardwood Component (%): 100</td><td rowspan="2">Pools by Stream Length (%): 28.0

Pool Frequency (%): 36.4</td></tr>
<tr><td colspan="2">Reach Length (ft): 1,640.4</td></tr>
<tr><td colspan="2">Dry Channel Length (ft): 0</td><td rowspan="2">Dominant Bank Vegetation: Leaf Litter

Vegetation Cover (%): 0.6</td><td rowspan="2"><u>Residual Pool Depth (%)</u>
< 2 ft deep: 100.0
2 to 2.9 ft deep: 0.0
3 to 3.9 ft deep: 0.0
>=4 ft deep: 0.0</td></tr>
<tr><td colspan="2">Riffle/Flatwater Mean Width (ft): 6.8</td></tr>
<tr><td colspan="2" rowspan="2"><u>Bankfull Width</u>
Range (ft): N/A

Dominant (ft): 9.1</td><td>Dominant Shelter: Bubble Curtain</td><td>Mean Max Residual Pool Depth (ft): 1.02</td></tr>
<tr><td>Occurrence of Large Woody Debris (%): 1.3</td><td>Mean Pool Shelter Rating: 51</td></tr>
<tr><td rowspan="2">Temp</td><td>Water (F): 48 to 50</td><td colspan="2">Pool Substrate (%): Sand: 50.0, Gravel: 33.3, Small Cobble: 16.7</td></tr>
<tr><td>Air (F): 53 to 54</td><td colspan="2">Embeddedness Value (%): (1) 0.0, (2) 16.7, (3) 83.3, (4) 0.0</td></tr>
</table>

MASR3

<table>
<tr><td colspan="2">Channel Types: A2/B2</td><td rowspan="2">Canopy Density (%): 88.9

Hardwood Component (%): 100</td><td rowspan="2">Pools by Stream Length (%): 26.1

Pool Frequency (%): 39.0</td></tr>
<tr><td colspan="2">Reach Length (ft): 1,640.4</td></tr>
<tr><td colspan="2">Dry Channel Length (ft): 0</td><td rowspan="2">Dominant Bank Vegetation: Blackberry/poison oak

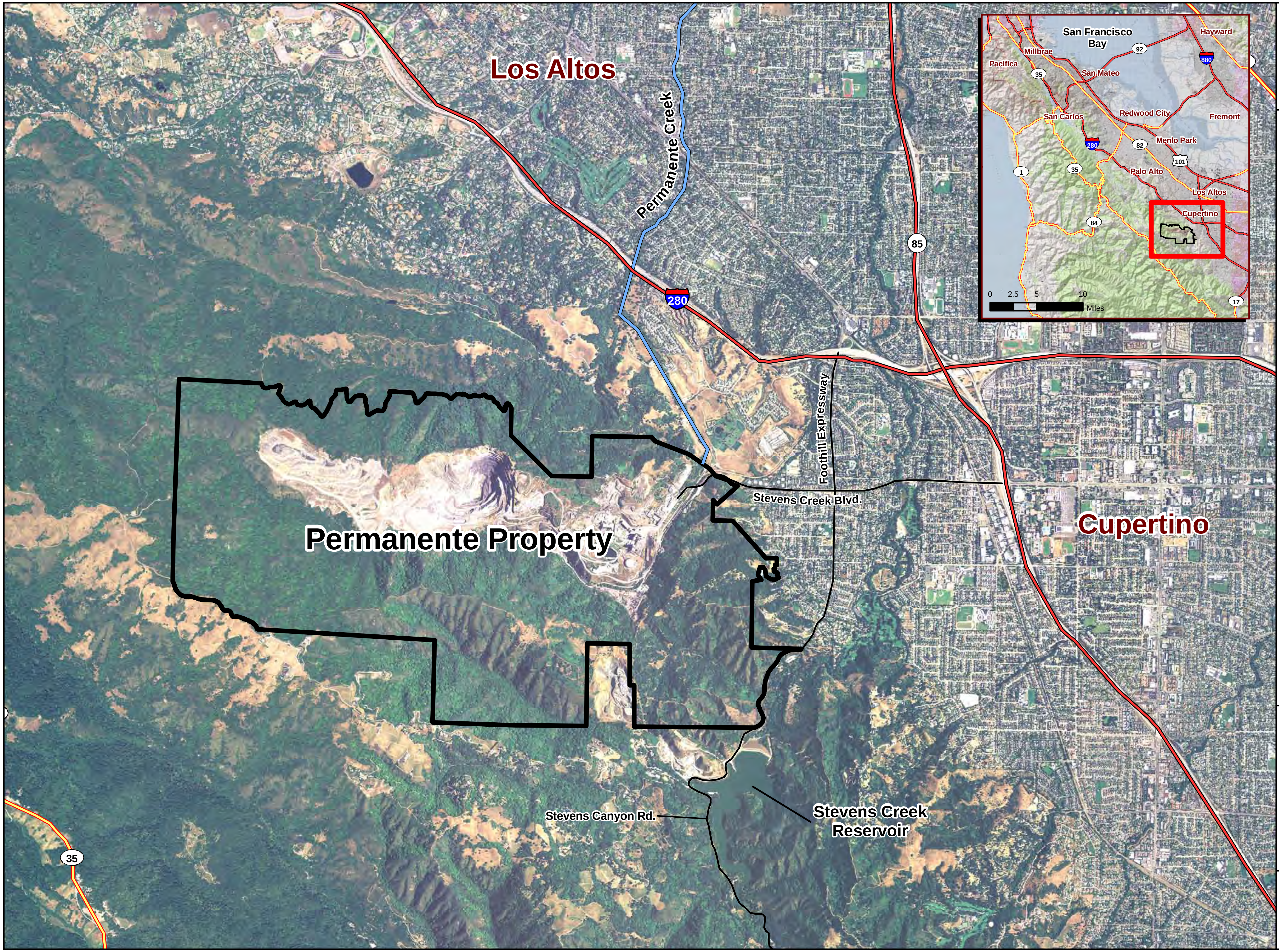
Vegetation Cover (%): 12.3</td><td rowspan="2"><u>Residual Pool Depth (%)</u>
< 2 ft deep: 100.0
2 to 2.9 ft deep: 0.0
3 to 3.9 ft deep: 0.0
>=4 ft deep: 0.0</td></tr>
<tr><td colspan="2">Riffle/Flatwater Mean Width (ft): 6.7</td></tr>
<tr><td colspan="2" rowspan="2"><u>Bankfull Width</u>
Range (ft): N/A

Dominant (ft):7.0</td><td>Dominant Shelter: Bubble Curtain</td><td>Mean Max Residual Pool Depth (ft): 1.12</td></tr>
<tr><td>Occurrence of Large Woody Debris (%): 4.1</td><td>Mean Pool Shelter Rating: 65</td></tr>
<tr><td rowspan="2">Temp</td><td>Water (F): 49 to 50</td><td colspan="2">Pool Substrate (%): Gravel: 75.0, Small Cobble: 25.0</td></tr>
<tr><td>Air (F): 52 to 54</td><td colspan="2">Embeddedness Value (%): (1) 0.0, (2) 25.0, (3) 75.0, (4) 0.0</td></tr>
</table>

MASR4

Channel Types: B1/A1 Reach Length (ft): 1,743.1		Canopy Density (%): 83.7 Hardwood Component (%): 100	Pools by Stream Length (%): 53.4 Pool Frequency (%): 43.8
Dry Channel Length (ft): 0 Riffle/Flatwater Mean Width (ft): 6.3		Dominant Bank Vegetation: Leaf Litter Vegetation Cover (%): 13.9	<u>Residual Pool Depth (%)</u> < 2 ft deep: 100.0 2 to 2.9 ft deep: 0.0 3 to 3.9 ft deep: 0.0 >=4 ft deep: 0.0
<u>Bankfull Width</u> Range (ft): N/A Dominant (ft):7.4		Dominant Shelter: Bubble Curtain	Mean Max Residual Pool Depth (ft): 1.57
		Occurrence of Large Woody Debris (%): 0.0	Mean Pool Shelter Rating: 59
Temp	Water (F): 48 to 50	Pool Substrate (%): Gravel: 80.0, Bedrock: 20.0	
	Air (F): 51 to 52	Embeddedness Value (%): (1) 0.0, (2) 0.0, (3) 80.0, (4) 20.0	

APPENDIX B. FIGURES REFERENCED IN REPORT



wra
ENVIRONMENTAL CONSULTANTS

Lehigh Permanente
Quarry
Santa Clara County, CA

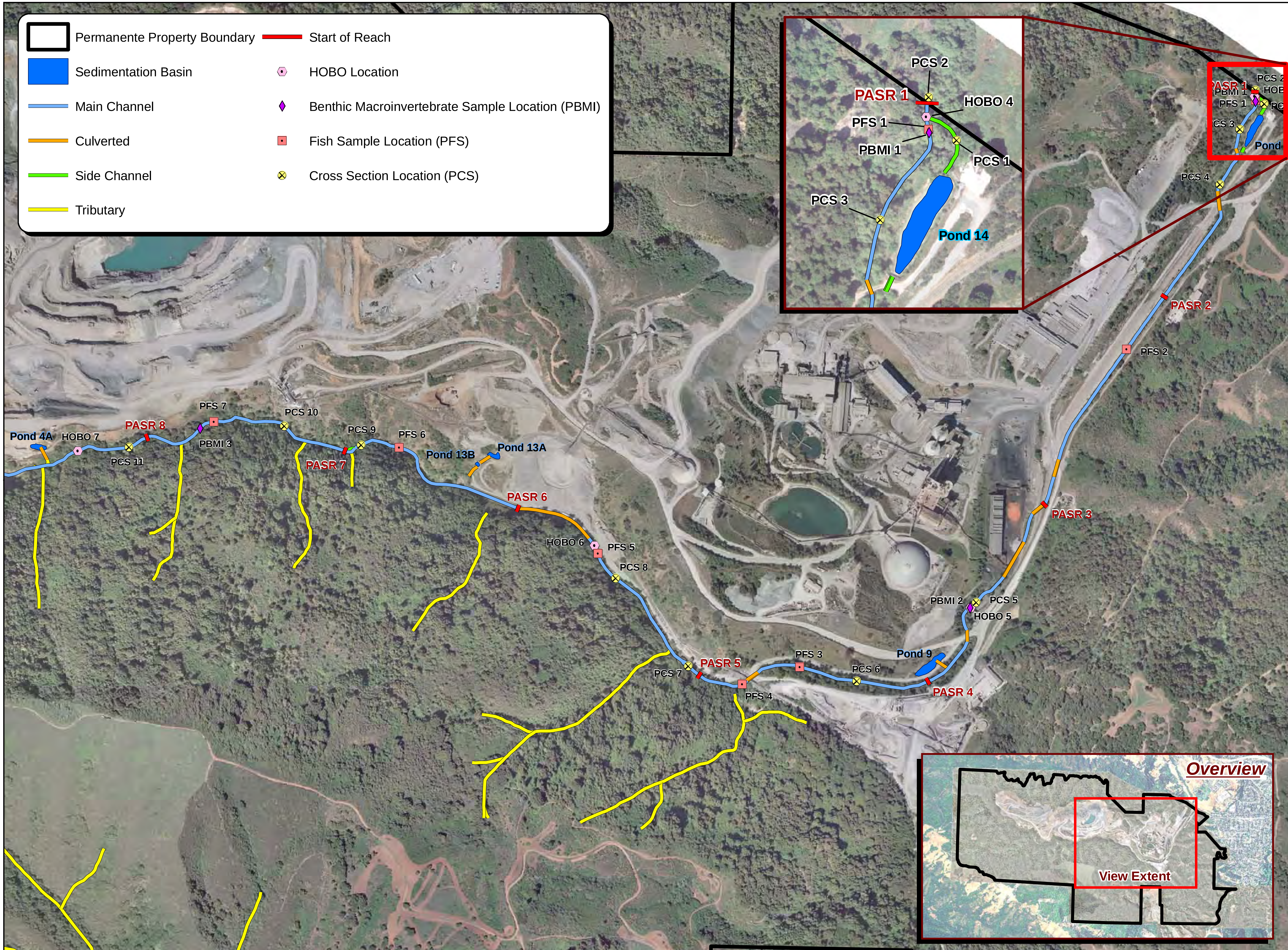
Figure 1.

Permanente Property
Location Map

N
W E
S

0 0.25 0.5 1
Miles

Date: May 2010
Map By: Michael Rochelle
Image: 2005 NAIP
Filepath: I:\Acad2000\16000\16143\gis\Arcmap\Delineation\Property Wide\Location.mxd



ENVIRONMENTAL CONSULTANTS

Lehigh Permanente Quarry
Santa Clara County, California

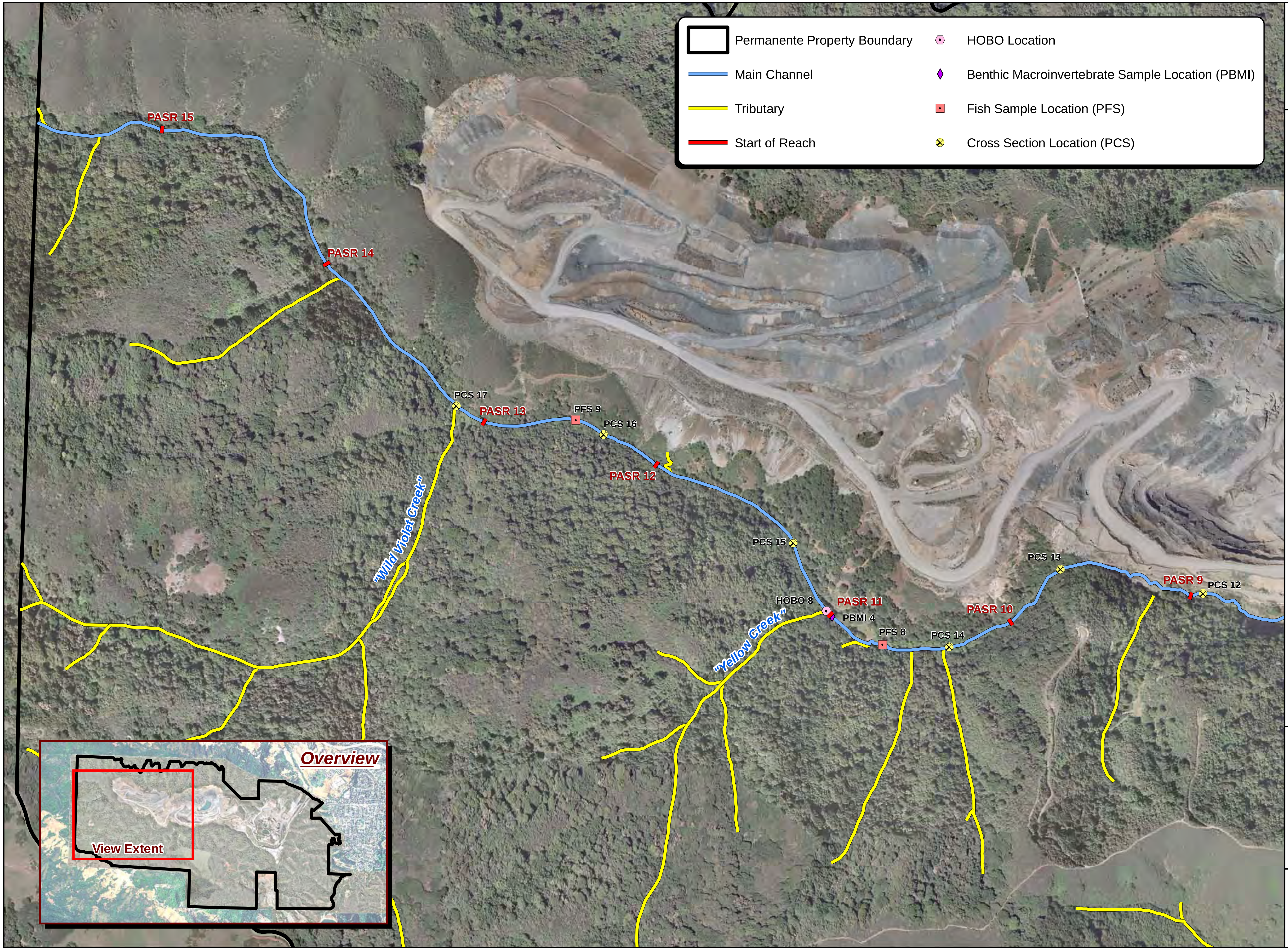
Figure 2a.

Permanente Creek Aquatic Baseline Study Areas

N
W E
S

0 250 500 1,000
Feet

Date: May 2010
Map By: Michael Rochelle
Aerial: April 2007
Filepath: I:\Acad2000\16000\16143\gis\Arcmap\AquaticPermAquaticAssessment1.mxd



ENVIRONMENTAL CONSULTANTS

Lehigh Permanente Quarry
Santa Clara County, California

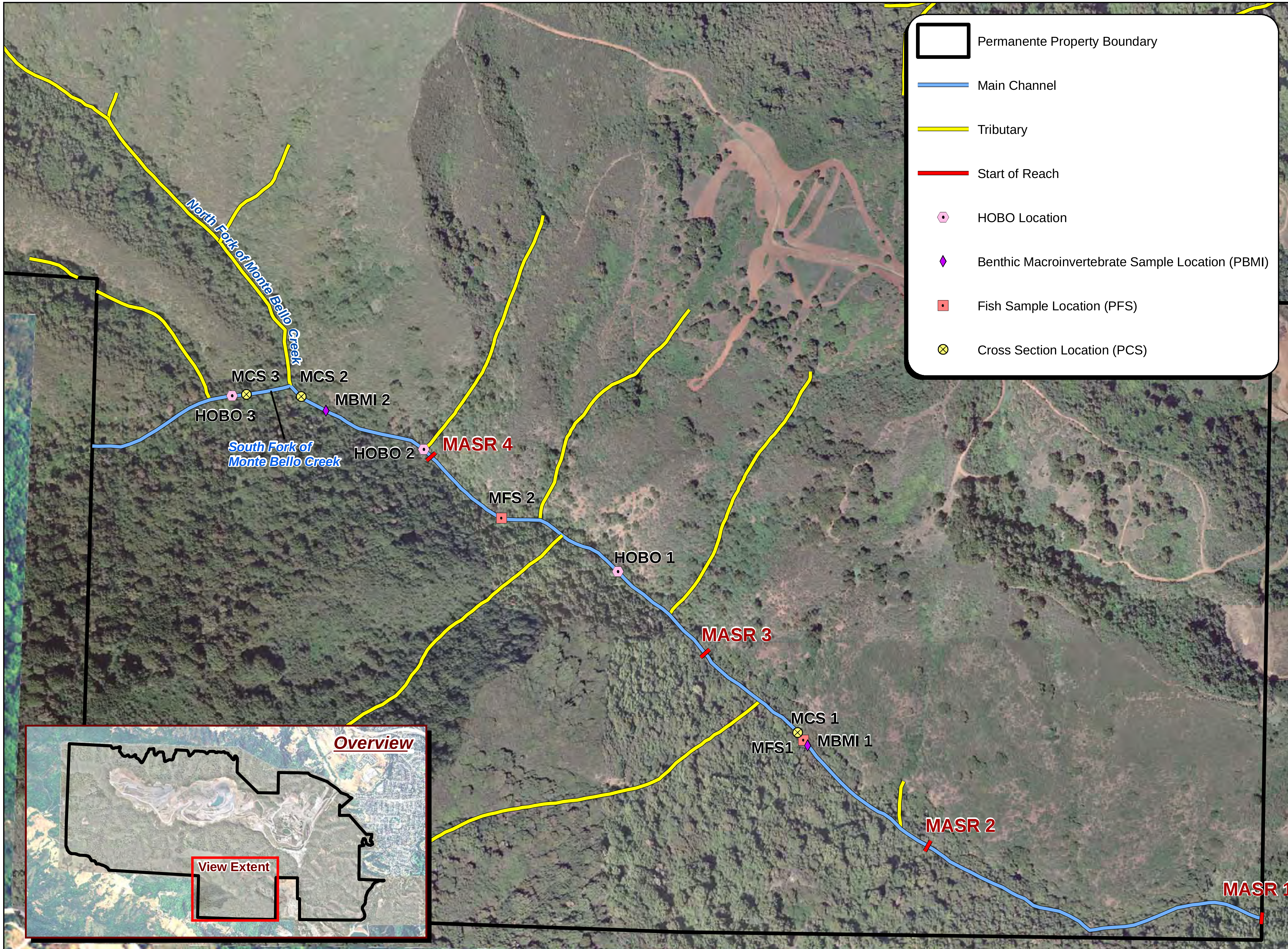
Figure 2b.

Permanente Creek Aquatic Baseline Study Areas

N
W E
S

0 250 500 1,000
Feet

Date: May 2010
Map By: Michael Rochelle
Aerial: April 2007
Filepath: I:\Acad2000\16000\16143\gis\Arcmap\AquaticPermAquaticAssessment2.mxd



ENVIRONMENTAL CONSULTANTS

Lehigh Permanente Quarry
Santa Clara County, California

Figure 2c.

Monte Bello Creek Aquatic Baseline Study Areas

N
W E
S

0 150 300 600 Feet

Date: May 2010
Map By: Michael Rochelle
Aeiral: April 2007
Filepath: I:\Acad2000\16000\16143\gis\Arcmap\MontebelloAquaticAssessment.mxd

Figure 3. Mean daily temperatures at five (5) Hobo locations along Permanente Creek overlaid with atmospheric data collected at California Weather Database Station CIMIS #69 in San Jose, California.

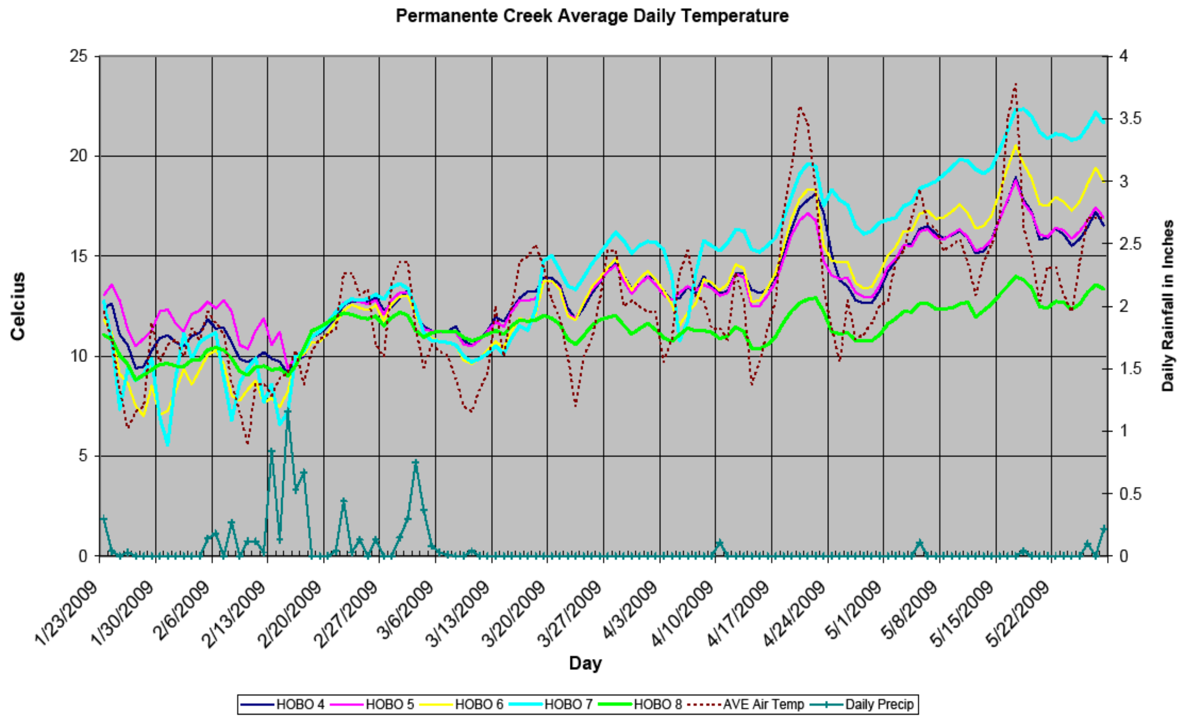


Figure 4. Mean daily temperatures at three Hobo locations along Monte Bello Creek overlaid with atmospheric data collected at California Weather Database Station CIMIS #69 in San Jose, California.

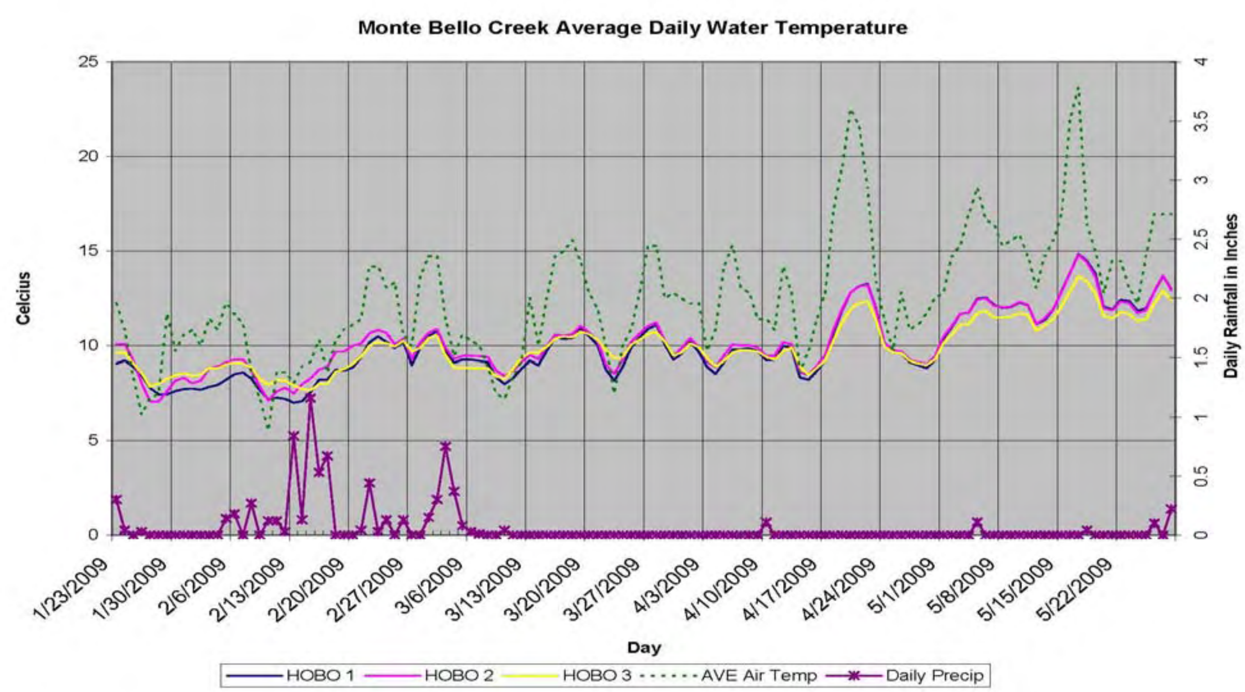


Figure 5. Percent composition of Level II habitat types by frequency along Permanente Creek.

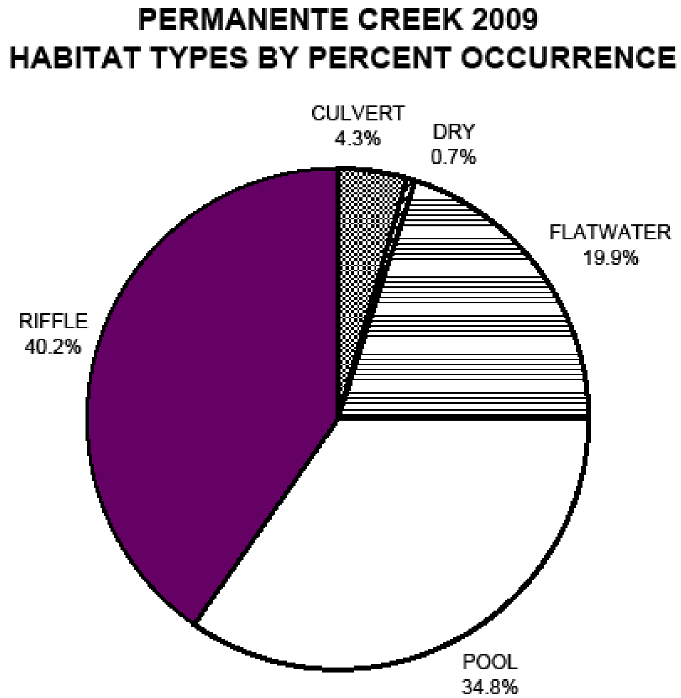


Figure 6. Percent composition of Level II habitat types by length along Permanente Creek.

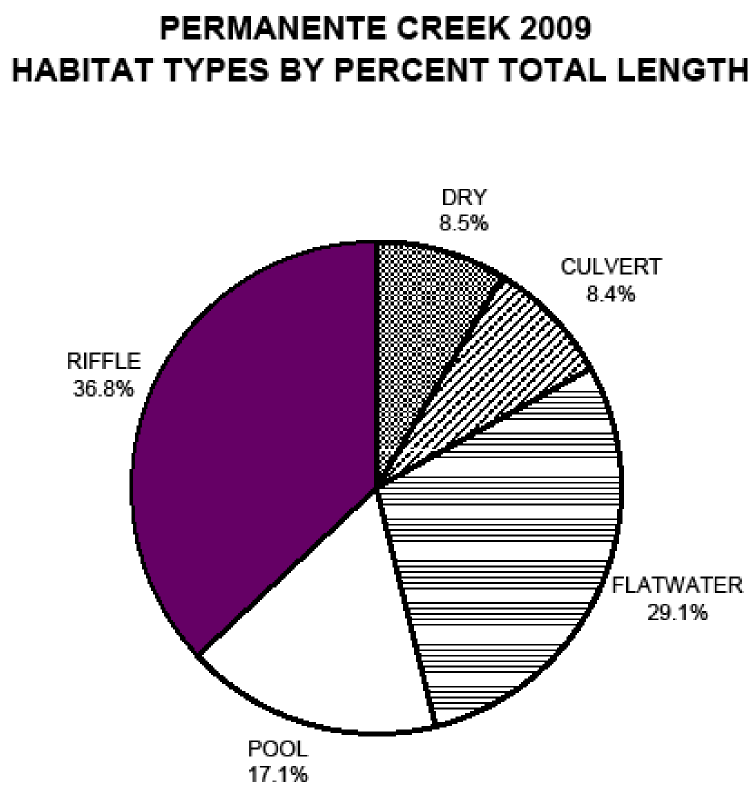


Figure 7. Percent composition of Level IV habitat types by frequency along Permanente Creek.

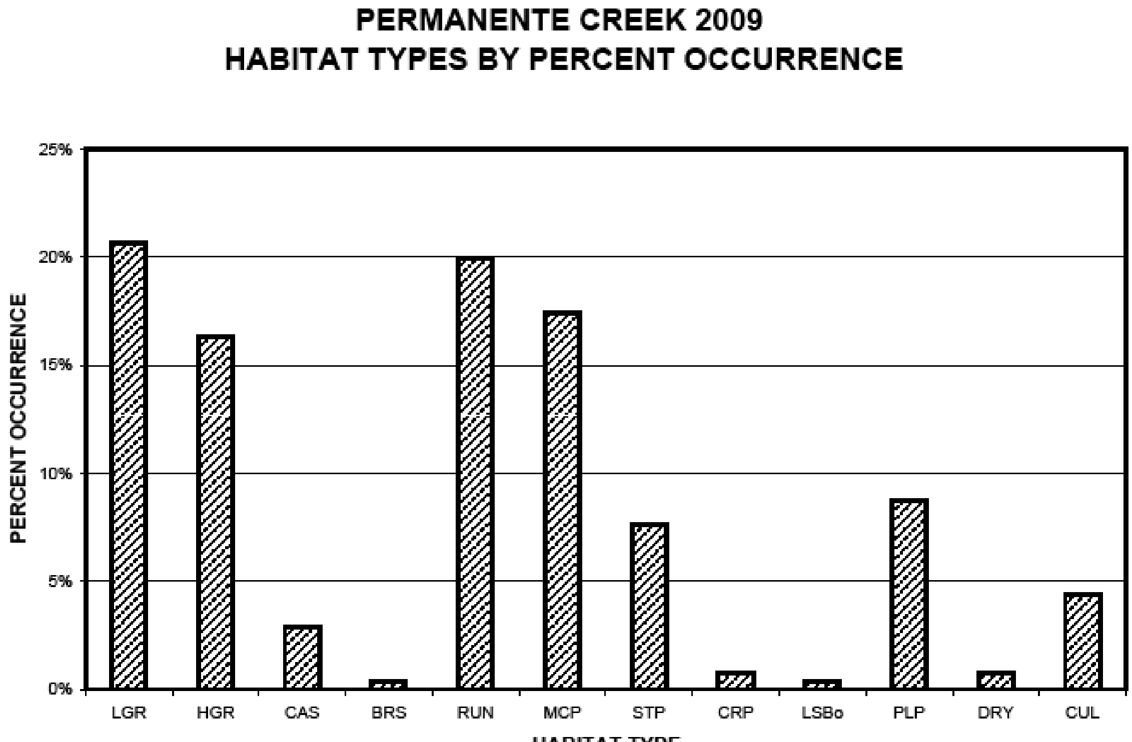


Figure 8. Percent composition of pool type frequency as a percentage of total pools encountered along Permanente Creek.

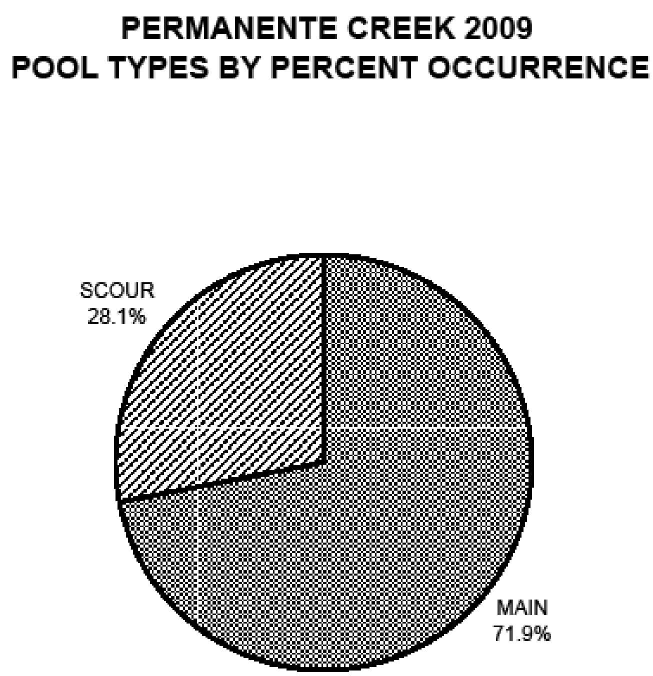


Figure 9. Composition of pool cover along Permanente Creek.

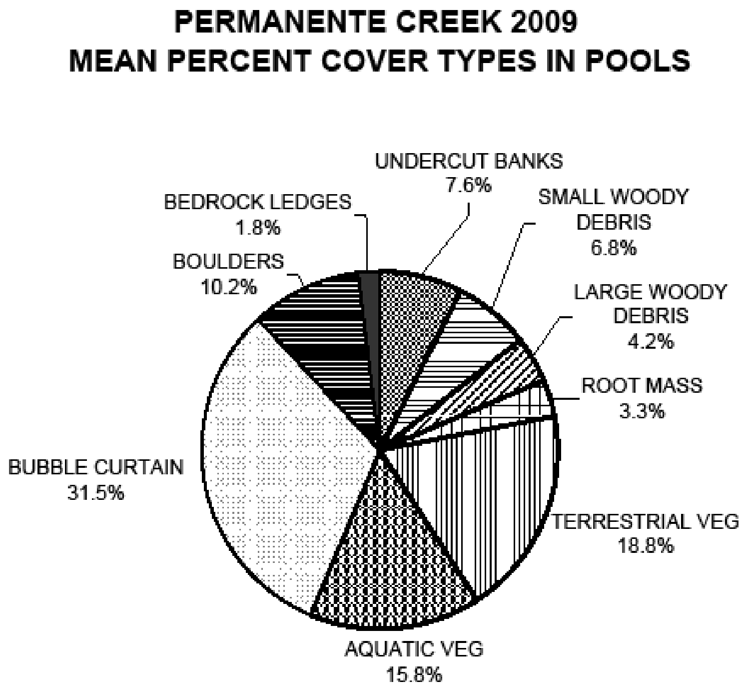


Figure 10. Percentage of pool tail-outs by dominant substrate.

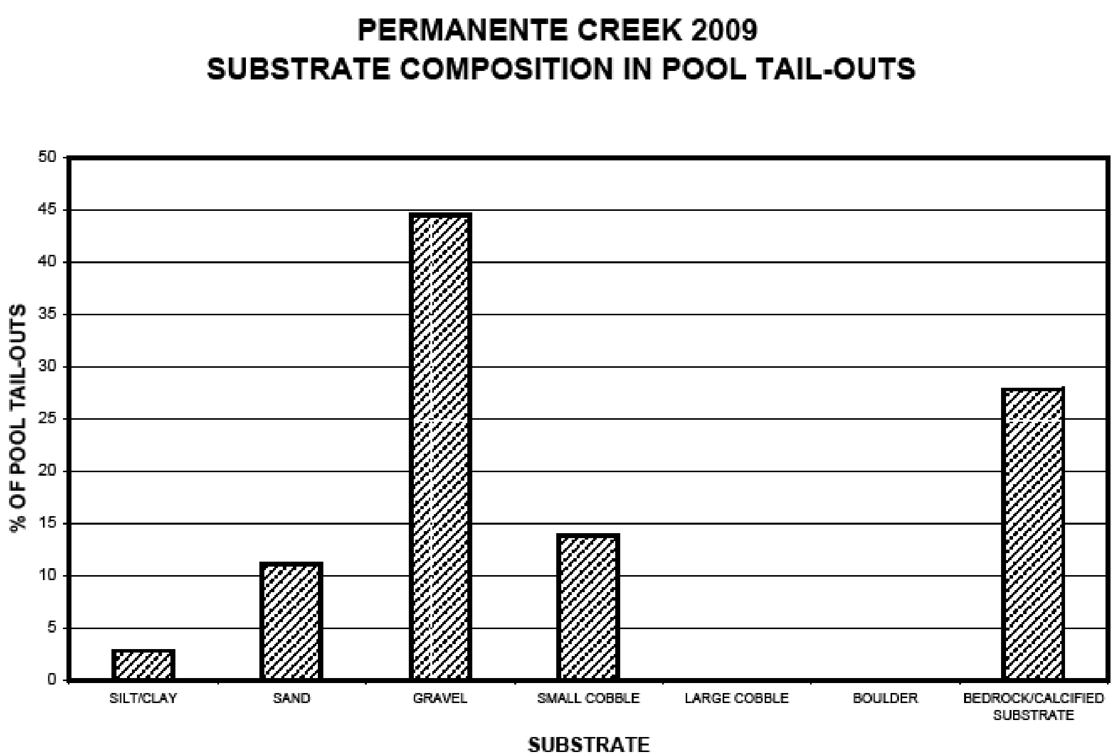


Figure 11. Composition of canopy cover along Permanente Creek.

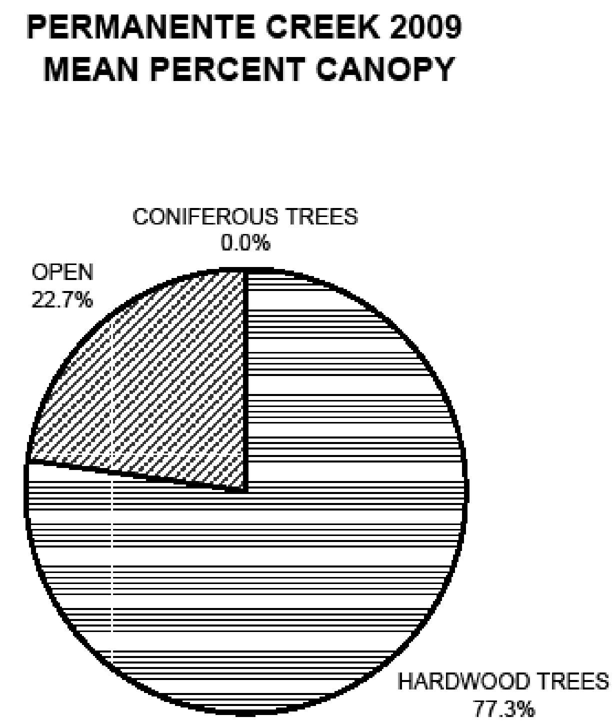


Figure 12. Percent composition of Level II habitat types by frequency along Monte Bello Creek.

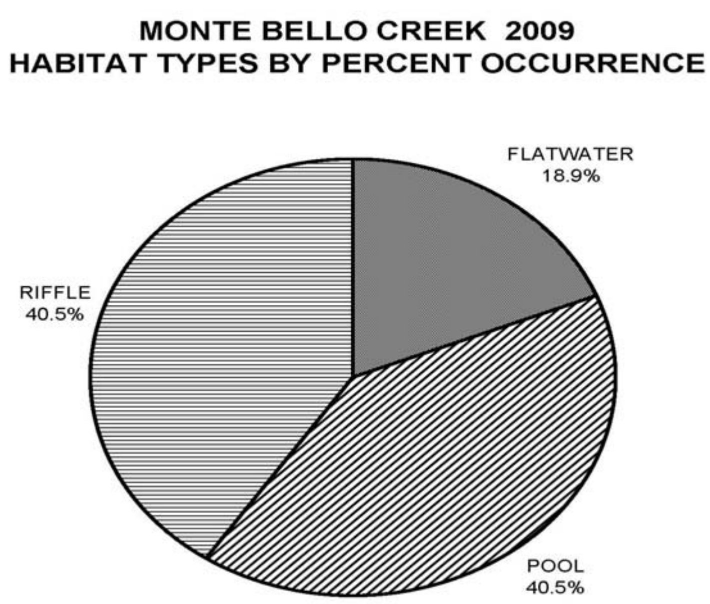


Figure 13. Percent composition of Level II habitat types by length along Monte Bello Creek.

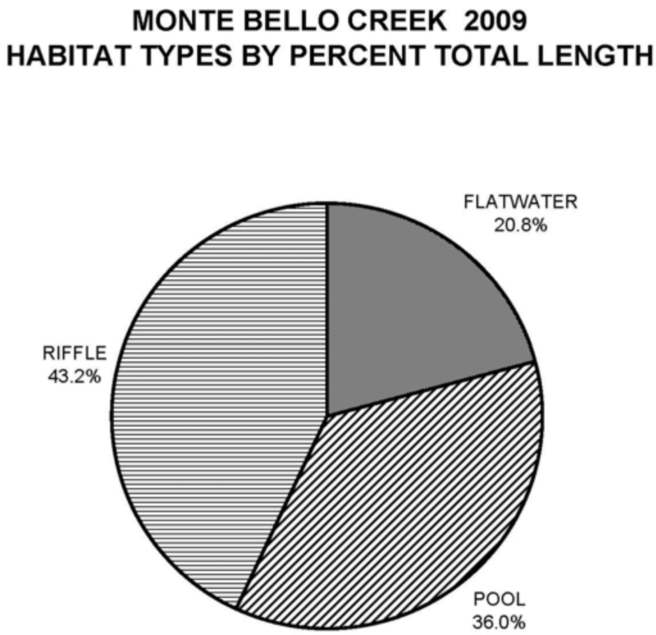


Figure 14. Percent composition of Level IV habitat types by frequency along Monte Bello Creek.

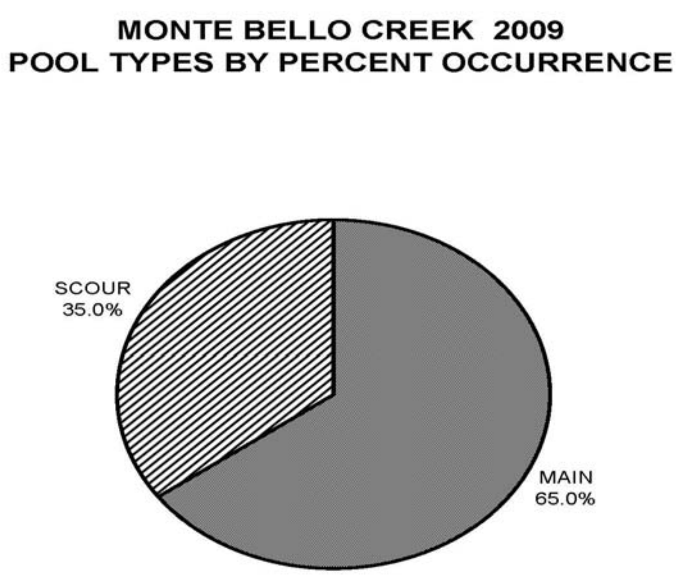


Figure 15. Percent composition of pool type frequency as a percentage of total pools encountered along Monte Bello Creek.

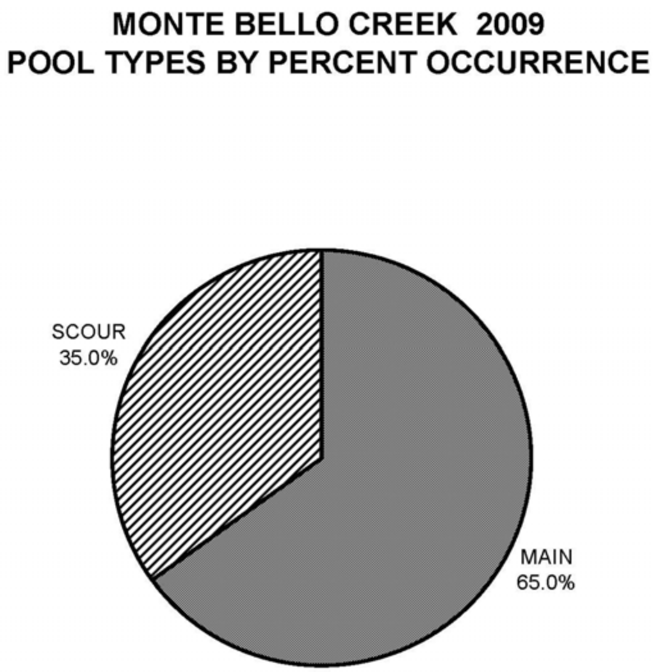


Figure 16. Composition of pool cover along Monte Bello Creek.

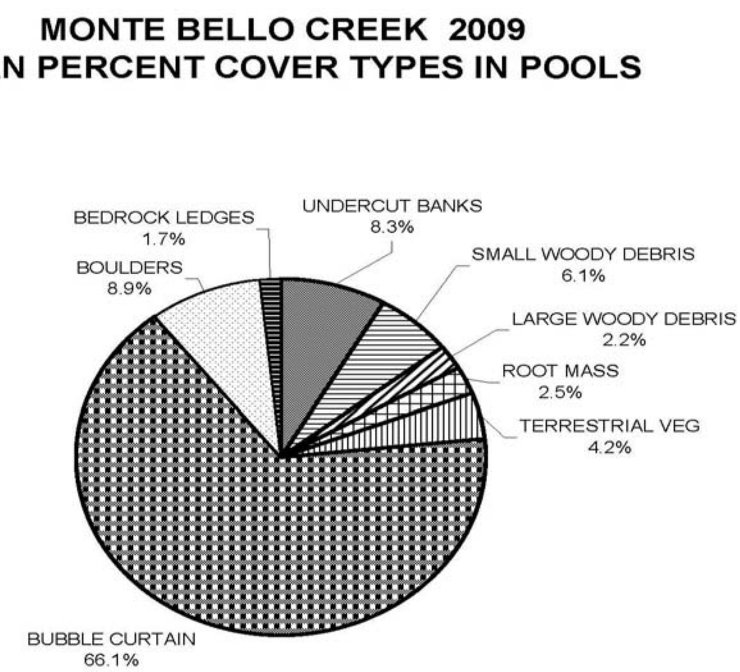


Figure 17. Percentage of pool tail-outs by dominant substrate along Monte Bello Creek.

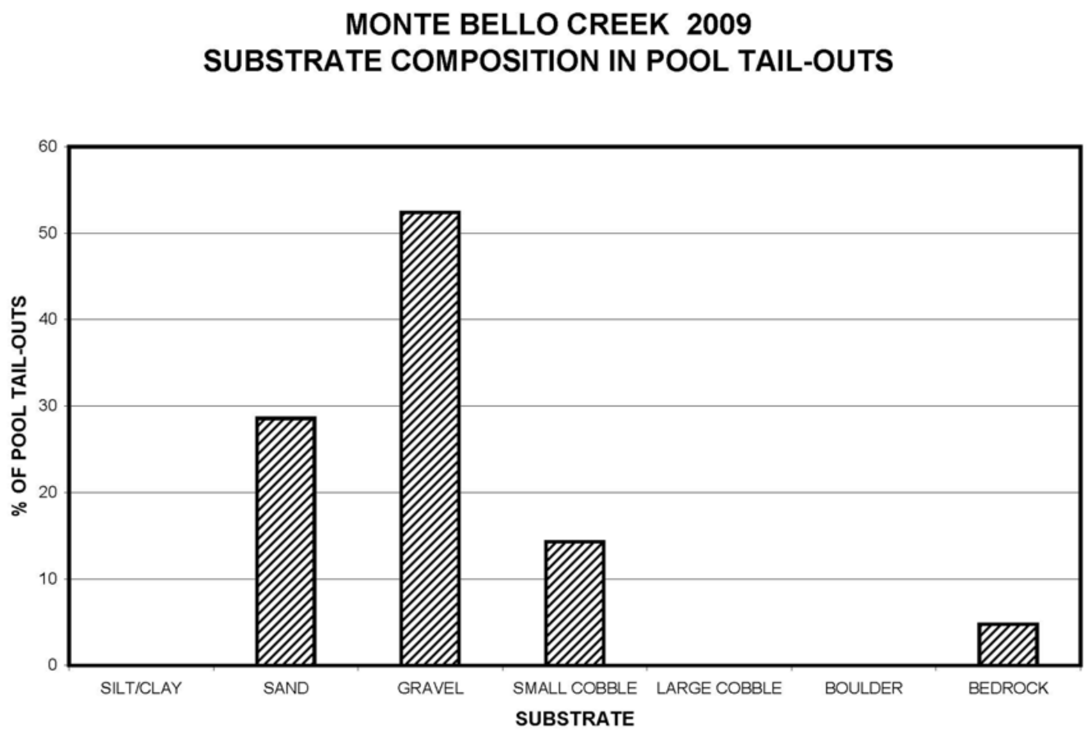


Figure 18. Composition of canopy cover along Monte Bello Creek.

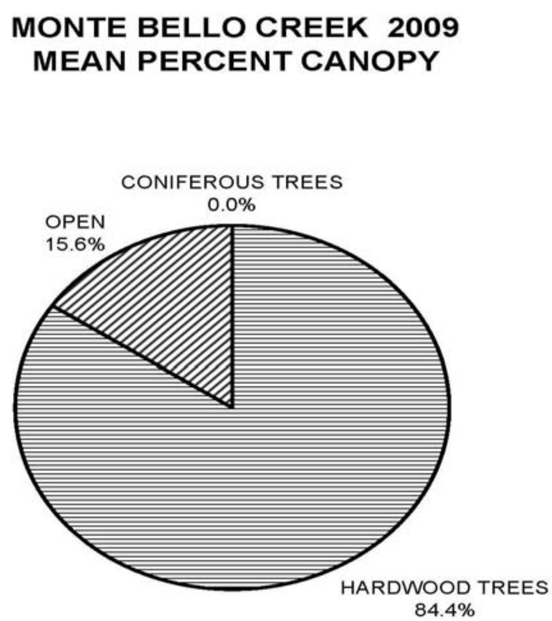


Figure 19. Fish sample results by reach and species for Monte Bello and Permanente Creeks.

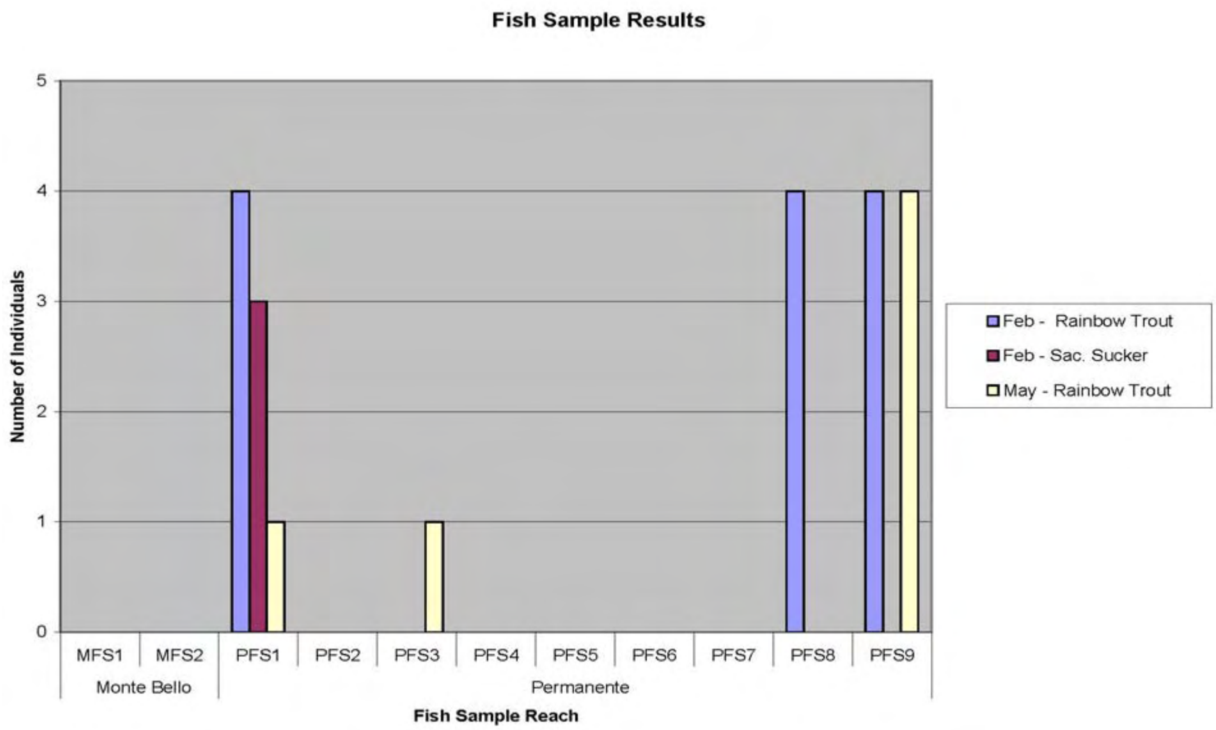


Figure 20. Breakdown of Rainbow Trout size classes captured during fish sample surveys in Monte Bello and Permanente Creeks.

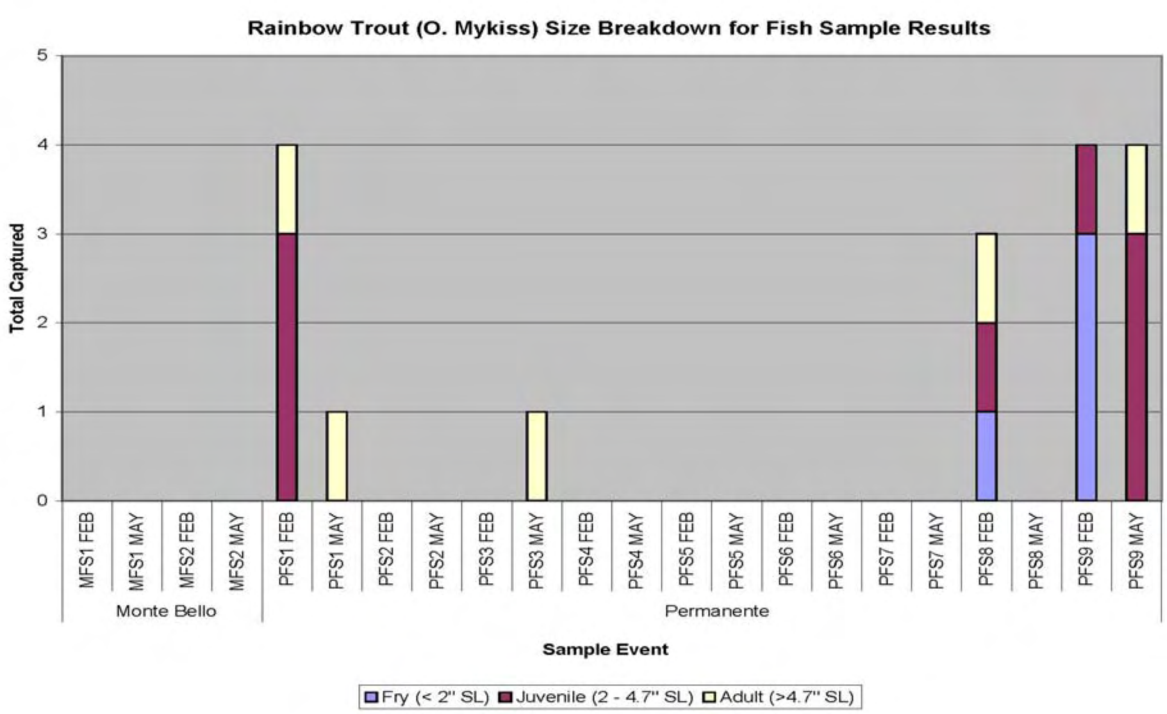


Figure 21. Breakdown of Rainbow Trout size classes as percent of total catch.

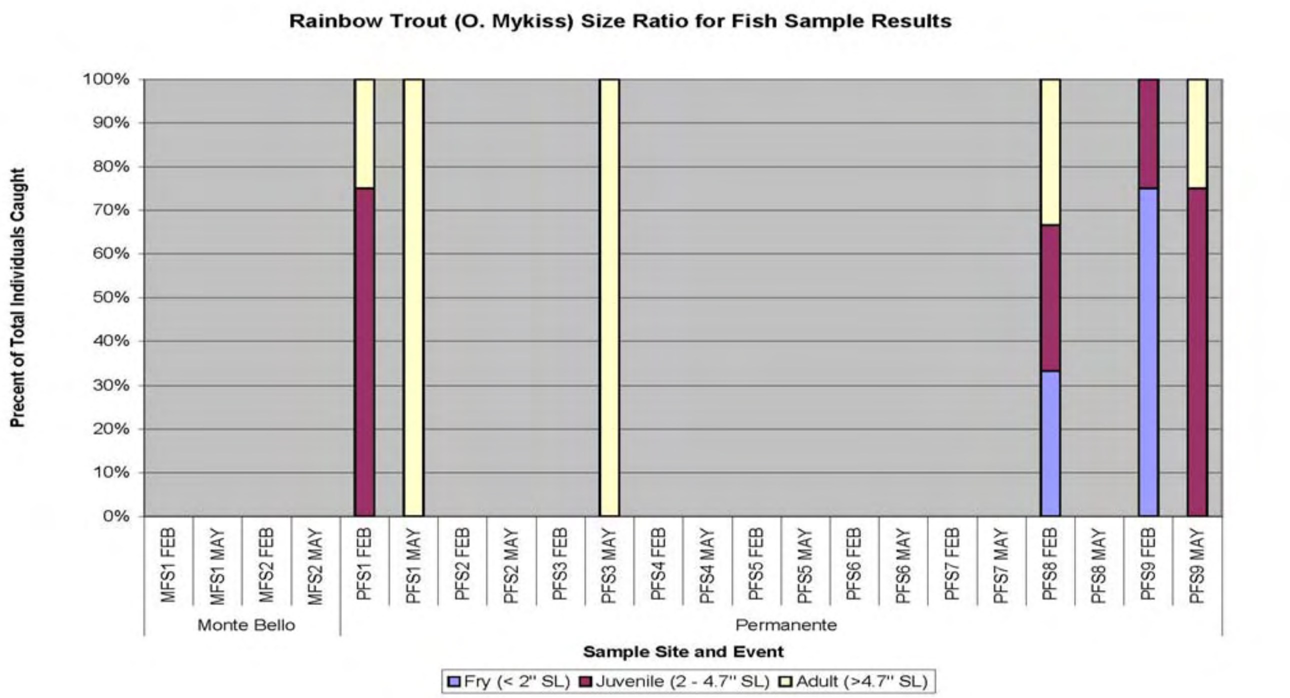


Figure 22. Results of the snorkel surveys by reach in Permanente Creek.

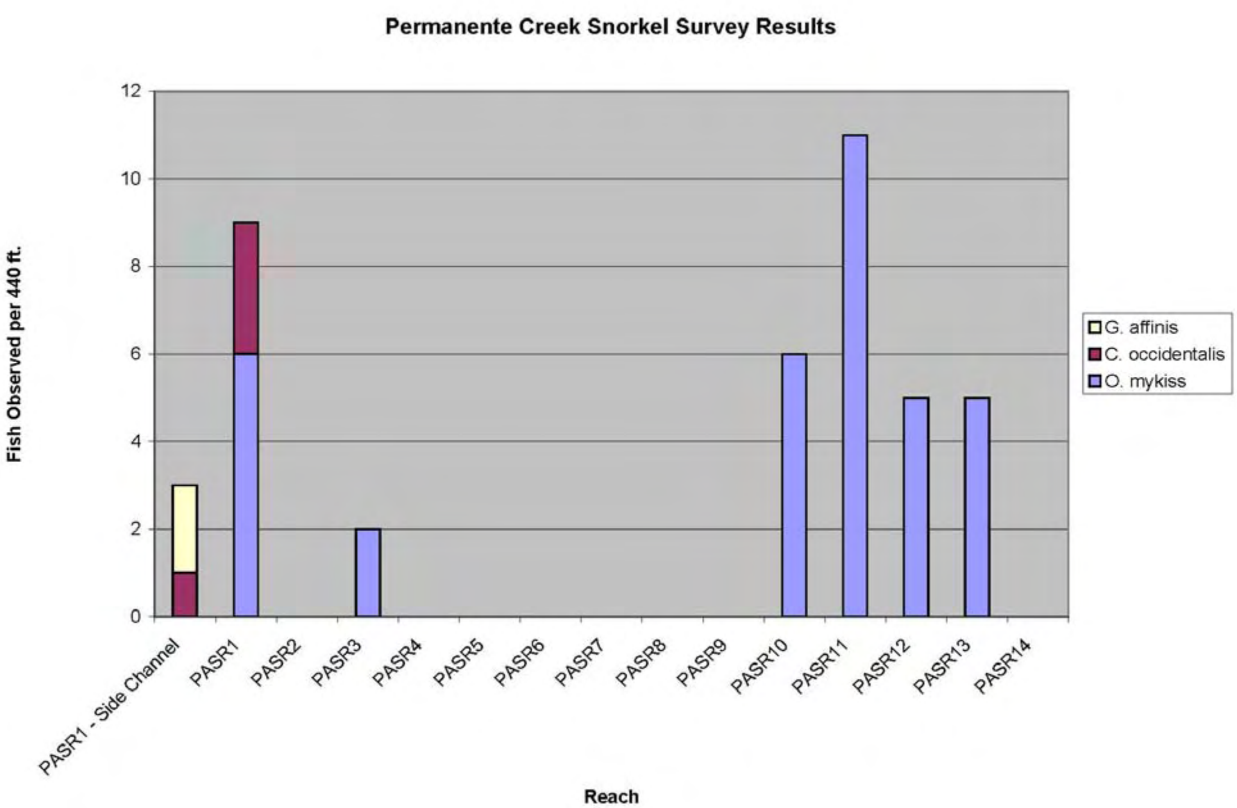


Figure 23. Breakdown of Rainbow Trout size classes observed during snorkel surveys in Permanente Creek.

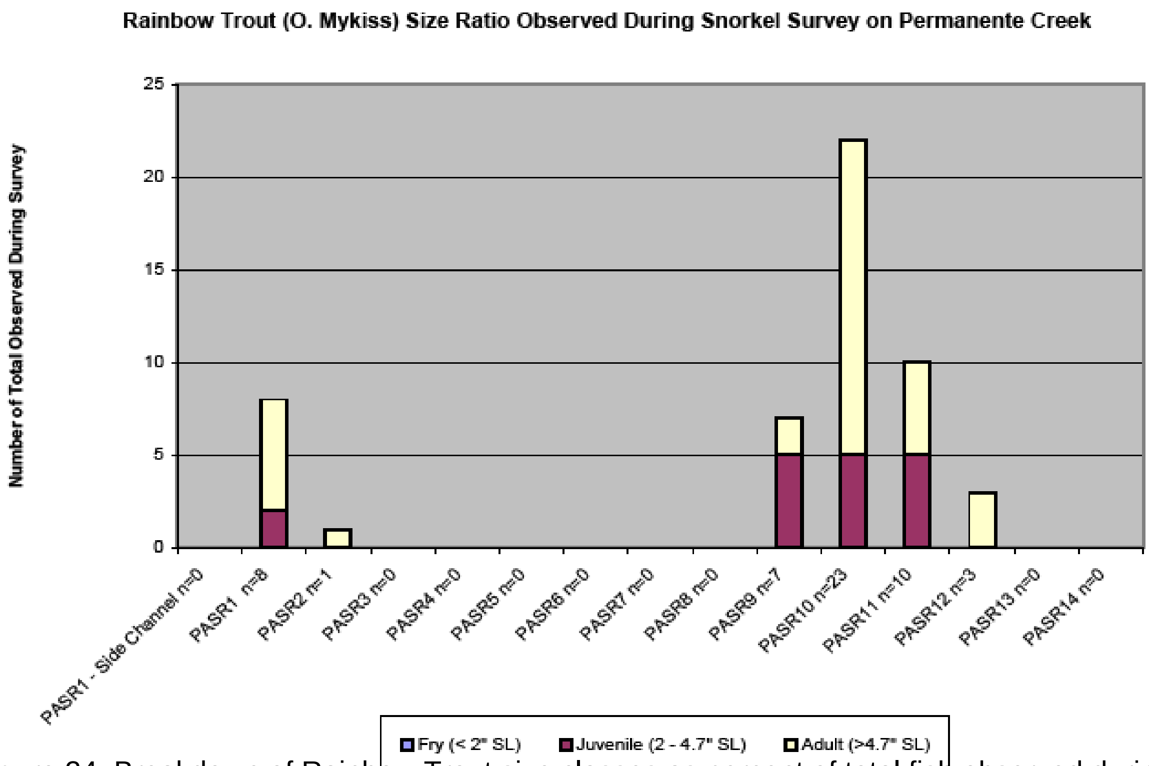


Figure 24. Breakdown of Rainbow Trout size classes as percent of total fish observed during snorkel surveys.

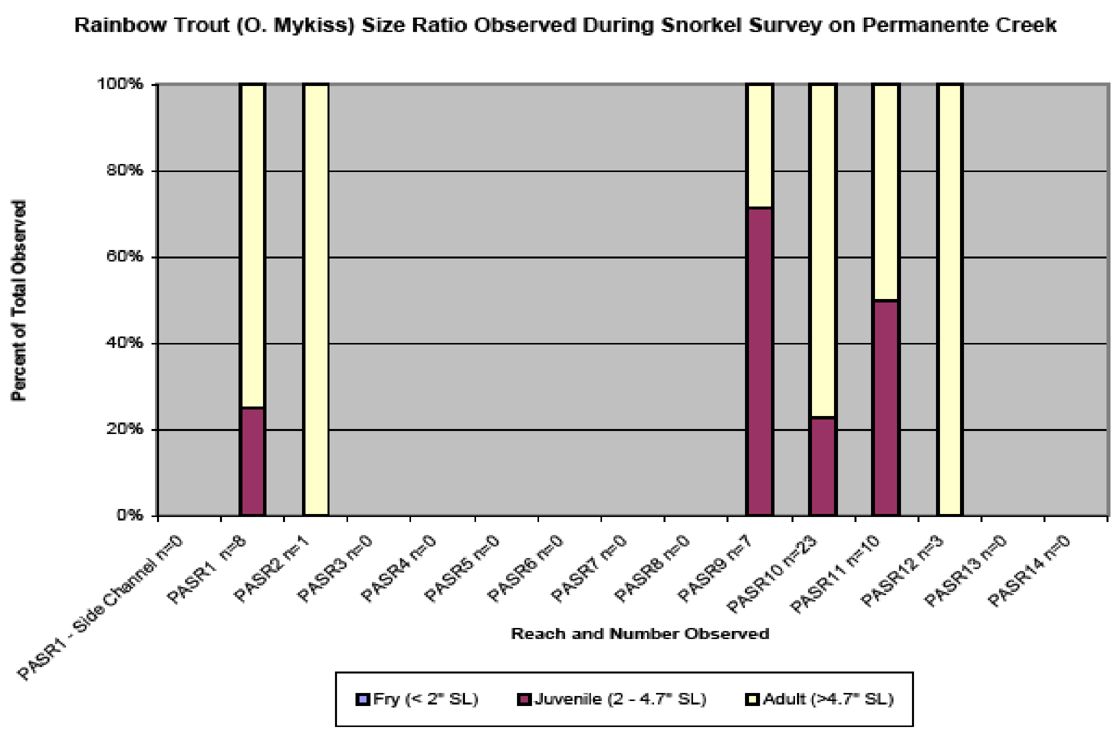


Figure 25. Time-weighted amphibian detections by Aquatic Survey Reach in Permanente Creek.

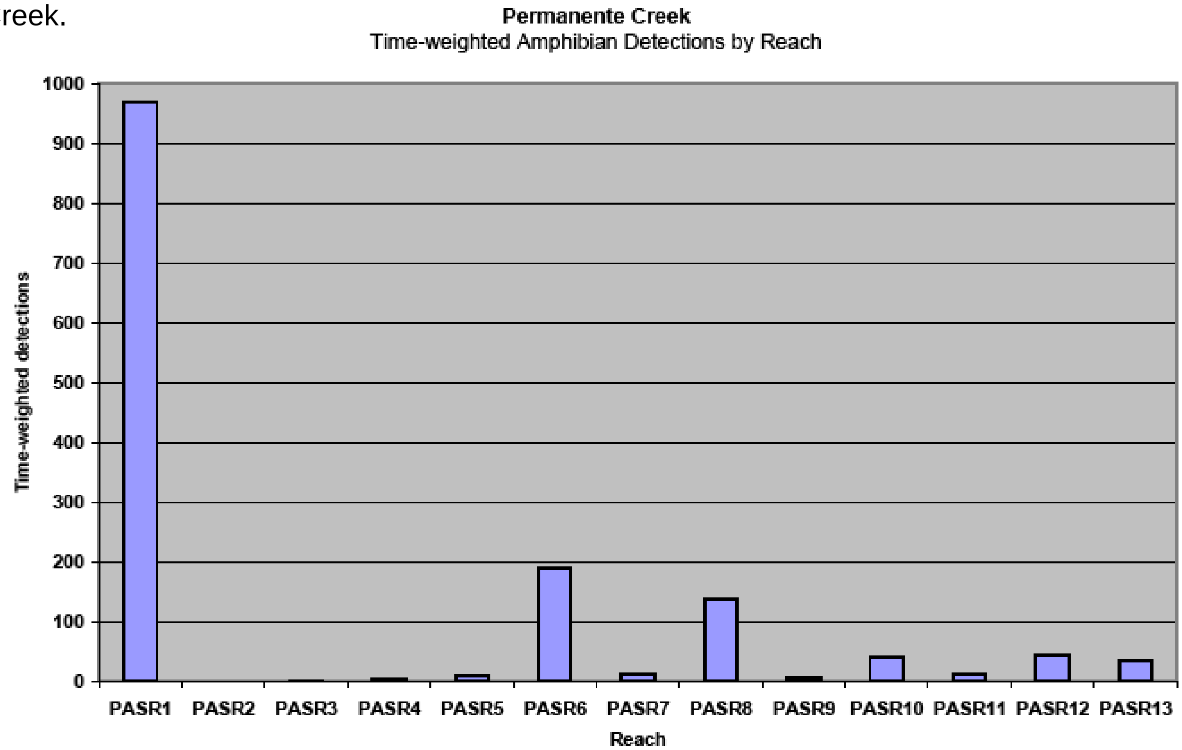


Figure 26. Species composition of amphibian detections as a percentage of detections per reach along Permanente Creek. n=total amphibian detections in each ASR.

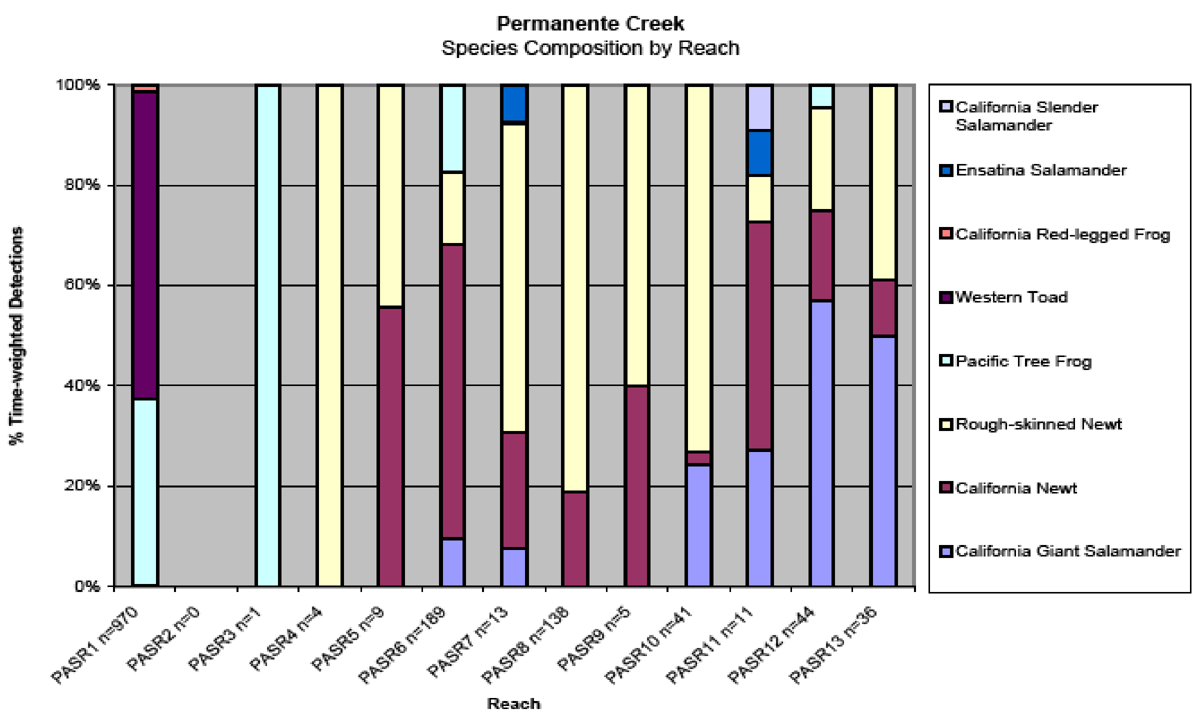


Figure 27. Time-weighted detections of amphibian species by Aquatic Survey Reach along Monte Bello Creek.

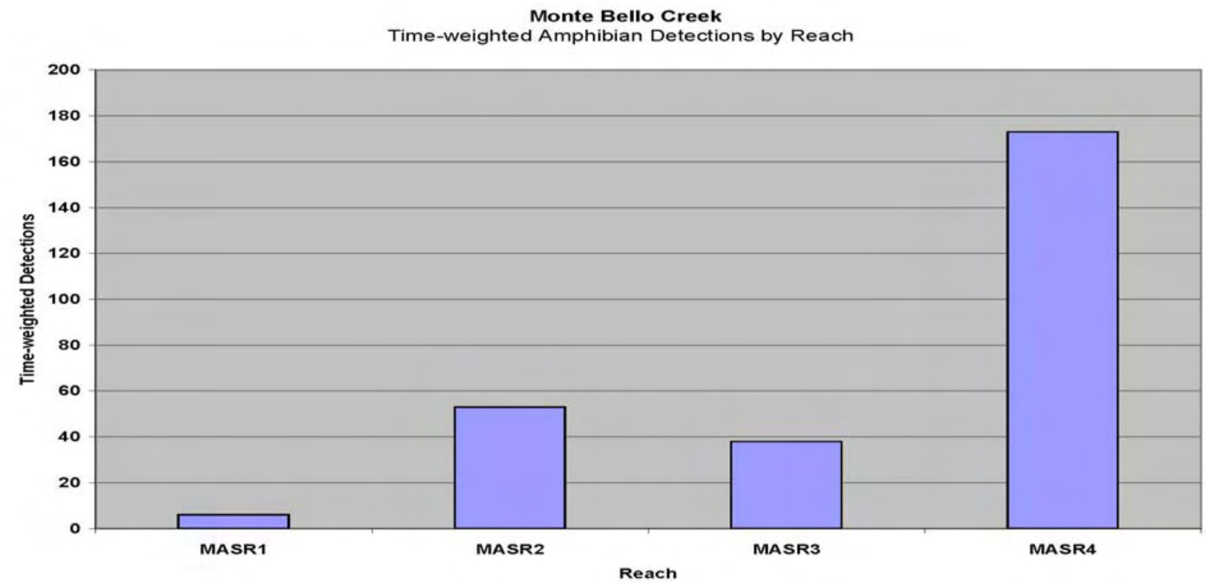


Figure 28. Species composition of amphibian detections as a percentage of detections per reach along Monte Bello Creek. n=total amphibian detections in each ASR.

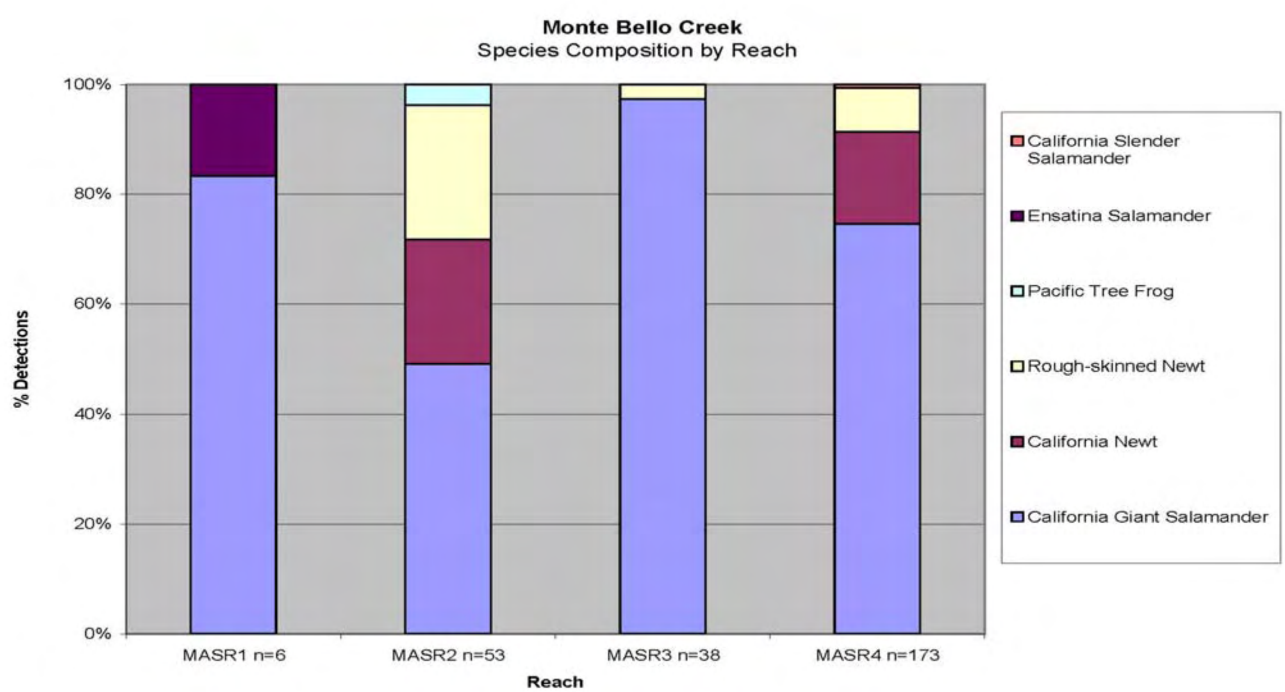


Figure 29. Benthic macroinvertebrate richness measures by sample location.

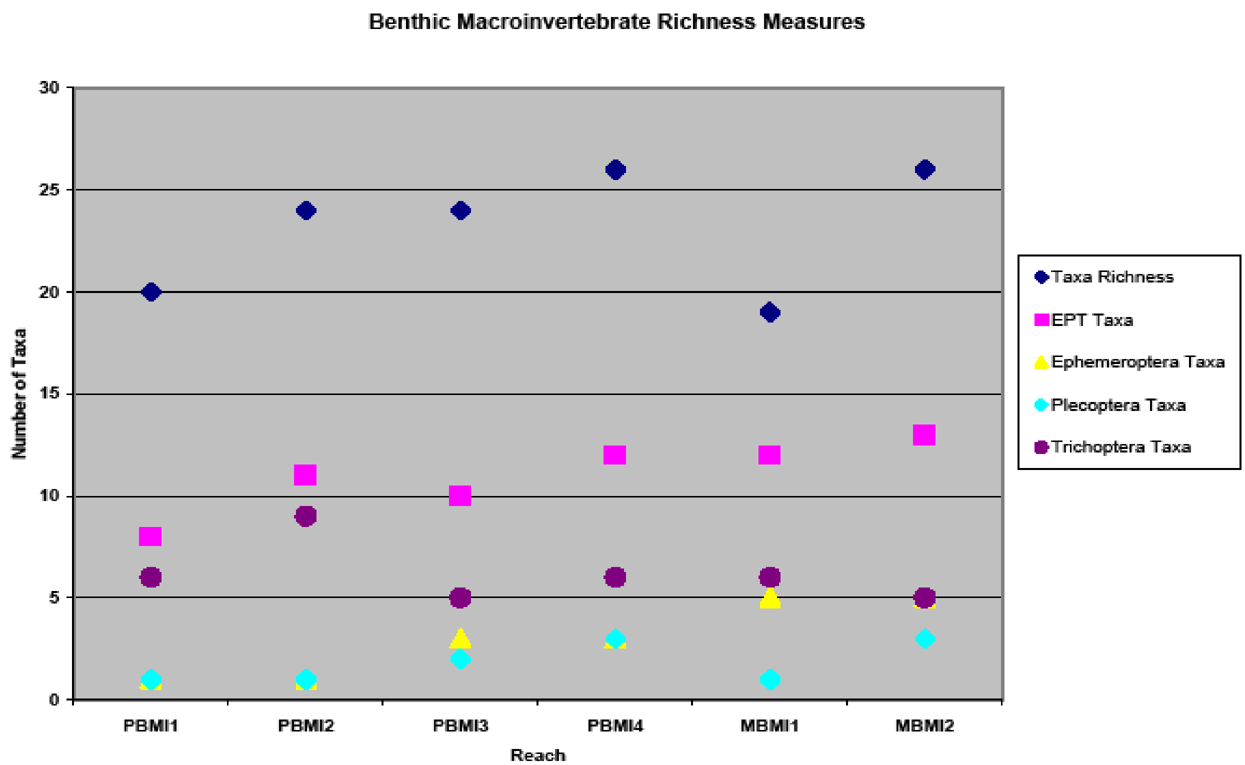


Figure 30. Benthic macroinvertebrate composition measures by sample location.

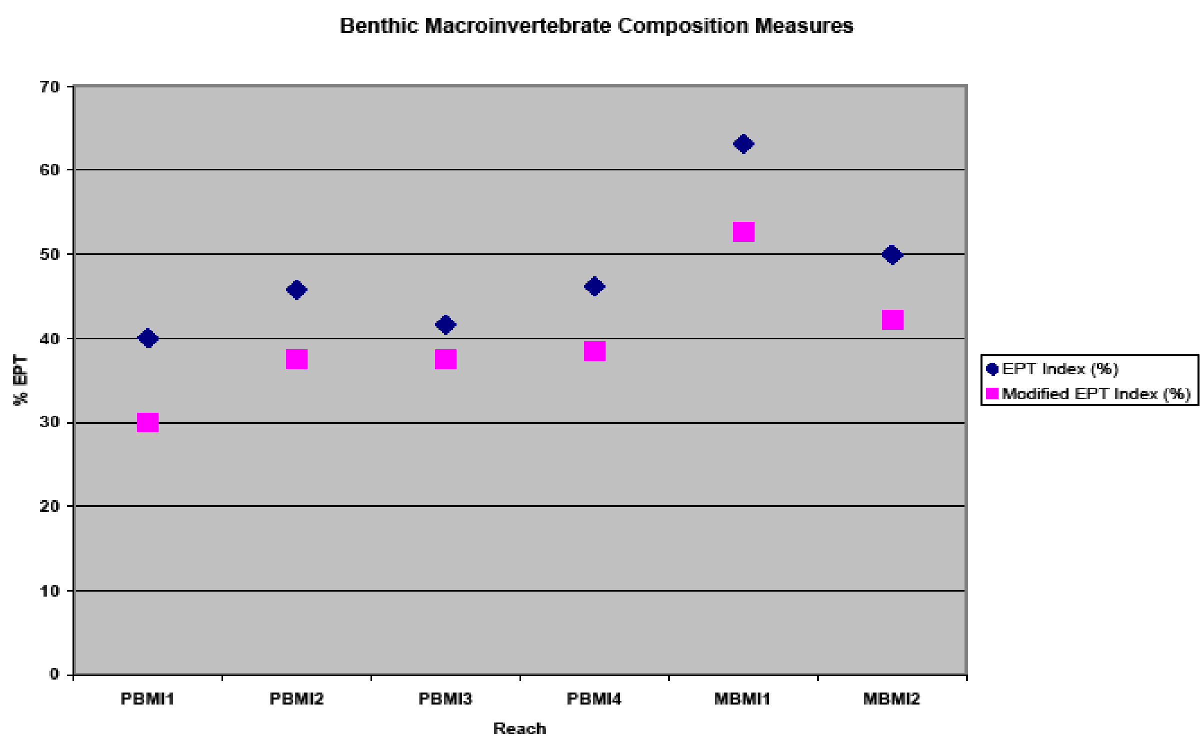


Figure 31. Shannon Diversity Index values by sample location.

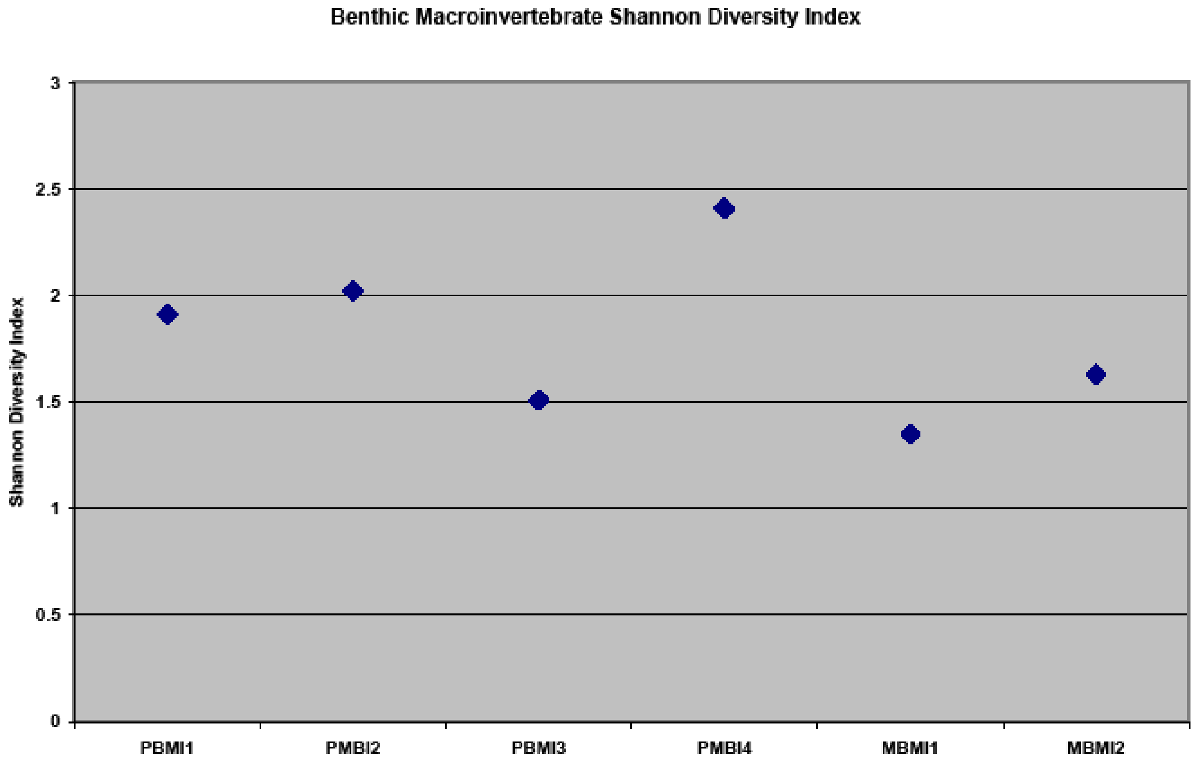


Figure 32. Tolerance/intolerance values by sample location.

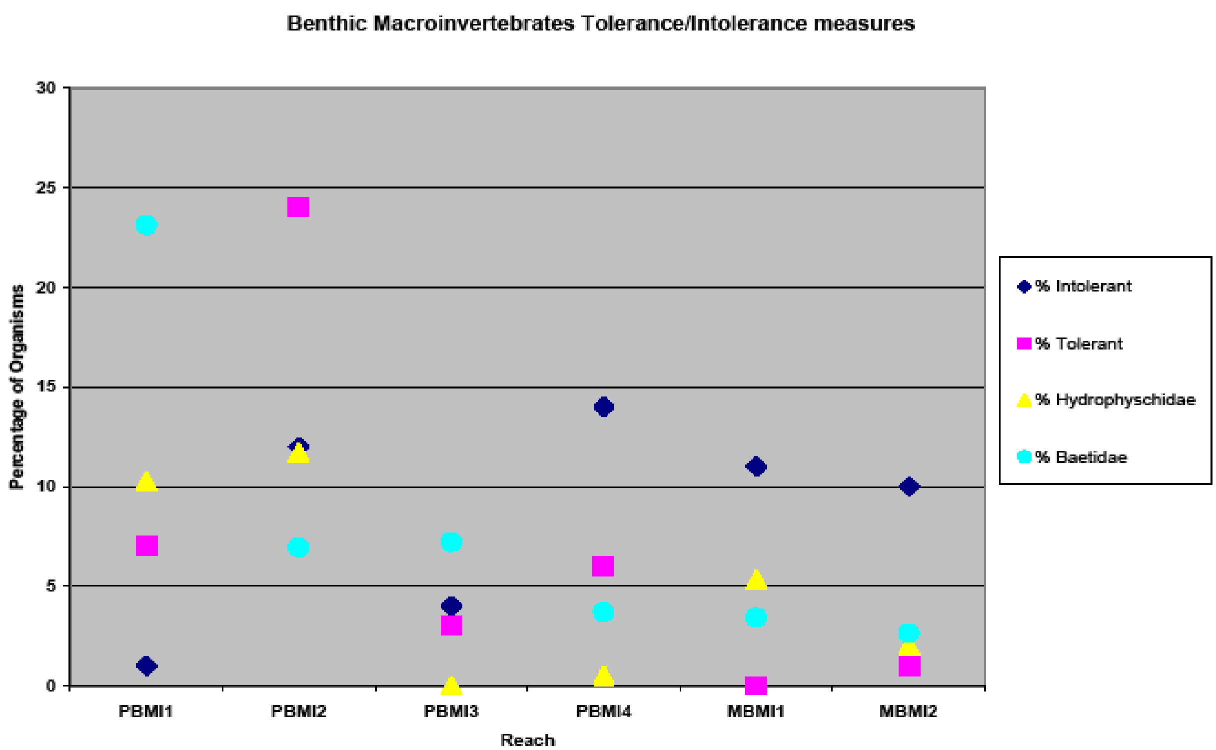
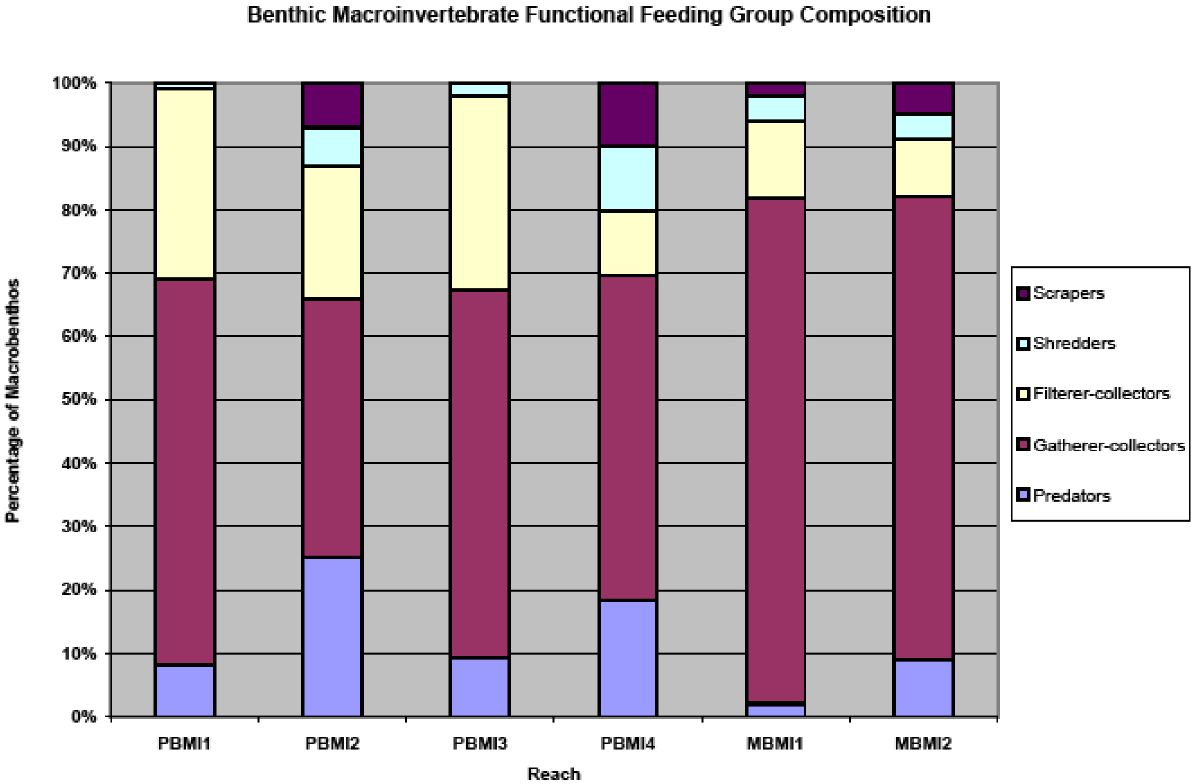


Figure 33. Composition of functional feeding groups as a percentage of organisms by sample location.



APPENDIX H
REVEGETATION PLAN

Revegetation Plan

Lehigh Permanente Quarry

Santa Clara County, California

Prepared for:

Lehigh Southwest Cement Company
24001 Stevens Creek Blvd.
Cupertino, CA 95014

Attn: Carolina D. Addison
Director of Environment Land Resource Development

Prepared by:

WRA, Inc.
2169 G East Francisco Boulevard
San Rafael, CA 94901

Attn: Amy Parravano
amy.parravano@wra-ca.com

May 2023 WRA #16143-18

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EXECUTIVE SUMMARY

This Revegetation Plan (Plan) describes the revegetation program for Permanente Quarry's proposed Reclamation Plan replaces the previously approved revegetation plan (2012) except for the Permanente Creek Reclamation Area (PCRA), which is not addressed in this document. This Plan provides specific guidance on soil composition and depth, species planting palette, and revegetation success criteria. The Plan is based on site specific analysis and testing, augmented by the results of test plot monitoring, and current and future revegetation results, to optimize revegetation success. This Plan employs the following revegetation strategies:

- Species palette based on:
    - Initial assessment of native plants in undisturbed areas
    - Results of 16 test plots
- Planting plans that incorporate:
    - Analysis and characterization of planned final slope angles
    - Slope aspect
    - Visibility from populated or frequently visited areas
    - Environmental objectives, such as aesthetics from public viewpoints
    - Substrate limitations (such as hard rock walls)
    - Other prevailing considerations (such as highwall benches regraded for stability)
- Resoiling with materials designed to address lack of stockpiled topsoil. Materials may include fine-grained rock, salvaged soils, soil amendments or mulches, or imported soils, as available.
- Interim erosion control and final revegetation with native and naturalized species, using:
    - Suppliers specializing in California native plants
    - Seed collected from on-site plants or the surrounding region where local genetics are factored
    - Plugs and container plants where local slope and aspect will support larger species
- Success based on revegetation performance standards, demonstrated by monitoring and measuring for species richness, density, and cover.
- Maintenance until success criteria is met through supplemental planting, weed control, and application of organic materials.

Utilizing these strategies, the Plan is designed to reclaim disturbed lands to self-sustaining revegetated cover that support a condition of open space consistent with the County Hillside zone land use. The vegetation communities established will mature over time to be similar to surrounding natural areas. Eventually these areas will develop into mixed scrub habitat that will blend in with the surrounding environment. While these should provide habitat for wildlife, wildlife habitat is not a specific reclamation goal. When practical, seeds used for the revegetation effort will be generated from seed collected on-site and contract grown in commercial gardens to generate large amounts seed and plant stock that have adapted to local conditions. These strategies are based off a soil development plan and a detailed test plot program. The test plot program generated useful data regarding the optimal species blends and planting methods. Additionally, the soil development plan and test plot program were designed to develop blends of materials available on-site and supplemented by imported cover that will enhance the amount of growth media available for revegetation purposes, as necessary to ultimately achieve revegetative success.

Table of Contents

List of Appendices

List of Preparers

Hope Kingma Principal in Charge
Amy Parravano Senior Associate Biologist
Scott Batiuk Associate Plant Biologist
Cody Lambrecht Restoration Landscape Designer
Michael Rochelle GIS Analyst

List of Acronyms

Cal-IPC	California Invasive Plant Council
CANGC	California Association of Nurseries and Garden Centers
Lehigh	Lehigh Southwest Cement Company
PCRA	Permanente Creek Reclamation Area
Quarry	Permanente Quarry
RPA	Reclamation Plan Area
SAIC	Science Applications International Corporation
SAR	Sodium Adsorption Ratio
SMARA	California Surface Mining and Reclamation Act
USDA	United States Department of Agriculture

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1.0 INTRODUCTION

This Revegetation Plan (Plan) has been prepared at the request of Lehigh Southwest Cement Company (Lehigh) for the Permanente Quarry (Quarry). This plan provides recommendations for revegetation of 631 acres of the Reclamation Plan Area (RPA). The RPA and boundaries of the larger 3,510-acre Quarry property are shown in Figure 1. The recommendations in this Plan are intended to comply with the requirements of the California Surface Mining and Reclamation Act (SMARA), Public Resources Code section 2710 et seq., and SMARA's reclamation standards at Code of Regulations, Title 14, section 3705 et seq. (Reclamation Standards). This Plan replaces the previously approved reclamation plan (2012) except for the Permanente Creek Reclamation Area (PCRA), which will be addressed in a separate revegetation memorandum associated with the Permanente Creek Restoration Project dated November 14, 2018.

SMARA regulations at California Code of Regulations Section 3711 provide guidance to developing site-specific performance standards for topsoil salvage, maintenance, and redistribution. The regulations include salvaging soil before mining begins; however, they also provide,

> *If the amount of topsoil needed to cover all surfaces to be revegetated is not available on-site, other suitable material capable of sustaining vegetation (such as subsoil) shall be removed as a separate layer for use as a suitable growth media.*

Permanente Quarry is such a site. Operations here were initiated almost a century before these regulations were developed. Consequently, as reclamation planning is employed, creative options must be available to address surfaces that do not have the proper water holding capacity and nutrients for rapid establishment of vegetation; thus, this Plan compiles available data for site conditions and the results of on-site revegetation test plots and provides conceptual recommendations for resoiling and revegetation. Because no solution may be sufficient for the entirety of the approximately 631 acres to be revegetated, flexibility is provided for the soil amendment materials. While the vegetation goals are set in terms of SMARA reclamation standards for revegetation richness, density, and cover, the key determinant of success will be whether a self-sustaining vegetation is initiated that will, over time, control erosion, prevent off-site sedimentation, and attenuate visual contrasts where mined surfaces are visible from off-site locations. These revegetation goals are compatible with the land use goal for reclamation.

Materials available to supplement growth media are limited; however, the reclamation plan calls for use of imported soil and other materials to backfill the Quarry. If that provision is employed, then the solution to soil amendment is more easily resolved by diverting a fraction of the import for that use.

Reclamation of the RPA will occur within the disturbed areas shown in Figure 1. Existing and planned soil disturbance at the site that is to be revegetated totals approximately 631 acres, and this acreage has been broken up into three phases associated with reclamation sequencing. The acreage of each Revegetation Phase Polygon is shown in Table 1 and is inclusive of the disturbed areas with a small buffer around the disturbance area to smooth boundaries. Reclamation will be divided into three distinct phases, and the sizes of the areas requiring revegetation in each phase are described in Table 1. These areas are referred to as "Revegetation Phases" and parallel the Reclamation Phasing described in the Reclamation Plan (Lehigh Southwest Cement Company 2023). Engineered swales will be created on the interior edges of benches to collect and direct stormwater. Reclamation will include revegetation of disturbed ground, except for active roads and adjacent drainage swales, with native species following the guidance set forth in the Reclamation Standards. Reclamation will occur in phases with progressive revegetation of areas as the planned landforms are graded to final contour.

Table 1. Revegetation Phase Acreages

PHASE	APPROXIMATE ACREAGE
Phase 1 (0–20 years)	298
Phase 2 (15–30 years)	95
Phase 3 (30–40 years)	232
TOTAL REVEGETATION AREA:	**631**

This Revegetation Plan includes a description of the following:

- Goals of the revegetation program;
- Site characteristics that influence revegetation;
- Test plot program (constructed in 2008) and results;
- Proposed soil development and planting methods; and
- Performance standards.

Appendix A lists potential suitable native plant species for revegetation of the RPA. Appendix B includes soil test reports from Soil and Plant Lab, Inc. Appendix C includes Figures 1-5 as referenced in this Revegetation Plan. Appendix D summarizes revegetation along test plots and associated maps and photos.

1.1 Revegetation Goals and Objectives

The goal for revegetation efforts in the RPA is to establish a self-sustaining vegetation cover that will, over time, control erosion, prevent off-site sedimentation, and attenuate visual contrasts where mined surfaces are visible from off-site locations. Use of native shrubs will assist in blending mined surfaces into the surrounding landscape. Revegetation will be sufficient to stabilize the surface against the effects of long-term erosion and is designed to meet the post-mining land use goal.

Revegetation plans intend to visually integrate with the surrounding undeveloped areas and provide for soil protection. The surrounding areas include north-facing slopes with scrub communities and scattered high meadows and dry south-facing slopes vegetated with chaparral and scrub species. The objective of RPA revegetation for north-facing slopes is to establish shrub and herbaceous species present in adjacent undisturbed communities..

For south-facing RPA slopes, the objective of revegetation is to mimic the mixed scrub and chaparral communities present on south-facing slopes in adjacent undeveloped areas by seeding with native shrubs and grasses that will eventually contribute to the establishment of scrub communities. Results from the completed test plot program have been used to improve the phased reclamation of the quarry and are described in Appendix D. Annual monitoring results of the test plots provided useful information on species survivorship, natural recruitment success, and soil blend and depth preferences. The results also help assess additional revegetation components such as benefits of mulch around container plants and the need for herbivory control. These analyzed results were used to further refine the planting plan such that the most successful plant species and soil blends are used preferentially to facilitate revegetation of the site as quickly as possible.

1.2 Summary of Revegetation Tasks

Tasks described in this Plan will provide vegetative cover for final contours, thus controlling erosion and stabilizing slopes on-site. Revegetation efforts will utilize plant materials capable of self-regeneration without continued dependence on irrigation, soil amendments, or fertilizer in accordance with the Reclamation Standards.

Seeding of the finished slopes with a mixture of grasses, herbaceous plants, and shrubs will provide surface cover and erosion control for the new slopes. This Plan describes the test plot program, soil treatment and plant installation, maintenance and adaptive management guidelines, and verifiable monitoring standards to achieve the goals and objectives listed above.

2.0 EXISTING CONDITIONS

2.1 Native Soil Types

The USDA *Soil Survey of Santa Clara Area, California* (USDA 1958) indicates that the RPA has seven native soil types (map units) and depicts excavated Quarry areas as a "Pit" map unit. These map units are described in detail below. According to the soil survey, the native soils of the RPA were subject to erosion and gullying, were generally quite shallow, and hosted a plant community almost wholly dominated by scrub. Although historical Quarry activities have disturbed the native soils, previous successful restoration plantings at the Quarry have shown that plant communities may be restored on a variety of surfaces.

Pit (Ec): This map unit consists of areas large enough to map where excavations have been made and where the original soil has been removed. Excavations in this area have been principally for limestone and aggregate production.

Azule silty clay, 20–30% slopes (At): Azule silty clay surface soil consists of brown or pale-brown silty clay that normally varies from 8–15 inches in depth. The surface soil overlies a brown or pale brown slightly compact subsoil of silty clay texture. The underlying material occurs at depths of 20–45 inches and is light-brown or light yellowish brown unconsolidated material of clay loam or silty clay loam texture. In a few places a small amount of gravel occurs in the profile. The native vegetation is mostly brush, but there are some areas of this soil type in grassland and woodland.

Los Gatos clay loam, 20–35% slopes (La): The Los Gatos surface soils are brown and become nearly reddish brown when moist. They grade into brown or reddish-brown subsoil of clay loam texture. In most places some rock fragments occur in the subsoils. The number and size of fragments increase with depth. The soils are underlain by hard but generally broken or shattered metamorphosed sedimentary rock at depths of 26–38 inches.

Los Gatos clay loam, moderately eroded, 20-35% slopes (Lb): This soil differs from the non-eroded Los Gatos clay loam described above mainly in degree of erosion, except that the exposed soil is redder in color, somewhat shallower, and contains a few gullies.

Los Gatos - Maymen stony soils, undifferentiated, 50%+ slopes (Lf): This map unit consists of very steep and stony areas of Los Gatos and Maymen soils. Slopes are steep, and in most places rock outcrops are numerous. The vegetation is a dense growth of brush. The Los Gatos soils predominate, but in some places large areas of Maymen soils occur. The Los Gatos surface soils are brown and become nearly reddish brown when moist. They grade into brown or reddish brown slightly compact subsoils of finer texture than the surface soils. In most places some rock fragments occur in the subsoils. The number and size of fragments increase with depth. The soils are underlain by hard but generally broken or shattered shale or sandstone that has undergone varying degrees of metamorphosis. Maymen surface soils are light brown or pale brown. They overlie light brown or light reddish brown medium textured subsoils. In most places rock fragments occur in the subsoils and in the surface soils. The subsoils grade irregularly at shallow depths into hard sandstone or conglomerate bedrock.

Permanente stony soils, undifferentiated, 50%+ slopes (Pa): These very steep areas of Permanente soils are very shallow and stony. The surface soils are brown (becoming nearly reddish brown when moist), medium textured, stony, and generally non-calcareous. In most places fragments of bedrock are mixed with the surface soils, which grade irregularly at very shallow depths into light-gray or white hard limestone bedrock. The natural vegetation is almost entirely brush.

Soper gravelly loam, 20–35% slopes (Sm): The surface soil is a brown or light brown, slightly or medium acid gravelly loam to depths of 8–13 inches. The surface soil grades into a slightly more reddish-brown, moderately compact, weakly blocky subsoil of gravelly clay loam texture. The subsoil retards drainage somewhat and causes waterlogging of the surface soil during heavy rains. At depths of 23–32 inches the subsoil grades into a noncalcareous moderately or weakly consolidated conglomerate bedrock that is somewhat more permeable than the subsoil.

Soper gravelly loam, 35-50% slopes (So): This soil is normally somewhat shallower than that on less steep slopes. The natural vegetation is a thick growth of brush. The typical slopes of Soper soils usually range from 20–35%, but steep slopes are more common in this area. The surface soils are brown or light brown, medium textured, and generally gravelly. The surface soils grade into slightly more reddish-brown, moderately compact, weakly blocky subsoils of gravelly clay loam texture. The subsoils in most places are dense enough to retard drainage to a moderate degree. The subsoils grade into brown or yellowish-brown noncalcareous, moderately or weakly consolidated conglomerate bedrock.

2.2 Climate

The RPA lies within a semi-arid Mediterranean climate zone characterized by warm summer and mild winter temperatures with a substantial slope effect contributing to vegetative community differences on north- and south-facing slopes. Rainfall occurs mainly from November through April. Average annual rainfall is about 22 inches; however, precipitation can range widely from year to year. On north-facing slopes, conditions are moister and cooler than on south-facing slopes as evidenced by the dramatic differences in vegetative communities. The RPA will have both north-facing and south-facing slopes.

2.3 Vegetation

Vegetation in the RPA is described in WRA's *Biological Resources Assessment* (2011). Portions of the RPA have been historically disturbed by Quarry operations and other industrial activities dating to the early 1900's. According to the *Biological Resources Assessment*, a Northern Mixed Chaparral/Scrub Oak Chaparral/Coast Live Oak Woodland community is presumably the natural community that once dominated the majority of the RPA. Most of the hillslopes surrounding the RPA are described as one of these community types. These biological communities are a mosaic of south-facing dry rocky slopes with thin soils dominated by chaparral species and north-facing slopes and shaded ravines dominated by a mature tree and shrub dominated canopy. These north facing slopes support oak woodland and bay forest in the canyons and chaparral on the ridges.

Shrub species typical of the chaparral community on south-facing slopes include mainly native species: California sagebrush (*Artemisia californica*), chamise (*Adenostoma fasciculatum*), coyote brush (*Baccharis pilularis*), scrub oak (*Quercus berberidifolia*), buckbrush (*Ceanothus cuneatus*), toyon (*Heteromeles arbutifolia*), and poison oak (*Toxicodendron diversilobum*). On north-facing slopes, typical overstory species include coast live oak (*Quercus agrifolia*), California bay (*Umbellularia californica*), scrub oak, toyon, and California buckeye (*Aesculus californica*) with scattered valley oak (*Quercus lobata*), and blue oak (*Quercus douglasii*). Scrub species in the understory on north-facing slopes are typically coyote brush and poison oak.

2.4 Previous Revegetation Sites

Previous natural and focused revegetation efforts at the Quarry have occurred successfully. In the EMSA, cut slope above the old "boneyard" was covered with a dense shrub community dominated by purple sage (*Salvia leucophylla*; see Appendix A). The slope below the old boneyard is adjacent to the Quarry entrance and is vegetated with a variety of native and ornamental tree species, including olive (*Olea europaea*), Monterey pine (*Pinus radiata*), Deodar cedar (*Cedrus deodara*), and coast live oak. These slopes were graded during the construction of the previous administration building locations in 1941. Historic aerial photos from 1948 show young plantings in some of these areas that are currently covered with a dense layer of trees and shrubs.

Previous material storage areas were successfully revegetated per the 1985 Reclamation Plan (known as Area C in that plan). Native shrub species such as coyote brush and California buckwheat (*Eriogonum fasciculatum*) were used in that revegetation effort and currently dominate the area today (Appendix A).

Past revegetation efforts typically consisted of grading slopes to a final contour, hydroseeding or seeding with native grass species, and planting at a low to moderate density with native shrubs and trees including coyote brush, chamise, and oaks from locally collected cuttings and acorns. The growing substrate was typically crushed overburden rock with little reclaimed topsoil. More than a decade after reclamation, the most successful sites were primarily south-facing slopes which are now dominated by 70–100% cover of native shrubs including California buckwheat, coyote brush, buckbrush, and California sagebrush.

Irrigation was utilized in some revegetated areas to encourage the establishment of planted trees and shrubs, and protective cages were installed around most plantings to reduce damage from deer browsing. Generally, these areas are now dominated by an herbaceous layer of non- native and native grass species including wild oats (*Avena* spp.), brome grasses (*Bromus* spp.), three weeks fescue (*Festuca microstachys*), and Italian ryegrass (*Festuca perennis*).

3.0 GROWTH MEDIA DEVELOPMENT

Areas to be revegetated in the RPA will largely consist of overburden rock surfaces overlain by fine-grained cover, other fill slopes, areas used for general operations that have been compacted for vehicle travel, backfill within the Quarry, and limited stability benches along highwall cut slopes. Overburden on-site is low-grade limestone or greenstone that must be mined to reach the high-grade limestone situated at deeper elevations. Fill slopes scheduled to undergo revegetation will be graded to a final contour. For the purposes of this report, "soil" refers to the upper layer of earth in which plants grow, typically consisting of a mixture of decomposed rock and organic material. "Topsoil" refers to the upper most layer of soil, typically the upper 5–10 inches, and it contains the highest levels of organic matter, microorganisms, and plant seeds. "Growth media" is a term used to capture any mixture of these components with other materials available on-site. This term is broader than soil because it captures a variety of materials intended to support plant growth that may provide lower than typical levels of organic material content. The terms "soil laboratory," "soil analysis," and "soil sample" colloquially capture all these material types.

The growth media development plan is designed to produce recommendations for additional materials that may be added, if necessary, to improve soil texture, structure, and nutrient availability to promote successful revegetation . To provide information on growth media conditions for the RPA growth media development program, several samples of soil and other materials available on-site were collected. These samples included a representative sample of the overburden rock which will be the underlying substrate throughout the RPA, as well as samples from 25 undisturbed reference sites, three existing revegetation sites, and five potential supplemental material sources. While

The Soil and Plant Laboratory, Inc. in Santa Clara, California performed an analysis of the soil and on-site materials samples, including an assessment of the following characteristics:

- pH
- Total Exchangeable Cations
- Salinity
- Sodium
- Sulfate
- Sodium Adsorption Ratio (SAR) Value
- Boron
- Macronutrients (Nitrogen, Phosphate, Potassium, Calcium, Magnesium, Sulfur)
- Micronutrients (Iron, Manganese, Copper, Zinc)
- United States Department of Agriculture (USDA) Soil Textural Classification
- Organic Matter Content (Percent Dry Weight)

Detailed reports on the soil sample analyses are provided in Appendix C. Figure 2 shows the location of soil samples described below. Table 2 outlines the primary characteristics of the soil samples.

Table 2. Description and characteristics of soil samples (additional details in Appendix D).

SAMPLE MATERIAL	DOMINANT PLANT COMMUNITY	USDA map unit (1958)	Organic matter (% dry weight)	USDA SOIL CLASSIFICATION
Undisturbed Reference Topsoil (potential topsoil sources)				
EMSA - C5	chaparral	La	2.4	Clay Loam
EMSA - C6	chaparral	Lf	2.5	Very Gravelly Sandy Loam
EMSA - C7	chaparral	Sm	3.5	Sandy Clay Loam
EMSA - C8	chaparral	La	2.5	Clay Loam
EMSA Native	chaparral	Sm	7.4	Sandy Loam
WMSA Native	chaparral	Lf	2.5	Clay Loam
South of Quarry - C1	chaparral	Pa	6.9	Gravelly Sandy Loam
South of Quarry - C2	chaparral	Lf	8.8	Sandy Clay Loam
South of Rock Plant - C3	chaparral	Pa	6.7	Loam
South of Rock Plant - C4	chaparral	So	7.6	Gravelly Sandy Loam
EMSA - G3	grassland	La	0.7	Gravelly Sandy Clay Loam
EMSA - G4	grassland	La	2.2	Gravelly Clay Loam
South of Quarry - G1	grassland	La	2.6	Sandy Clay Loam
South of Rock Plant - G2	grassland	At	0.7	Sandy Clay Loam
Revegetation Site Samples				
East Quarry Revegetation	native shrubs (70%) [Cal. buckwheat, coyote brush]	Lf	4.8	Very Gravelly Sandy Loam
West Quarry Revegetation	non-native grass (90%), w/ scattered plantings	Pa	3.7	Very Gravelly Loam Sand
WMSA Revegetation	native & non-native grass (70%), w/ shrub/tree plantings	Lb	0.8	Very Gravelly Sandy Loam
Supplemental Materials				
Overburden rock	N/A	Lf	1.2	Gravelly Sandy Loam
Quarry fine greenstone	N/A	Ec	0.7	Very Gravelly Loamy Sand
Rock Plant fines	N/A	At	1.4	Clay Loam
West Main topsoil	N/A	Lf	0.5	Very Gravelly Sand
Quarry topsoil	N/A	Pa	1.2	Very Gravelly Sandy Loam

3.1 Reference Sites

As shown in Table 2 and Figure 2, soil conditions at the 25 undisturbed reference sites supporting native plant communities served as a reference for determining the requirements to achieve a suitable growth medium for revegetation. Existing revegetation sites also provide information for targeting suitable soil conditions since these sites are underlain by a substrate similar to that which will be used in the RPA. Three revegetation sites were sampled in the WMSA and Quarry, and they vary in age of installation and revegetation techniques and plant materials used.

3.1.1 Undisturbed Topsoil Sites

The "EMSA Native" and "WMSA Native" topsoil samples (referred to as "East Dump Native" and "West Dump Native" in soil laboratory reports [Appendix C]) were collected and analyzed in May 2008 while the other 23 undisturbed topsoil samples were collected and analyzed in February and March 2009. Samples were taken from existing road cut banks and vegetated portions of the RPA and adjacent areas on the Quarry property, within oak woodland, chaparral, and grassland vegetation communities. The samples varied in soil texture, organic matter content, and other characteristics (Appendix C). Soil structure and organic matter also varied within each vegetation community type, although grassland samples had low organic matter content and woodland and forest samples generally had higher organic matter content. The organic matter content of the reference soil samples varies between 0.7–9.7% with an average content of 4.8%. A minimum organic matter content of approximately 3% is typically desired for native plant establishment.

3.1.2 East Quarry Revegetation Site

The "East Quarry Revegetation" soil sample (referred to as "Reveg East Pit" in soil laboratory data) was obtained from a revegetation area in the northeast portion of the Quarry (Figure 2). This area was planted in the 1980s, and the primarily south-facing slopes of the site are now dominated by grass and native brush species, including California buckwheat, coyote brush, buckbrush, and California sagebrush. Soil analyses indicate that soil at the East Quarry Revegetation site has the highest organic matter content (4.8%) of the three revegetation sites, an amount sufficient to support native vegetation (Appendix C). The soil texture has a high amount of gravel fractions as well as coarse sands. A soil pit showed a relatively thick "O" horizon, or organic horizon, compared to the other two revegetation sites. Of the three revegetation sites where soil samples were taken, the East Quarry Revegetation site also supports the highest cover of native vegetation, dominated by native shrubs. The other two revegetation sites were dominated by non-native grasses. Given the relatively high organic matter content of the soil and the well-established native vegetation at the East Quarry Revegetation site, the soils at this site provide an appropriate target for RPA soil characteristics.

3.1.3 West Quarry Revegetation Site

The "West Quarry Revegetation" soil sample (referred to as "Reveg West Pit" in soil laboratory data) was obtained from a revegetation area in the northwest portion of the Quarry (Figure 2). The West Quarry Revegetation site was developed in the 1970s. Currently the non-native grass wild oats (*Avena barbata*) dominate the site with broadly scattered plantings consisting of such species as Monterey cypress (*Hesperocyparis macrocarpa*), ornamental pine (*Pinus* sp.), and blue elderberry (*Sambucus mexicana*). The soil conditions at the West Quarry Revegetation site show a slightly lower amount of organic matter (3.7%) than the East Quarry Revegetation site and a similarly high amount of gravel fractions and coarse sands.

3.1.4 WMSA Revegetation Site

The “WMSA Revegetation” soil sample (referred to as “Reveg Slope West Dump” in soil laboratory data) was obtained from a revegetation area at the north end of the WMSA (Figure 2). Installed between 2002 and 2006, the WMSA Revegetation site is predictably less mature than the other two revegetation sites and correspondingly, the vegetation cover at this site is less dense. Hydroseeded grasses and shrub and tree plantings dominate these north-facing slopes. The soil has a relatively low amount of organic matter (0.8%) compared to the other two revegetation sites. A hydroseed slurry, including some compost, biosol fertilizer, mycorrhizal inoculant, and hydrostraw, was applied directly to the overburden rock in this revegetation effort.

3.2 Target Soil Characteristics and Potential Remediation Techniques

Based on the assessment of the undisturbed reference and revegetation sites, some recommendations can be made on the soil characteristics for the RPA that would likely support successful revegetation. These recommendations can be employed at the operator’s discretion based on the location, timing, and availability of soil amendments needed to meet the performance standards. Important factors to consider include soil texture and organic matter content in addition to soil chemistry and nutrient levels. The soil characteristics of the East Quarry Revegetation site provide an appropriate target because it is a revegetation site with the most well-established vegetation and utilized a topsoil medium with loamy soil mixed with small rocks similar to that which will be available under the project. The soil conditions of the undisturbed reference sites provide better conditions as plant growth media; however, these conditions will be more difficult and less realistic to achieve than those at the revegetation sites since the RPA will be more similar to the previous revegetation sites.

Targeting a loamy/rocky topsoil texture would be desirable for the RPA to achieve adequate infiltration rates and an appropriate plant growth medium. Loamy soils with high amounts of gravel and coarse sand were observed to support native shrub species, and so may be an acceptable and desirable soil characteristic in revegetation areas. The East Quarry Revegetation site soil is classified as a Very Gravelly Sandy Loam, and while this soil may include large, gravel-size particles, it has enough smaller material and organic matter to support a chaparral community.

3.3 Available Materials

Since topsoil was not salvaged and stockpiled when initial quarry disturbance occurred many decades ago, there is a deficiency of topsoil on-site. Therefore, existing stockpiles of topsoil, new topsoil generated during quarry operational and reclamation practices, and imported fill will be overlain on WMSA overburden rock, primarily for long-term water protection quality purposes, and to the incidental benefit of revegetation efforts. Remaining topsoil from the RPA will be harvested and stockpiled for reclamation purposes.

3.3.1 Imported Soils

The Quarry surface will be covered with imported surplus construction soil that meets site-specific acceptance criteria. Potential sources of this material will be evaluated for contamination and testing for pesticides, salts, and other impediments to plant growth. To augment growth media, imported surplus construction soil with higher organic matter content than on-site materials may also be used in revegetation.

3.3.2 Overburden Rock

The results of the soil analysis for the representative overburden rock sample (referred to as "West Waste Rock" in soil laboratory data) indicate that the overburden rock alone is not an ideal substrate for certain plant communities being targeted in the RPA. During the test plot program, the lack of moisture-holding capacity in this material resulted in low grass-seed germination rates; however, shrub germination was extensive with the highest number of stems per area, but they were quite slow growing due to the limited moisture availability. The particle size analysis shows that the USDA classification is a Gravelly Sandy Loam with a diverse distribution of particle sizes. With this varied distribution of particle sizes, the susceptibility to consolidation is high. Over time, particles of various sizes could lock into a consolidated state which could slow down water infiltration rates to an undesirable degree and could cause the soil to be impervious in places. The organic content (1.2%) of the overburden rock is low for supporting a native plant community. The pH level indicates slightly alkaline conditions, and the natural lime content is relatively high. The content of salinity, sodium, and boron is safely low, and the Sodium Adsorption Ratio (SAR) value is acceptable. Available nitrogen and potassium are low, phosphorus is fair, and calcium, magnesium, and sulfate are well supplied. Iron, copper, manganese, and zinc occur at low levels (Appendix C).

Given its rocky texture and low organic content, the overburden rock will benefit from the cover of topsoil and/or potential amendments.

3.3.3 Disturbed Topsoil

Both the West Main and Quarry (referred to as Pit 1 in soil laboratory data) topsoils are samples of salvaged, disturbed soils. These samples contained high amounts of gravel content and coarse sands with a broad distribution of particle sizes. The susceptibility to consolidation is very high for these materials. The organic matter content is relatively low at 0.5% and 1.2%, respectively. Somewhat similar to the Quarry fine greenstone material, incorporating the West Main and Quarry topsoil materials with the overburden rock may provide suitable soil texture for vegetation establishment, but would add little value as a source of nutrients and organic matter.

3.3.4 Quarry Fine Greenstone

The Quarry fine greenstone material (referred to as Pit 1 in soil laboratory data) may be left in place or harvested from a slope failure occurring in the Quarry pit if layback of the northern slope is implemented as part of mining and reclamation operations will largely be removed and covered by imported materials. The greenstone material contains coarse sands with high gravel content, and similar to the overburden rock material, the susceptibility to consolidation of this material is high. The infiltration rates are estimated at a slow 0.10 inches per hour and could be even slower when consolidated. Buttress fill will largely cover this substrate.

3.3.5 Rock Plant Fines

The Rock Plant fines material is a byproduct of the rock processing activities at the Quarry. It has a clay loam texture and contains a substantially greater amount of silt and clay compared to the overburden rock. The Rock Plant fines material has relatively low organic matter content (1.4%). Blending the Rock Plant fines material with the overburden rock may improve soil texture conditions; however, based on efforts to create soil blends by the Soil & Plant Laboratory, achieving a homogeneous blend with this material may be difficult to achieve on the broad scale required. The Rock Plant fines material has high moisture content and would have to be dried before it is incorporated with the other soil materials. Only non-limestone fines would be used for revegetation purposes and to address water quality considerations.

3.4 Growth Media Preparation Experimentation

Based on the soil analysis results, a suitable plant growth medium can be created in the RPA by incorporating supplemental materials into imported topsoil on top of and/or incorporated directly into the mined surfaces, as necessary and available (Section 3.5.4). In addition, due to RWQCB requirements for long term water quality protection, several feet of fine-grained material will likely be placed, to the added benefit of accelerated revegetation.

In 2008, nine different growth media combinations were tested at the Soil & Plant Laboratory to gain information on the soil composition resulting from various blends of soil materials, overburden rock, and compost, which was a proxy for added topsoil. In formulating the blends, the lab targeted 4.8% organic matter, the amount of organic matter found in the East Quarry Revegetation soil sample. A summary of the soil blend results is listed in Table 3. These blends are meant to provide a menu of growth media amendment options to provide flexibility that can be used strategically during reclamation and are not intended to be prescriptive for the site.

Nutrient values show improvement in overall fertility for all the blends compared to the overburden rock alone, most often as a result of the nutrient rich compost addition, which served as a proxy for added topsoil. The target organic matter content of 4.8% was surpassed for all the test blends except one, which still had an adequate amount of organic matter for native plants. In general, adding about 25% compost on a volume basis, as a proxy for pure topsoil in the test plots, provided an appropriate amount of organic matter for establishment of native plants.

Lab results indicated that excess sodium occurring in the compost used in the test blends contributed to elevated salinity and Sodium Adsorption Ratio (SAR) values present in the test blend results which was not present in the soil samples tested alone. Evaluating the intended compost or imported fill product prior to use is recommended to assure that salts are safely low. Elevated salinity in the growth media could hinder seed germination and be toxic to seedlings. Compost is not currently proposed for use in reclamation of the RPA (see Section 4.0).

Table 3. Summary of Soil Blend Test Results

	SOIL BLEND	ORGANIC MATTER (% DRY WEIGHT)	USDA SOIL CLASSIFICATION
1	**Overburden rock (73%); compost (27%)**	7.0	Very Gravelly Sandy Loam
2	**Quarry fine greenstone (40%); overburden rock (20%); Rock Plant fines (20%); compost (20%)**	4.0	Very Gravelly Sandy Clay Loam
3	**Rock Plant fines (41%); Quarry fine greenstone (35%); compost (24%)**	5.6	Very Gravelly Loam
4	**Quarry fine greenstone (81%); compost (19%)**	5.1	Very Gravelly Sandy Loam
5	**Quarry fine greenstone (43%); overburden rock (36%); compost (21%)**	8.5	Very Gravelly Sandy Loam

6	**EMSA Native topsoil (68%); overburden rock (32%)**	5.1	Very Gravelly Sandy Loam
7	**EMSA Native topsoil (75%); Quarry fine greenstone (25%)**	10.1	Very Gravelly Sandy Loam
8	**Rock Plant fines (50%); West Main topsoil (28%); compost (22%)**	6.3	Very Gravelly Loam
9	**Rock Plant fines (46%); compost (22%); Quarry fine greenstone (16%); West Main topsoil (16%)**	6.8	Very Gravelly Loam

The most favorable soil blend candidates were those with predominantly EMSA Native topsoil material [blends 6 and 7]. Combining the overburden rock or Quarry fine greenstone material with the EMSA Native topsoil resulted in growth media with excellent fertility and organic content and creates the most promising plant growth media of the blends tested. Growth media mixtures for imported topsoil do not need compost or imported organic matter-rich fill to achieve the target organic matter content level since they are already well-supplied with organic matter.

The second-best soil blends contain the Rock Plant fines material [blends 3, 8, and 9]. While the Rock Plant fines material favorably increases silt and clay content of the coarser overburden rock, Quarry fine greenstone, and West Main and Quarry disturbed topsoil materials, producing homogeneous soil blends with these materials may prove to be logistically difficult. Only non-limestone Rock Plant fines would be considered for inclusion in this mixture. The Rock Plant fines material has a high moisture content and would have to be dried before it is incorporated with the other soil materials. In field conditions, the drying and consequent incorporation of this material may be time-consuming and its effectiveness unpredictable. It is recommended that results from test plots using the Rock Plant fines material be obtained before application on a large scale.

The tested soil blends utilizing compost (as a proxy for topsoil) with the overburden rock or Quarry fine greenstone provide adequate conditions for native plant establishment although the soil texture may be coarser than desired [blends 1, 4, and 5].

3.5 Growth Media Preparation

The objective of this Plan is to meet revegetation objectives using whatever fine-grained media and other materials are available when reclamation within each phase occurs. Different growth media treatments may be used for various surfaces of the RPA, depending on the target plant community and general aspect and substrate of each area. For the purposes of the reclamation plan, it is understood that the supplementary materials discussed below will be non-limestone materials.

3.5.1 Ideal Material Quantities

WRA has investigated portions of the EMSA, Rock Plant, and areas south of the Quarry with undisturbed topsoil and native vegetation and described available topsoil depths and general condition. Soil depths (including the A and B horizons) in undisturbed portions of the RPA average from 8–11 inches in chaparral and 13 inches in grasslands.

The ideal soil preparation depth for areas targeted for scrub in the RPA is 6 inches, a depth tested in the test plots and considered suitable to support most shrub and grass species to be seeded. This target could include 50% ripped overburden rock mixed with 50% topsoil blend. Preliminarily, this could include 3 inches of loamy topsoil which will be amended with other materials to achieve the 6-inch planting medium. In practice, the exact percentages of the blend may be altered based on topsoil and fill availability.

The shrub plantings on highwall benches will require a deeper planting substrate such as 12 inches to support root establishment. Similar to the reclaimed slopes, the ideal planting substrate could consist of 50% overburden rock with a 50% topsoil blend amendment. Preliminarily, this could include 6 inches of pure topsoil, to be amended with other materials to achieve a 12-inch planting medium. The exact percentages of the combination may be adjusted in future reclamation efforts based on test plot results and material availability. These topsoil quantities were chosen based on the results of test plot monitoring. Test plots with thicker soils (up to 24 inches) were consistently overrun by undesired annual grasses.

3.5.2 Soil Surface Treatments

The Reclamation Plan proposes solutions to ensure that material capable of sustaining vegetation (such as using a combination of on-site materials from regrading and imported cover) is used as the growth media into which plants will be planted or seeds sown (Appendix D, Figure 3). In limited areas, highwall benches are planned to remain in place at reclamation for long-term stabilization purposes. The rocky vertical faces will not support substantial vegetative growth; however, the highwall benches flanking the hard rock walls will be revegetated using a revegetation treatment described in Section 4. Cross sections of these areas are provided (Appendix D, Figure 5) for reference.

SOIL BACKFILL

The soil backfill area is limited to the area comprising the existing quarry and adjacent buttress slopes, which will be backfilled with imported and on-site materials to bring it up to final reclamation contours. Many of these materials have been used as growth media blends in the test plot program. In general, these areas will be planted with species targeting scrub and chaparral habitats. Moisture content of the area should support target species richness and cover.

COARSE OVERBURDEN

Coarse overburden represents the largest soil treatment area since this material is the most prevalent surface on-site. Coarse overburden is overburdening rock that has been stockpiled over the years and is in the 2-8” size class. This material was used in the test plot program given its abundance. Used alone, coarse overburden supports very high stem counts of native shrubs in the test plot program. Although total cover of shrubs in the coarse overburden plots was relatively low, shrub establishment was high and some individual shrubs began to grow substantially towards the later years of the test plot monitoring indicating that this treat is an effective, long-term treatment for returning large areas to native scrub or chaparral habitat. The low organic matter content reduces the amount of moisture retention of the soil blend which favors hearty native shrubs over grass and forb species which would otherwise outcompete the shrubs. These areas (largely the WMSA) are scheduled to be covered with finer-grained materials, which are expected to resolve the revegetation limitations.

COMPACTED SOILS

Many of the existing and historic operational areas of the quarry are covered with compacted soils. These are a mixture of soil and rock types that have been laid down at various times throughout history and used for roads, parking, maintenance areas, et cetera. Due to vehicular traffic over the years, they are compacted; however, they contain a mixture of material sizes which can help increase plant establishment and water retention. Areas of compacted soils will be ripped prior to reclamation to enhance plant establishment. Scrub and chaparral communities will be the target communities much like the areas of coarse overburden.

HIGHWALL BENCHES

A limited area at the crest of the greenstone slide is planned for a step-like series of flat benches and vertical or near vertical walls. The hard composition of the rock in these areas promote slope stability despite near vertical slopes. While the near vertical slopes will not be planted, the highwall benches will be revegetated. The majority of the highwall bench soil treatment area will support scrub and chaparral communities. Where needed, some areas will be ripped (when not native rock) and planted similarly to the compacted soils areas.

IMPORTED COVER AND FILL

To augment existing topsoil supplies and ensure sufficient depths of growth media, imported cover and fill will be placed. Potential sources of this material should be evaluated for contamination, and testing for pesticides, salts, and other plant growth impediments should be implemented if deemed necessary.

3.5.3 Soil Amendments

COMPOST

Compost is derived from the biological decomposition of organic material, including such materials as grass and lawn clippings, food overburden, municipal solid overburden, and sewage sludge. Compost is known to enhance macronutrient fertility, improve soil structure, increase infiltration and moisture retention, and improve nutrient exchange capabilities of the soil. Compost may be used as an amendment to enhance soil structure and nutrient composition of the soil substrate. To ensure adequate quality of the compost, if used, it should be certified with the Seal of Testing Assurance by the U.S. Composting Council.

MYCORRHIZAL INOCULANTS

Mycorrhizal fungi grow in beneficial association with plant roots in the soil and form unique structures known as mycorrhizae. The mycorrhizae play an important role in facilitating nutrient transfer from the soil to the plant roots. Mycorrhizal inoculants can be added to the soil to help provide the benefits of mycorrhizae; however, the effectiveness of such inoculants is not well established. To achieve the potential benefits of mycorrhizae, mycorrhizal inoculants or duff collected from vegetative litter at an adjacent site can be installed in planting sites. Alternatively, the inoculants can be added to a seed mix blend.

SLOW-RELEASE FERTILIZERS

Fertilizers should be used sparingly on soils which support native plants and only to address revegetation deficiencies with respect to meeting performance standards. Since native plants are accustomed to drought conditions and low levels of nutrients in the soil, the use of fertilizers can promote the presence of exotic weeds which can outcompete native plants. The use of slow-release fertilizers can be suitable to accelerate growth of native plants. Slow-release fertilizers release nutrients over a three-month to two-year period, providing the appropriate amount of nutrients for native plants. Installing slow-release fertilizer tablets in planting pits is recommended in some reclaimed soil conditions to provide a supplemental nutrient source for container plants; however, when included in broadcasted hydro-slurry or mulch treatments, slow-release fertilizers can promote the establishment of grasses which may outcompete shrubs. While this may be desirable in some areas, it could prevent establishment of shrubland vegetation types in other areas; therefore slow-release fertilizers should be used sparingly or only in planting pits during revegetation efforts.

MULCH

Mulches include many different materials and can be applied on the soil surface or incorporated into the soil. Surface applications protect a site from erosion but do not have as much effect on soil composition as when they are incorporated into the soil. When incorporated, mulches can act as organic amendments, increasing organic matter content, moisture infiltration, and nutrient cycling. Materials such as straw and wood residues (wood chips, bark, and sawdust) are commonly used as mulch. Straw mulches can be blown on to the surface of the soil and secured with a tackifying agent following seed application. Straw mulch application would be the easiest material to apply around existing planted vegetation if it is determined that performance standards are not being met and additional organic material is necessary. Other materials should be installed and incorporated into growth media material in advance of planting to avoid smothering seedlings.

While wood residues such as chips, bark, and sawdust can provide cheap organic matter for soils, they may not stay in place adequately on steep slopes. A layer of two to three inches of wood and bark mulch can be used around large shrub plantings can help exclude weeds, improve moisture retention, and add organic matter to the soil.

BONDED FIBER MULCHES

The addition of various types of bonded fiber mulches is an available option for blending with seed mixes that could contribute to both plant growth and soil stabilization. The mulches contain wood fibers and other inert materials that retain moisture while maintaining air circulation which promotes seed germination and plant growth. They also add organic material to the growing surface which contributes carbon and other nutrients. Soil-bonding agents are also added to the fiber mulches which provide excellent erosion control. The combined aspects of these materials make them an ideal option suited to the steep and inaccessible slopes in the PCRA. While these products are not currently proposed for use in revegetation, they may be a suitable alternative to fiber rolls on steeper, less accessible slopes.

3.5.4 Timing Restrictions and Recommendations

Growth media earthwork activities, including soil development work, should occur during the dry season. Topsoil should not be moved or handled when wet. Soil amendments should be applied shortly before seeding and planting, if possible, to ensure optimal microbial activity.

4.0 REVEGETATION

This section describes plant installation planned for the RPA as displayed in Appendix D, Figure 3. Revegetation will establish a self-sustaining vegetation cover that will, over time, control erosion, prevent off-site sedimentation, and attenuate visual contrasts where the WMSA surfaces are visible from off=site locations. Use of native shrubs will assist in blending surfaces into the surrounding landscape. Revegetation efforts are planned to be implemented in phases following completion of each phase of growth media placement. Planting and maintenance should be conducted using an adaptive management approach, based on revegetation test plots that were initiated in 2008. A preliminary erosion control phase may be incorporated prior to the revegetation tasks listed below, to allow for specific site revegetation plans to be developed based on reclamation field conditions. The seed mix shown in Table 4 includes species that have proven successful in other revegetation efforts on the Quarry property and is recommended to provide erosion control and initial establishment of grasses and herbaceous species as needed in temporarily disturbed areas.

Table 4. Erosion-Control Seed Mix

SCIENTIFIC NAME	COMMON NAME	PURE LIVE SEED (lb / acre)*
Bromus carinatus	California brome	16
Elymus glaucus	blue wildrye	10
Elymus X Triticum	Regreen sterile hybrid wheatgrass	10
Eschscholzia californica	California poppy	3
Lupinus nanus	sky lupine	5
Stipa pulchra	purple needlegrass	8
Plantago erecta	California plantain	3
Trifolium willdenovii	tomcat clover	3
Festuca microstachys	three weeks fescue	8
	TOTAL:	**53**

*The final seed mix will depend upon availability at the time of implementation

Appendix A provides an extensive list of native species observed in undisturbed portions of the Quarry property, which may be or have previously been used in revegetation planting or seeding at the Quarry. Propagule availability, lead time needed for nursery production, and results of the test plots helped refine this list as reclamation progresses. Most seed and container plants used in the test plots came from on-site sources. A similar approach will be used for the reclamation revegetation effort. To date, seed has been collected on-site, contract grown by local seed growing facilities, and the resulting seeds used for revegetation efforts. When on-site seed or plants are not available, local sources are used with an attempt to obtain the most local stock possible. On-site and local stock is adapted to the specific microclimates of the RPA, and their use reduces genetic mixing with nearby natural vegetation. The general plan for revegetation is to establish grasses, forbs, and shrubs on slopes with shrub container plantings installed in deeper soils on the benches (Appendix D, Figure 3).

Though all revegetation areas within the RPA will be revegetated to meet performance criteria, key areas on the WMSA ridgeline facing highly populated or frequently visited locations may require additional techniques to reach performance criteria more quickly to blend in with vegetated surroundings (Appendix D, Figure 3). These techniques may include tools such as irrigation when practical, enhanced growth media application, emphasis on hydroseeding over broadcast seeding, and higher densities of container plantings.

4.1 Seeding

4.1.1 Project Area Seeding

In the main portions of the RPA, contoured surfaces would be amended and covered with grass, herb, and shrub species over the areas to be revegetated. Drainage ditches and access roads will be left bare until the completion of the contouring and slope seeding, at which time roads will be ripped and revegetated. The limited area of highwall benches will not be recontoured, but they will be seeded. Appropriate native seed mixes for reclamation are listed in Table 5 and were tested in the test plots (see Section 5.0). A preliminary seed mix of shrubs and grasses is shown in Table 5, which includes species known to thrive in undisturbed adjacent habitats or observed to perform well in previous revegetation areas and test plot results. These species should be used, pending availability, for the earliest phases of the proposed reclamation project. The seed mix will be applied as necessary over the entire revegetation area.

Table 5. Preliminary Species for RPA General Seeding

SCIENTIFIC NAME	COMMON NAME	PURE LIVE SEED (lb / acre)*	BULK SEED (lb/acre)*
SHRUBS			
Adenostoma fasciculatum	chamise	1.0-2.0	7-15
Artemisia californica	California sagebrush	0.5-1.5	5-15
Baccharis pilularis	coyote brush	0.05-0.15	5-15
Diplacus aurantiacus	sticky monkeyflower	0.5-1	15-30
Eriogonum fasciculatum	California buckwheat	1-1.5	20-30
Heteromeles arbutifolia	toyon	2.5-4	5-8
Salvia leucophylla	purple sage	0.7-2	1.5-4
Salvia mellifera	black sage	1.1-3	2-6
GRASSES AND HERBS			
Achillea millefolium	yarrow	0.5-1.7	0.5-2
Acmispon americanus* var. *americanus	Spanish clover	0.7-2	1-3
Acmispon glaber	deerweed	1.5-3.5	2-4.5
Artemisia douglasiana	mugwort	0.1-0.5	1-5
Bromus carinatus	California brome	4.6-9	6-11
Elymus glaucus	blue wildrye	4.6-8	6-11
Eschscholzia californica	California poppy	1.2-2	2-3
Festuca microstachys	Three weeks fescue	2.5-5	3.5-7
Heterotheca grandiflora	telegraph weed	0.2-1.5	1-7.5
Lupinus nanus	sky lupine	0.8-2.5	1-3
Melica californica	California melic	1.3-3	2-4
Sisyrinchium bellum	blue-eyed grass	1.5-2	2-3
Stipa pulchra	purple needlegrass	2.9-7	4-9.5
Poa secunda	one-sided bluegrass	1.3-4	2-5.5
Trifolium willdenovii	tomcat clover	1.4-3	2-4.5

*The final seed mix will depend upon availability at the time of implementation

4.2 Shrub Plantings

Shrubs would be planted as container plants or seeds in the revegetation areas. Container plantings would occur on the benches where a deeper layer of topsoil and/or soil-building materials is applied to ensure adequate space for root development. To the extent practical, shrubs to be planted will be generated from seeds collected from the Quarry property or from local sources. Shrubs should be planted at approximately 4.5-foot spacing in the designated planting areas. The remaining slopes and benches would be covered with shallower topsoil and/or soil-building materials and seeded with a grass/herb/shrub seed mix, without containerized shrub plantings.

The need for herbivory protection for specific species can be evaluated based on the results of initial plantings. Weed mats or several inches of mulch may be placed around planted shrubs to reduce competition and retain moisture.

This plan is designed to provide appropriate conditions for planting, so it is not dependent upon irrigation. The need for irrigation during initial establishment should be assessed during the adaptive management reclamation efforts. DriWater gel pac irrigation systems were tested in the test plots. DriWater is a biodegradable silica-based product that is buried next to the plants and slowly releases stored water into the soil. By planting shrubs without irrigation, a more drought-tolerant stand may be established, increasing the chances of their survival; however, if monitoring during the first 5 years of the early revegetation phases indicates significant losses of plant material that threatens achievement of performance standards, the need for irrigation should be re-evaluated.

As with hydroseeding or seeding, adaptive management will be used to determine which shrub species will be planted, the most effective spacing and location, and species to use in replacement plantings if necessary. A preliminary list of shrubs to be planted on benches of the RPA is provided in Appendix D, Table 4. Species selection and numbers will depend on propagule collection and availability.

4.3 Timing

All seeding should be performed and completed between September 1 and December 1 to take advantage of warm soil temperatures and winter rains for successful germination and establishment. Container planting should be performed during the winter season and completed by approximately the end of January to improve plant establishment.

4.4 Targeted Water Augmentation

To expedite plant growth, water resources may be augmented through either the installation of temporary water tanks and PVC pipes to distribute water to plants and seedlings or through the utilization of backpack sprayers or mobile water tanks with handheld hoses to allow laborers to target planted plants or germinated broadcasted seeds. Volumes of water application should depend on rain patterns and ambient heat.

5.0 MONITORING

5.1 Installation Monitoring

To ensure adherence to the guidelines of this revegetation plan, all implementation activities will be monitored by qualified individuals. Records will be kept of soil-building treatments applied, addition of soil amendments as determined to be necessary, and all plant and seed installation. Hydroseed records will include identification of the date of application and a description and map of the location where various seed mixes are applied. Additionally, installation of shrub plantings will be documented to identify the location and approximate area planted, and the number of shrubs planted or seeded.

5.2 Vegetation Monitoring

5.2.1 Project Area Vegetation Monitoring

Monitoring must be performed to document revegetation success. Following installation, each revegetation area should be monitored as necessary to determine if reseeding, irrigation, or soil amendments are necessary to demonstrate the performance criteria at the earliest possible time. Revegetation will be conducted in phases; therefore, monitoring of each phase will be stratified, commencing in a particular revegetation area upon completion of installation. Each phase will be monitored until the area meets performance standards for two consecutive years without intervention. Revegetation sites shall be identified on a map and monitored to assure that standards are adequately achieved to within a minimum 80% confidence level as required by Reclamation Standards.

SOIL SURFACE TREATMENT DIFFERENTIATION

Due to available topsoil volumes, soil surface treatments will differ within the RPA. Because these soil surface treatments are anticipated to influence plant growth due to differences in organic matter availability, water holding capabilities, and compaction rates, plant establishment will predictably vary between growth media types. All vegetation monitoring plots shall be stratified to include multiple plots within each soil surface treatment area.

SHRUB PLANTING AREAS

Randomly selected plots will be monitored in planting areas, with the number of plots sampled suitable to attain 80% confidence in data results. In addition, both north- and south-facing areas should be represented in sampling. Container planting areas will be sampled using a nested approach as utilized in reference site data collection; other sampling methods may be used but will require appropriate conversion of species richness standards. The nested approach means that once a plot center is randomly selected, shrubs are assessed within a 5-meter radius and herbs within a 1-meter radius from the plot center. Monitors will identify and count all shrubs surviving in their respective plots. All shrub and herb species cover within each layer will be estimated within each respective plot, and all species will be identified to the extent possible.

SEEDED AREAS

Sampling plots will be selected randomly throughout the areas seeded with grasses, herbs, and shrubs to determine native species richness and percent cover of each species. As with the planting areas, sampling will occur in nested plots, with shrubs assessed within 5-meter radius and herbs within a 1-meter radius from the plot center. The number of plots for each installation phase will be selected to achieve an 80% confidence level in the performance results. Stratification of sampling areas may be necessary if the mix of shrubs and herbs varies greatly in different areas either due to variation in hydroseed applications or soil or other site conditions. For example, areas strongly dominated by herbs and grasses may instead be monitored using smaller sampling plots appropriate to grasslands.

Revegetated areas should be monitored in late spring or early summer to ensure that most plants will be identifiable to the species level. Monitoring will be conducted by a qualified biologist with experience in plant identification. After monitoring data has been collected, a report summarizing the success of revegetation efforts, comparison of data to Year 5 performance standards, any observed obstacles to achieving performance standards, and any remedial actions recommended will be prepared and submitted to Lehigh by October 15 of that year. This will allow for proper timing of remedial plantings and/or seeding if determined to be necessary.

5.3 Performance Standards

5.3.1 Project Area Performance Standards

Performance standards describe the minimum targets for species richness and percent cover for hydroseed and planting areas. Performance standards represent anticipated conditions 5 years after installation, based on a study of reference sites in the vicinity conducted by WRA and test plot results. SMARA requirements state that performance standards must be met for 2 consecutive years without significant human intervention prior to release of financial assurances. Revegetation of approximately 631 acres in the RPA is intended to create approximately 20-40% coverage of native shrub habitat interspersed among grasses within five years of planting.

Reference site data were used to develop an achievable set of performance standards; however, at reference sites, the differences in parameters associated with different soil surface treatments were not investigated. Standards were adapted based on WRA’s best professional judgement to reflect anticipated differences plant establish to create achievable performance standards (Tables 6 through 9). Native species richness targets have been chosen to reflect data collected from the reference sites and test plot results and then adjusted for anticipated soil surface treatments These densities and percent cover values reflect the expected growth of shrubs in the first 5 years of the revegetation areas.

Reference data values for percent cover and density of shrubs describe mature communities that have not seen significant disturbance in decades. While the target plant communities of the revegetation areas should eventually blend with these mature communities, they cannot be expected to achieve similar characteristics over only 5 years of growth. Instead, shrub planting areas are designed to mimic pioneering plant communities that will continue to develop and dominate the benches and slopes over several decades through growth and natural regeneration.

Table 6. Proposed Five-year Performance Standards for RPA Revegetation for Coarse Overburden Soil Treatment Areas

	SEED AREA SHRUB/GRASSLAND MIX	
	Shrubs	Herbs
Richness (avg. native species per plot)**	1*	1*
Canopy Cover	10	10
Total Cover		20%

* Performance standards for seeded areas may need to be adjusted to reflect feasible five-year results of the species mix ultimately selected based on test plot results and early revegetation efforts during the reclamation period. In particular, the balance between shrub and herbaceous species cover may vary.

** Richness standards are based on plot sizes used in reference data collection and described in this Plan: 5m-radius plots for shrubs, and 1m-radius plots for herbs/grasses.

Table 7. Proposed 5-year Performance Standards for RPA Revegetation for Cover and Soil Backfill Areas

	SEED AREA SHRUB/GRASSLAND MIX	
	Shrubs	Herbs
Richness (avg. native species per plot)**	3*	3*
Canopy Cover	20	20
Total Cover		40%

* Performance standards for seeded areas may need to be adjusted to reflect feasible 5-year results of the species mix ultimately selected based on test plot results and early revegetation efforts during the reclamation period. In particular, the balance between shrub and herbaceous species cover may vary.

** Richness standards are based on plot sizes used in reference data collection and described in this Plan: 10m-radius plots for trees, 5m-radius plots for shrubs, and 1m-radius plots for herbs/grasses

Table 8. Proposed 5-year Performance Standards for RPA Revegetation for General Compacted Soils Soil Treatment Areas

	SEED AREA SHRUB/GRASSLAND MIX	
	Shrubs	**Herbs**
Richness (avg. native species per plot)**	2*	2*
Canopy Cover	10	10
Total Cover		20%

* Performance standards for seeded areas may need to be adjusted to reflect feasible 5-year results of the species mix ultimately selected based on test plot results and early revegetation efforts during the reclamation period. In particular, the balance between shrub and herbaceous species cover may vary.

** Richness standards are based on plot sizes used in reference data collection and described in this Plan: 5m-radius plots for shrubs, and 1m-radius plots for herbs/grasses.

Table 9. Proposed 5-year Performance Standards for RPA Revegetation for Highwall Soil Treatment Areas

	SEED AREA SHRUB/GRASSLAND MIX	
	Shrubs	**Herbs**
Richness (avg. native species per plot)**	3*	3*
Canopy Cover	10	10
		20%

* Performance standards for seeded areas may need to be adjusted to reflect feasible 5-year results of the species mix ultimately selected based on test plot results and early revegetation efforts during the reclamation period. In particular, the balance between shrub and herbaceous species cover may vary.

** Richness standards are based on plot sizes used in reference data collection and described in this Plan:5m-radius plots for shrubs, and 1m-radius plots for herbs/grasses.

5.4 Performance Standards for Weed Control

In addition to vegetation monitoring to assess the success of revegetation efforts, the cover of weeds (non-native invasive plants) will be assessed as part of vegetation sampling described in Section 5.2.

Reference plots were surveyed by WRA in undisturbed natural grassland habitat in and adjacent to the Quarry property to assess native and non-native species richness and cover. The reference plots contained 28 species, 13 of which were non-native, and an additional eight are listed as invasive species in the California Invasive Plant Council's (Cal-IPC) Inventory (Cal-IPC 2023) Although two of the seven native species recorded had the highest cover, the next ten species with the highest cover were non-native or invasive species. Non-native and invasive species accounted for over 50% of the vegetative cover; therefore, performance standards were developed that took this information into account.

5.4.1 Project Area Weed Control Performance Standards

For the purposes of RPA maintenance and monitoring, non-native plants, excluding annual grasses, listed in the Cal-IPC Inventory (2023) as highly invasive will be considered invasive weeds subject to control and performance standards. If invasive weeds are found to exceed a combined 10% relative cover over all sampled quadrats in the RPA, weed abatement activities will commence. Invasiveness rankings in the Cal-IPC Inventory may change over time based on new information, and the rank of non-native plants found within the reclamation area could change.

5.5 Adaptive Management

The operators responsible for revegetation efforts to date in the RPA have experienced success with adaptive strategies. The strategy described above may prove to be less efficient than other strategies developed later; therefore, if a different planting strategy is implemented in the RPA in which the above performance standards and monitoring guidelines cannot be followed, a revision to this revegetation plan will be submitted as a substitute for this document or portions thereof.

6.0 MAINTENANCE

Maintenance of revegetation areas across the site will take place as necessary based on post-revegetation monitoring and the evaluation of meeting performance standards.

6.1 General Maintenance

Maintenance of revegetation areas shall consist of reseeding or replanting unsuccessful revegetation efforts, weed control to limit the extent of noxious weeds, and repair of erosion damage. If significant rills or gullies are identified in the RPA that could contribute to sedimentation outside the RPA, remedial actions will include reseeding of the area with an approved erosion control seed mix, and if necessary, slope stabilization measures will be undertaken.

If revegetation efforts are not successful regarding the performance standards outlined in Section 5.3 of this report within 5 years following initial seeding, the under-performing areas will be reevaluated to determine the measures necessary to improve performance. If necessary, these areas will be reseeded and/or replanted with methods modified as needed. This may include the use of container stock and irrigation or simply additional seeding during a wet winter season. Prior to reseeding, the operator shall evaluate previous revegetation practices to identify cultural methods to benefit the overall revegetation effort. If, after a site is reseeded, revegetation efforts still do not yield satisfactory results, additional reseeding or other intervention methods may be required.

Weed control is necessary to reduce the occurrence of undesirable invasive and noxious species of plants that may invade the RPA and where weeds could interfere with revegetation efforts or increase fire hazards, as specified in SMARA regulations. Weeds are undesired, generally introduced, and invasive plants that can compete with revegetation efforts; however, many introduced species occur widely in the region and are common in both the surrounding active Quarry and adjacent undeveloped lands. Eradication of all weeds is therefore unachievable; so specific noxious plant species are targeted for control.

As described in Section 5.4, species listed by Cal-IPC (2023) as highly invasive will be considered problematic and will be targeted during maintenance of this revegetation effort if they exceed the designated threshold of 10% cover. Invasive plant species typically found in the RPA and in surrounding lands include yellow star thistle and pampas grass. Weed control methods may include chemical and mechanical removal techniques depending on the species and number of individuals encountered. Priorities in weed abatement should focus on those species listed as highly invasive, in addition to other weeds that directly threaten the successful establishment and survival of revegetation species. The percent cover of weeds, abatement measures recommended and undertaken, and other observations on weed control will be included in vegetation monitoring reports. Weed abatement responsibilities may cease once performance standards have been met for each phase of revegetation efforts, unless invasive species in completed revegetation areas are deemed a threat to nearby efforts still in progress.

7.0 REFERENCES

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SAIC 2004	Science Applications International Corporation (SAIC). 2004. Burton Mesa Mitigation Site Final Project Report, prepared for: Central Coast Water Authority. Buellton, California.
USDA 1958	U.S. Department of Agriculture, Soil Conservation Service. 1958. Soil Survey of Santa Clara Area, California. In cooperation with the University of California Agricultural Experiment Station.
URS 2011	URS Corporation. 2011. Permanente Creek Long Term Restoration Plan. March.
WRA 2011	WRA, Inc. 2011. Biological Resources Assessment for the Permanente Quarry, Cupertino, Santa Clara County, California. July.
WRA 2011	WRA, Inc. 2011. Revegetation Test Plot Program As-built Report for the Permanente Quarry, Cupertino, Santa Clara County, California. March.

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APPENDIX A.
PLANT LIST FOR PERMANENTE QUARRY REVEGETATION

Appendix A. Potential Native Plant Palette for Lehigh Permanente Quarry Upland Revegetation

FAMILY	SCIENTIFIC NAME	COMMON NAME
NATIVE GRASSES		
Poaceae	*Bromus carinatus*	California brome
Poaceae	***Elymus glaucus***	**blue wildrye**
Poaceae	*Elymus multisetus*	big squirreltail grass
Poaceae	*Festuca occidentalis*	western fescue
Poaceae	*Festuca rubra*	red fescue
Poaceae	*Leymus triticoides*	creeping wild rye
Poaceae	*Melica californica*	California melic grass
Poaceae	***Nassella pulchra***	**purple needle grass**
Poaceae	*Vulpia microstachys*	three-weeks fescue
Poaceae	*Poa secunda*	one-sided bluegrass
NATIVE HERBS		
Asteraceae	*Achillea millefolium*	common yarrow
Asteraceae	*Achyrachaena mollis*	blow wives
Asteraceae	*Eriophyllum confertiflorum*	golden yarrow
Asteraceae	***Heterotheca grandiflora***	**telegraphweed**
Asteraceae	*Wyethia glabra*	smooth mule ears
Brassicaceae	*Streptanthus glandulosus* ssp. *glandulosus*	bristly jewelflower
Caryophyllaceae	*Silene californica*	California windmill pink
Fabaceae	*Lotus purshianus* var. *purshianus*	Spanish clover
Fabaceae	***Lotus scoparius***	**deerweed**
Fabaceae	*Lupinus bicolor*	miniature lupine
Fabaceae	*Lupinus microcarpus* var. *densiflorus*	chick lupine
Fabaceae	*Lupinus nanus*	sky lupine
Fabaceae	*Lupinus succulentus*	succulent lupine
Fabaceae	*Trifolium willdenovii*	tomcat clover
Hydrophyllaceae	*Nemophila menziesii*	baby blue eyes
Hydrophyllaceae	*Phacelia campanularia*	desert bells
Iridaceae	*Sisyrinchium bellum*	blue-eyed grass
Lamiaceae	*Salvia columbariae*	Chia
Liliaceae	*Chlorogalum pomeridianum*	soap plant
Linaceae	*Linum grandiflorum*	flowering flax

FAMILY	SCIENTIFIC NAME	COMMON NAME
Nyctaginaceae	*Mirabilis californica*	California four o'clock
Onagraceae	*Camissonia ovata*	sun cup
Onagraceae	*Clarkia purpurea* ssp. *Quadrivulnera*	winecup clarkia
Onagraceae	*Epilobium canum*	California fuchsia
Onagraceae	*Oenothera elata* var. *hookeri*	evening primrose
Papaveraceae	***Eschscholzia californica***	**California poppy**
Papaveraceae	*Stylomecon heterophylla*	wind poppy
Plantaginaceae	*Plantago erecta*	California plantain
Polemoniaceae	*Navarretia squarrosa*	skunkweed
Polygonaceae	*Eriogonum nudum*	naked buckwheat
Portulacaceae	*Calandrinia ciliata*	red maids
Rosaceae	*Fragaria vesca*	woodland strawberry
Scrophulariaceae	*Antirrhinum kelloggii*	Kellogg's snapdragon
Scrophulariaceae	*Castilleja exserta*	purple owl's clover
Scrophulariaceae	*Scrophularia californica*	bee plant
NATIVE SHRUBS		
Asteraceae	***Artemisia californica***	**California sagebrush**
Asteraceae	*Artemisia douglasiana*	California mugwort
Asteraceae	***Baccharis pilularis***	**coyote brush**
Caprifoliaceae	*Sambucus mexicana*	blue elderberry
Ericaceae	*Arctostaphylos glauca*	big berry manzanita
Ericaceae	*Arctostaphylos viscida*	white-leaf manzanita
Fabaceae	*Lupinus albifrons* var. *albifrons*	silver bush lupine
Grossulariaceae	*Ribes californicum*	hillside gooseberry
Grossulariaceae	*Ribes malvaceum*	chaparral currant
Lamiaceae	***Salvia leucophylla***	**purple sage**
Lamiaceae	***Salvia mellifera***	**black sage**
Malvaceae	*Malacothamnus fasciculatus*	chaparral bushmallow
Malvaceae	*Malacothamnus fremontii*	Fremont's bushmallow
Polygonaceae	***Eriogonum fasciculatum***	**California buckwheat**
Rhamnaceae	*Ceanothus cuneatus*	buckbrush
Rhamnaceae	*Ceanothus integerrimus*	deer brush
Rhamnaceae	*Ceanothus leucodermis*	chaparral whitethorn

FAMILY	SCIENTIFIC NAME	COMMON NAME
Rhamnaceae	*Rhamnus californicus*	coffeeberry
Rhamnaceae	*Rhamnus crocea*	redberry
Rosaceae	***Adenostoma fasciculatum***	**chamise**
Rosaceae	*Cercocarpus betuloides*	birch-leaf mountain mahogany
Rosaceae	*Heteromeles arbutifolia*	toyon
Rosaceae	*Holodiscus discolor*	ocean spray
Rosaceae	*Prunus ilicifolius*	holly-leaf cherry
Rosaceae	*Rosa californica*	wild rose
Scrophulariaceae	*Mimulus aurantiacus*	bush monkey flower
Sterculiaceae	*Fremontodendron californica*	flannel-bush
Species in bold were successfully established in previous revegetation efforts, or have colonized revegetation sites effectively, and should be included in seed mixes or planting palettes.		

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APPENDIX B. SOIL LABORATORY REPORTS

Locations:

352 Mathew St.
Santa Clara, CA 95050
(408) 727-0330

1594 North Main St.
Orange, CA 92867
(714) 282-8777

SANTA CLARA OFFICE
June 11, 2008
Report 08-162-0042
Analyses under Report 08-143-9035

WRA ENVIRONMENTAL
2169-G E. Francisco Blvd.
San Rafael, CA 94901

Attn: Ingrid Morken

RE: HANSON PERMANENTE QUARRY – CUPERTINO, JOB NO. 16143

Background

The 10 samples analyzed under Report #08-143-0035 represent soils in need of evaluation to determine their suitability to support native plant growth. Analytical results are discussed in a manner to help categorize desirable soil candidates to those less and undesirable for use.

Analytical Results

Best Soil Candidates

Samples represented by Pit #2 and East Dump Natives show favorable soil composition. Particle size data show a loam for Pit #2 and sandy loam for East Dump Native by USDA standards. Organic content at 6.6% and 7.4% in Pit #2 and East Dump native, respectively, is ample for natives. The pH values are moderately alkaline and with natural lime content high this indicates a strong buffering capacity to remain in this alkaline range. The pH is a bit higher than desired by most plants though some natives may be more alkaline tolerant. Dissipating the high lime may be of interest to prevent it from interfering with nutrient availability. Salinity, sodium and boron are very safely low in both and the SAR values show a proper balance. Nutritional data is comparable between the two and shows nitrogen, potassium, magnesium and sulfate deficient. Phosphorus and calcium are well supplied.

Secondary Soil Candidates

West Dump Native and Rock Plant Fines contain significantly greater silt and clay which indicates dense soil types that will hold water tightly and drain slowly. Both soils fall into the clay loam USDA classification. Silt plus clay at 65-75% indicates high moisture retention and slow drainage. Organic content is fair for natives in the West Dump Native while a bit low in the Rock Plant Fines. Organic content near 3.0% on a dry weight basis is in the range typically desired. Infiltration rates are estimated at 0.22 inch per hour.

Secondary Soil Candidates - continued

The pH in West Dump Native is slightly acidic and in the range preferred by most plants with natural lime favorably absent. The reaction level in Rock Plant Fines is at the upper end of the slightly alkaline range preferred by most plants and high lime content indicates pH is strongly buffered to remain in this range. This alkaline pH is likely suitable for most natives though dissipating high lime would be desirable to prevent antagonism of nutrient availability. Sodium and boron are safely low in both and the SAR values show a proper balance. Salinity is very slightly elevated in Rock Plant Fines and safely the reflection of abundant soluble calcium with salinity safely low in West Dump Native.

Nutritional data show nitrogen, phosphorus, and potassium low in both. Sulfate is additionally low in West Dump Native and well supplied in Rock Plant Fines. In West Dump Native, calcium is only fair relative to high magnesium. In Rock Plant Fines, magnesium is just fair relative to ample calcium.

Least Desirable Soil Candidate

The Basin Clean Out contains 50% clay and a combination of silt and clay at 85% which suggests very high moisture retention characteristics and very slow drainage. The USDA soil classification is clay and the infiltration rate is estimated at a slow 0.14 inch per hour. Organic content at 3.4% is sufficient for natives though greater organic matter would be desired to improve structure of this dense soil type. Salinity is very slightly elevated but safely the reflection of abundant soluble calcium. Sodium and boron are safely low and SAR value shows a proper balance. Nutritional data show nitrogen, phosphorus and potassium low. Calcium, magnesium and sulfate are well supplied. The pH is slightly alkaline and in the range preferred by most plants, though high lime is less than desirable.

Poor Soil Candidates

West Waste Rock, Pit #1 Topsoil and Crusher Site contain highly excessive gravel content and excessive coarse sands that in combination with a broad distribution between medium to fine sands, silt and clay *the susceptibility to consolidation is high*. The intermingling of these various particle sizes over time could result in a consolidated state impervious to air and water. Particle size data for West Waste Rock and Pit #1 Topsoil show sandy loam classifications by USDA standards and highly excessive gravel qualify these as “gravelly” and “very gravelly”, respectively. Greater clay content in the Crusher Site places this into the sandy clay loam textural class and excess gravel qualifies this as “gravelly”. Infiltration rates are estimated at 0.19 inch per hour and could be slower in a consolidated state. Organic content is low in all three for natives. The reaction level in West Waste Rock is at the upper end of the slightly alkaline range with unfavorable high lime content. The pH values in Pit#1 Topsoil and Crusher Site are moderately alkaline and higher than preferred by most plants with unfavorable high lime that will buffer pH to remain in this alkaline range. Salinity, sodium and boron are safely low throughout with SAR values showing a proper balance.

Page-3
WRA ENVIRONMENTAL
Report 08-162-0042

Poor Soil Candidates - continued

Nutrient levels show nitrogen and potassium low throughout with phosphorus fair in West Waste Rock and Pit #1 Topsoil. Sulfate is fair in the Crusher Site and otherwise well supplied. Calcium and magnesium are sufficient in all three.

The Pit 1 Fine Greenstone and West Main Topsoil contain significantly greater coarse sands with similar excessive gravel contents and the coarser particle make-up makes the *susceptibility to consolidation very high*. Particle size data indicate a loamy sand for Pit 1 Fine Greenstone and a sand for West Main Topsoil. Highly excessive gravel fractions qualify both as “very gravelly”. Infiltration rates are estimated at a significantly slow 0.10 inch per hour and could be even slower when consolidated. Organic content is low in both. The pH levels fall in the moderately alkaline range with medium to high lime content which will buffer pH to remain in this range that may be a bit high for natives. Salinity is safely low in both as is boron. Sodium is slightly elevated in Pit 1 Fine Greenstone and the elevated SAR value indicates calcium and magnesium do not properly balance soluble sodium which can adversely impact soil permeability. Sodium is safely low in the West Main Topsoil and the SAR value shows a proper balance. Nitrogen and potassium are low in both. Magnesium is fair relative to ample calcium in the Pit 1 Fine Greenstone. Remaining major nutrients are otherwise sufficient.

Heidi Fisher

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Email only 5 pages. /dlb

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San Rafael CA 94901

Soil & Plant Laboratory, Inc.
Leaders in Soil & Plant Testing Since 1946
352 Mathew Street Santa Clara, CA 95050 408-727-0330 (phone) 408-727-5125 (fax)
www.soilandplantlaboratory.com

Project : Hanson Permainente Quarry, Cupertino

Report No : **08-143-9035**
Purchase Order : Job 16143
Date Recd : 05/22/2008
Date Printed : 04/14/2009

COMPREHENSIVE SOIL ANALYSIS

Sample Description - Sample ID	Half Sat % / TEC	pH / Qual Lime	ECe dS/m	NO_3-N ppm	NH_4-N ppm	PO_4-P ppm	K ppm	Ca ppm	Mg ppm	Cu ppm	Zn ppm	Mn ppm	Fe ppm	Organic % dry wt.	Lab No.
				Sufficiency Factors											
Rock Plant Fines	29	7.6	3.8	20	7	14	64	2901	189					1.4	27561
	145	High		0.5		0.4	0.3	1.2	0.6						
West Main Topsoil	14	8.2	0.6	2	4	15	40	4491	1159					0.5	27562
	319	High		0.2		0.9	0.2	1.5	2.8						
Pit #1 Topsoil	17	7.8	2.6	3	5	17	42	2602	328					1.2	27563
	147	High		0.2		0.9	0.3	1.3	1.2						
Crusher Site	21	8.0	0.5	3	6	29	17	4811	738					1.0	27564
	299	High		0.2		1.2	0.1	1.3	1.5						

Saturation Extract Values						SAR	Gravel %		Percent of Sample Passing 2 mm Screen					USDA Soil Classification	Lab No.
									Sand						
Ca meq/L	Mg meq/L	Na meq/L	K meq/L	B ppm	SO_4 meq/L		Coarse 5 - 12	Fine 2 - 5	Very Coarse 1 - 2	Coarse 0.5 - 1	Med. to Very Fine 0.05 - 0.5	Silt .002-.05	Clay 0-.002		
27.9	8.3	10.2	0.9	0.12	31.6	2.4	0	0.3	0	0.6	24.2	42.6	32.6	Clay Loam	27561
3.0	2.5	0.7	0.1	0.02	2.3	0.4	23.4	36.0	44.6	21.4	22.8	8.0	3.2	Very Gravelly Sand	27562
21.7	11.6	2.8	0.3	0.09	33.1	0.7	20.6	21.8	12.2	12.4	33.2	25.6	16.6	Very Gravelly Sandy Loam	27563
2.7	1.7	0.7	0.1	0.03	2.0	0.5	12.1	19.2	15.4	12.2	24.2	23.0	25.2	Gravelly Sandy Clay Loam	27564

Sufficiency factor (1.0=sufficient for average crop) below each nutrient value. N factor based on 200 ppm constant feed. SAR = Sodium adsorption ratio. Half Saturation %=approx field moisture capacity. Nitrogen(N), Potassium(K), Calcium(Ca) and Magnesium(Mg) by sodium chloride extraction. Phosphorus(P) by sodium bicarbonate extraction. Copper(Cu), Zinc(Zn), Manganese(Mn) & Iron(Fe) by DTPA extraction. Sat. ext. method for salinity (ECe as dS/m),Boron (B), Sulfate(SO_4), Sodium(Na). Gravel fraction expressed as percent by weight of oven-dried sample passing a 12mm(1/2 inch) sieve. Particle sizes in millimeters. Organic percentage determined by Walkley-Black or Loss on Ignition.

* LOW , SUFFICIENT , HIGH

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San Rafael CA 94901

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www.soilandplantlaboratory.com

Project : Hanson Permainente Quarry, Cupertino

Report No : **08-143-9035**
Purchase Order : Job 16143
Date Recd : 05/22/2008
Date Printed : 04/14/2009

COMPREHENSIVE SOIL ANALYSIS

Sample Description - Sample ID	Half Sat % / TEC	pH / Qual Lime	ECe dS/m	NO_3-N ppm	NH_4-N ppm	PO_4-P ppm	K ppm	Ca ppm	Mg ppm	Cu ppm	Zn ppm	Mn ppm	Fe ppm	Organic % dry wt.	Lab No.
				Sufficiency Factors											
Pit #2	30	7.8	1.1	2	12	37	208	5883	265					6.7	27555
	312	High		0.2		1.0	0.5	1.2	0.4						
West Waste Rock	15	7.6	3.1	1	6	14	63	2672	232					1.2	27556
	146	High		0.2		0.8	0.5	1.5	1.0						
West Dump Native	28	6.9	0.6	1	5	13	37	5205	2866					2.5	27557
	494	None		0.1		0.4	0.1	0.8	3.5						
Pit 1 Fine Greenstone	11	7.8	2.7	1	4	15	40	1935	114					0.7	27558
	127	Medium		0.2		1.1	0.3	1.3	0.6						
East Dump Native	34	7.8	0.9	2	6	60	181	4063	93					7.4	27559
	207	High		0.1		1.5	0.7	1.2	0.2						
Basin Clean Out	36	7.5	4.1	1	7	15	46	3841	556					3.4	27560
	211	High		0.1		0.3	0.2	1.1	1.2						

Saturation Extract Values						SAR	Gravel %		Percent of Sample Passing 2 mm Screen					USDA Soil Classification	Lab No.
									Sand						
Ca meq/L	Mg meq/L	Na meq/L	K meq/L	B ppm	SO_4 meq/L		Coarse 5 - 12	Fine 2 - 5	Very Coarse 1 - 2	Coarse 0.5 - 1	Med. to Very Fine 0.05 - 0.5	Silt .002-.05	Clay 0-.002		
10.7	2.2	0.6	0.3	0.05	0.7	0.2	5.4	8.2	8.8	9.4	28.2	32.0	21.6	Loam	27555
24.6	9.1	6.2	0.3	0.15	34.5	1.5	16.1	18.7	19.8	15.2	29.2	20.5	15.3	Gravelly Sandy Loam	27556
2.5	3.4	0.8	0.1	0.04	0.5	0.5	4.6	6.3	6.4	7.4	20.6	27.0	38.6	Clay Loam	27557
3.6	1.4	21.8	0.2	0.98	21.0	13.9	7.3	29.5	27.5	23.8	35.1	9.8	3.8	Very Gravelly Loamy Sand	27558
8.7	1.0	0.4	0.4	0.09	0.5	0.2	6.5	7.3	8.1	12.8	48.5	21.8	8.8	Sandy Loam	27559
27.6	17.1	9.0	0.3	0.21	40.2	1.9	5.3	3.7	2.8	3.0	11	33.6	49.6	Clay	27560

Sufficiency factor (1.0=sufficient for average crop) below each nutrient value. N factor based on 200 ppm constant feed. SAR = Sodium adsorption ratio. Half Saturation %=approx field moisture capacity. Nitrogen(N), Potassium(K), Calcium(Ca) and Magnesium(Mg) by sodium chloride extraction. Phosphorus(P) by sodium bicarbonate extraction. Copper(Cu), Zinc(Zn), Manganese(Mn) & Iron(Fe) by DTPA extraction. Sat. ext. method for salinity (ECe as dS/m),Boron (B), Sulfate(SO_4), Sodium(Na). Gravel fraction expressed as percent by weight of oven-dried sample passing a 12mm(1/2 inch) sieve. Particle sizes in millimeters. Organic percentage determined by Walkley-Black or Loss on Ignition.

* LOW , SUFFICIENT , HIGH

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Locations:

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Santa Clara, CA 95050
(408) 727-0330

1594 North Main St.
Orange, CA 92867
(714) 282-8777

SANTA CLARA OFFICE
June 9, 2008
Report 08-149-0043

WRA ENVIRONMENTAL
2169-G E. Francisco Blvd.
San Rafael, CA 94901

Attn: Ingrid Morken

RE: HANSON PERMANENTE QUARRY – CUPERTINO, JOB NO. 16143
RE-VEGETATED SITES FOR COMPARISON

Background

The five samples received 5/28 were described as representing soils from sites that have been re-vegetated. Chemistry and particle size evaluation was requested to determine the discrepancies between areas and corresponding plant communities.

Summary/ Results

The pH values for East Dump Topsoil Source 1 & 2 and Reveg Slope West Dump show moderate alkalinity higher than preferred most plants, though likely suitable for some natives. East Dump Topsoil Source 2 and Reveg Slope West Dump do not contain any qualitative lime while East Dump Topsoil Source 1 contains medium natural lime. Reaction levels for Reveg East and West Pits are slightly alkaline and in the desired range with medium lime at Reveg West Pit and high natural lime at Reveg East Pit. Salinity, sodium and boron are comparable throughout and safely low throughout. The favorably low SAR values in all indicate calcium and magnesium properly balance soluble sodium.

Nutritional data show nitrogen low throughout with the exception of fair nitrogen at Reveg West Pit. At East Dump Topsoil Source 1 & 2, phosphorus and potassium are sufficient with magnesium low. Magnesium is also low at Reveg East Pit. Phosphorus and potassium are otherwise low and magnesium otherwise sufficient. Calcium is well supplied throughout with sulfate low to fair.

Organic content is low at Reveg Slope West Dump. Organic content is ample at Reveg East Pit and otherwise sufficient. Particle size analyses reveal sandy loam soils in all but Reveg West Pit which contains just slightly less clay qualifying this as a loamy sand. All contain highly excessive gravel fractions as well as very high coarse sands and range from very gravelly to gravelly qualifications. Infiltration rates are estimated on average of 0.22 inch per hour, but could be substantially slower in a consolidated state.

Heidi Fisher

HEIDI FISHER Email only 3 pages.

WRA Environmental
2169-G E. Francisco Blvd.
San Rafael, CA 94901

COMPREHENSIVE SOIL ANALYSIS
(AO5-1, AO5-2 or AO5-3)

Samples Rec'd: 5/28/08

Santa Clara Office
Lab No. 08-149-0043
Hanson Permanente Quarry Cupertino
P.O. No. Job 16143

Sample #	Half Sat%/ TEC	pH/ Qual Lime	ECe	NO_3 N	NH_4 N	PO_4 P	K	Ca	Mg	Cu	Zn	Mn	Fe	Organic % dry wt.	Sample Description & Log Number
				Parts Per Million Parts Dry Soil											
27712	15	7.8	0.6	10	1	8	67	5685	907					0.8	Reveg Slope West Dump
	360	None		0.4		0.5	0.2	1.6	2.0						0.608-G5800 SC-40

Sample #	Ca me/l	Mg me/l	Na me/l	K me/l	B ppm	SO_4 me/l	SAR	Gravel Coarse 5-12	Gravel Fine 2-5	Sand Very Coarse 1-2	Sand Coarse 0.5-1	Sand Med. to V. Fine 0.05-.5	Silt .002-.05	Clay 0-.002	USDA Soil Classification
	Saturation Extract Values							Percent of Sample Passing 2 mm Screen							
27712	3.7	2.5	0.6	0.1	0.01	1.3	0.3	30.0	23.7	24.3	12.2	32.0	18.1	13.4	Very Gravelly Sandy Loam

6/ 9/08

Sufficiency factor (1.0=sufficient for average crop) below each nutrient value. N factor based on 200 ppm constant feed. SAR = Sodium adsorption ratio. Half Saturation %=approx field moisture capacity. Nitrogen(N), Potassium(K), Calcium(Ca) and Magnesium(Mg) by sodium chloride extraction. Phosphorus(P) by sodium bicarbonate extraction. Copper(Cu), Zinc(Zn), Manganese(Mn) & Iron(Fe) by DTPA extraction. Sat. ext. method for salinity (ECe as dS/m), Boron(B), Sulfate(SO_4), Sodium(Na) and SAR. TEC(listed below Half Sat) = Est.Total Exchangeable Cations(meq/kg). Gravel fraction expressed as percent by weight of oven-dried sample passing a 12mm(1/2 inch) sieve. Particle sizes in millimeters.

WRA Environmental
2169-G E. Francisco Blvd.
San Rafael, CA 94901

COMPREHENSIVE SOIL ANALYSIS
(AO5-1, AO5-2 or AO5-3)

Samples Rec'd: 5/28/08

Santa Clara Office
Lab No. 08-149-0043
Hanson Permanente Quarry Cupertino
P.O. No. Job 16143

Sample #	Half Sat%/ TEC	pH/ Qual Lime	ECe	NO_3 N	NH_4 N	PO_4 P	K	Ca	Mg	Cu	Zn	Mn	Fe	Organic % dry wt.	Sample Description & Log Number
27708	22	7.5	1.0	11	2	10	150	7553	330					4.8	Reveg East Pit
	404	High		0.3		0.4	0.4	1.6	0.5						0.7308-G5796 SC-40
27709	19	7.4	0.6	23	4	9	118	7216	1086					3.7	Reveg West Pit
	452	Med		0.7		0.4	0.3	1.5	1.7						0.6608-G5797 SC-40
27710	17	8.0	0.7	11	1	17	124	2723	78					3.0	East Dump Topsoil Source 1
	143	Med		0.4		0.8	0.7	1.3	0.3						0.8708-G5798 SC-40
27711	22	7.9	0.8	11	4	24	214	3304	161					3.8	East Dump Topsoil Source 2
	181	None		0.3		0.9	0.8	1.1	0.4						1.0108-G5799 SC-40

Parts Per Million Parts Dry Soil: NO_3 N through Fe.

Sample #	Ca me/l	Mg me/l	Na me/l	K me/l	B ppm	SO_4 me/l	SAR	Gravel Coarse 5-12	Gravel Fine 2-5	Sand Very Coarse 1-2	Sand Coarse 0.5-1	Sand Med. to V. Fine 0.05-.5	Silt .002-.05	Clay 0-.002	USDA Soil Classification
27708	5.9	1.0	0.3	0.1	0.05	1.0	0.2	22.4	26.8	24.8	14.8	26.8	18.8	14.8	Very Gravelly Sandy Loam
27709	3.4	2.6	0.4	0.1	0.04	0.7	0.2	15.6	31.9	28.9	15.6	36.0	14.1	5.4	Very Gravelly Loamy Sand
27710	6.1	0.8	0.5	0.2	0.01	1.8	0.3	14.8	17.7	18.9	11.0	43.7	17.0	9.4	Gravelly Sandy Loam
27711	12.3	2.3	1.1	0.4	0.01	2.4	0.4	27.0	11.4	10.1	9.6	46.9	19.0	14.4	Very Gravelly Sandy Loam

Saturation Extract Values: Ca through SAR. Percent of Sample Passing 2 mm Screen: Sand, Silt, Clay.

6/ 9/08

Sufficiency factor (1.0=sufficient for average crop) below each nutrient value. N factor based on 200 ppm constant feed. SAR = Sodium adsorption ratio. Half Saturation %=approx field moisture capacity. Nitrogen(N), Potassium(K), Calcium(Ca) and Magnesium(Mg) by sodium chloride extraction. Phosphorus(P) by sodium bicarbonate extraction. Copper(Cu), Zinc(Zn), Manganese(Mn) & Iron(Fe) by DTPA extraction. Sat. ext. method for salinity (ECe as dS/m), Boron(B), Sulfate(SO_4), Sodium(Na) and SAR. TEC(listed below Half Sat) = Est.Total Exchangeable Cations(meq/kg). Gravel fraction expressed as percent by weight of oven-dried sample passing a 12mm(1/2 inch) sieve. Particle sizes in millimeters.

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Project : Hanson Permanente - Cupertino

SOIL FERTILITY AND MICRONUTRIENT ANALYSIS

Report No : **08-179-0041**
Purchase Order :
Date Printed : 07/01/2008
Date Recd : 06/27/2008

Sample Description - Sample Id - Plant Name	HalfSat % / TEC	pH s.u. / Qual. Lime	NO_3-N ppm	NH_4-N ppm	PO_4-P ppm	K ppm	Ca ppm	Mg ppm	Cu ppm	Zn ppm	Mn ppm	Fe ppm	Saturation Extract: B ppm	SO_4 meq/L	Na meq/L (SAR)	K meq/L	Ca meq/L / Mg meq/L	Cl meq/L	ECe dS/m	OM %	Lab No
			Sufficiency Factor										Sufficiency Factor								
West Waste Rock									0.9	0.5	5	16									28512
East Dump Native									1.5	6.4	6	28									28513
Green Stone Slide									0.8	0.8	4	13									28514
Rock Plant Fines									2.2	3.6	9	25									28515
West Main Topsoil									0.8	0.8	6	33									28516
Pit #1 Topsoil									1.3	1.3	4	19									28517
East Dump Topsoil Site 4									1.3	2.5	4	21									28518
East Dump Topsoil Site 5									2.5	2.4	8	72									28519

Sufficiency factor (1.0=sufficient for average crop) below each nutrient value. N factor based on 200 ppm constant feed. The value below sodium (Na) result is the SAR = Sodium adsorption ratio. Half Saturation %=approx field moisture capacity. Major elements, Nitrogen(N),Potassium(K), Calcium(Ca) and Magnesium(Mg) by sodium chloride extraction. Phosphorus(P) by sodium bicarbonate extraction. Copper(Cu), Zinc(Zn), Manganese(Mn) & Iron(Fe) by DTPA extraction. TEC(listed below Half Sat.) = Est.Total Exchangeable Cations (meq/kg).

* LOW , SUFFICIENT, HIGH

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SANTA CLARA OFFICE
July 24, 2008
Report 08-196-0046

WRA ENVIRONMENTAL
2169-G E. Francisco Blvd.
San Rafael, CA 94901

Attn: Ingrid Morken

RE: HANSON PERMANENTE QUARRY – CUPERTINO, JOB NO. 16143
SOIL DEVELOPMENT

Background

The 9 soil blends created in the laboratory on 7/14 represent the percentages of mineral topsoils and compost as requested. The blends were submitted to the laboratory for chemistry, fertility and particle size evaluation with regards to their feasibility for use in revegetation of areas with California natives.

Analytical Results

Particle size data for the Blend 2 (20% Waste Rock, 20% Pit 1 Fine Greenstone, 40% Plant Fines, 20% Compost) shows a sandy clay loam classification by USDA standards. The soils infiltration rate is estimated at a slow 0.18 inch per hour. Blend 3 (35% Pit 1 Fine Greenstone, 41% Plant Fines, 24% Compost) Blend 8 (28% West Main, 50% Plant Fines, 22% Compost) and Blend 9 (16% Pit 1 Fine Greenstone, 16% West Main, 46% Plant Fines, 22% Compost) all contain slightly higher silt content as a reflection of the Plant Fines which places these into the loam textural class. Infiltration rates are estimated on average of a slow 0.14 inch per hour. The remaining blends contain less silt and clay which qualifies these as sandy loam textural classes. Infiltration rates are estimated on average of a slow 0.11 inch per hour. All 9 of the soil blends are qualified as “very gravelly” and this qualifier is applied for greater than 35% combined gravel. The greater the diversity of gravel combined with coarse sands increases the susceptibility to consolidation of these various particle sizes and the tendency is highest in Blend 4 (81% Pit 1 Fine Greenstone, 19% Compost) Blend 5 (36% Waste Rock, 43% Pit 1 Fine Greenstone, 21% Compost) and Blend 9 (16% Pit 1 Fine Greenstone, 16% West Main, 46% Plant Fines, 22% Compost). Blend 1 (73% Waste Rock, 27% Compost) also shows a significant degree of susceptibility to consolidation with the remaining blends high to moderate.

Organic content at 4.0% in Blend 2 (20% Waste Rock, 20% Pit 1 Fine Greenstone, 40% Plant Fines, 20% Compost) is well supplied for natives. The 5.1% organic matter in Blend 4 (81% Pit 1 Fine Greenstone, 19% Compost) and Blend 6 (32% Waste Rock, 68% East Dump) is also well supplied for natives. The 5.6% in Blend 3 (35% Pit 1 Fine Greenstone, 41% Plant Fines, 24% Compost) and 6.3% in Blend 8 (28% West Main, 50% Plant Fines, 22% Compost) is ample. The 6.8% organic matter in Blend 9 (16% Pit 1 Fine Greenstone, 16% West Main, 46% Plant Fines, 22% Compost) as well as the 7.0% in Blend 1 (73% Waste Rock, 27% Compost) are abundant for natives. The 8.5% organic matter in Blend 5 (36% Waste Rock, 43% Pit 1 Fine Greenstone, 21% Compost) and the 10.1% organic matter in Blend 7 (25% Pit 1 Fine Greenstone, 75% East Dump) are ample as well.

The pH is moderately alkaline for Blend 6 (32% Waste Rock, 68% East Dump) and Blend 7 (25% Pit 1 Fine Greenstone, 75% East Dump) with natural lime medium. These values are a bit higher than preferred by most plants but likely suitable for natives. The remaining pH values are slightly alkaline and suitable for natives. Natural lime is absent in Blend 4 (81% Pit 1 Fine Greenstone, 19% Compost) and medium in Blend 5 (36% Waste Rock, 43% Pit 1 Fine Greenstone, 21% Compost) and is favorable. Natural lime content is otherwise high and indicates pH will be strongly buffered to remain in the alkaline range.

Salinity is safely low in Blend 6 (32% Waste Rock, 68% East Dump) and Blend 7 (25% Pit 1 Fine Greenstone, 75% East Dump) with sodium levels correspondingly safely low as well. The remaining samples, which contained the compost addition, show elevated salinity as a result of elevated sodium. The baseline soil results from Report #'s 08-143-0035 & 08-149-0043 did not reveal any significant concern relative to sodium. The South Valley Organics Compost would appear to be the source of the excess sodium. The elevated SAR values are a reflection of the sodium excess which would not be an issue when using compost safely low in sodium. Boron remains safely low throughout.

Nutritional data show iron continuing at low levels in all the blends. For Blend 6 (32% Waste Rock, 68% East Dump) and Blend 7 (25% Pit 1 Fine Greenstone, 75% East Dump) magnesium is low relative to ample calcium. Calcium is quite ample throughout. Zinc and manganese are low in these blends as well with copper additionally low in Blend 7 (25% Pit 1 Fine Greenstone, 75% East Dump). Zinc is low in Blend 4 (81% Pit 1 Fine Greenstone, 19% Compost) as well as Blend 5 (36% Waste Rock, 43% Pit 1 Fine Greenstone, 21% Compost). Remaining major and minor nutrients are sufficient to well supplied.

Comments

Nutritive values show a favorable improvement in overall fertility of the blends, as a result of the nutrient rich compost addition. The Waste Rock and Pit 1 Fine Greenstone blended with the East Dump still show excellent fertility and organic content, even with magnesium potentially low. The excess sodium of the South Valley Organics Compost is contributing to elevated salinity and SAR values. Evaluating the intended compost product prior to use is suggested to assure all troublesome salts are safely low. Elevated salinity could impair seed germination and be toxic to tender seedlings.

The compost addition was based on a target of 4.8% organic matter. This was achieved and even surpassed with the compost rates, with the exception of Blend 2 which was slightly lower though still well supplied for natives. The compost addition is felt to be within appropriate ranges and to simplify, incorporating 25% Compost on a volume basis would provide ample organic matter for healthy establishment of the natives. The only soil blends that do not apply are the Waste Rock and Pit 1 Fine Greenstone amended only with the East Dump which in itself provides ample organic matter.

Particle size distribution is quite similar between the Waste Rock and Pit 1 Fine Greenstone though the Waste Rock generally contains greater larger gravel. Blend 4, Pit 1 Fine Greenstone with Compost, and Blend 5 being Waste Rock, Pit 1 Fine Greenstone and Compost display nearly comparable particle size results. There is no significant improvement from blending the Waste Rock with the Pit 1 Fine Greenstone and consideration might be given to the energy expenditure of blending these two similar sources.

The logistics behind using the Plant Fines might be hindered by the issue of obtaining a homogenous soil blend with the other gravelly sources. The very high moisture content of the plant fines would need to be reduced for incorporation, however we found that drying of this material resulted in a dense, hard soil comparable to adobe brick that had to be pulverized for use in the blends. The addition of the Plant Fines does increase silt and clay content of the final blends thus decreasing gravel and coarse sands which is advantageous, but again the feasibility of achieving a homogenous blend may prove to be very difficult.

The best soil candidates are limited to Blend 6 & 7 which are predominantly the East Dump material. The second best candidates are those that contain 40% and 50% Plant Fines i.e. Blend 2, 3 & 8. Blends 2 & 3 are so similar and again the Pit 1 Fine Greenstone and Waste Rock are so similar that these are interchangeable. The 40% Plant Fines is the minimum amount of this material suggested for the blends in order to make some beneficial impact on soil texture. The next best candidate would be Blend 9. The Waste Rock or Pit 1 Fine Greenstone with just the Compost addition, Blends 1 & 4, provides the attributes of ample organic matter and abundant fertility for native plant establishment, though the coarse, diverse soil composition is less than desired. A blend of 75% Waste Rock or Pit 1 Fine Greenstone with 25% Compost would be a suitable blend to achieve adequate organic matter. The 75% Waste Rock or Pit 1 Fine Greenstone could be divided at any percentage if this of interest.

Heidi Fisher

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Email only 5 pages. /dlb

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Project : Hanson Permanente - Soil Development

Report No : **08-196-9046**
Purchase Order :
Date Recd : 07/14/2008
Date Printed : 04/14/2009
Page : 1 of 2

COMPREHENSIVE SOIL ANALYSIS

Sample Description - Sample ID	Half Sat % / TEC	pH / Qual Lime	ECe dS/m	NO_3-N ppm	NH_4-N ppm	PO_4-P ppm	K ppm	Ca ppm	Mg ppm	Cu ppm	Zn ppm	Mn ppm	Fe ppm	Organic % dry wt.	Lab No.
				Sufficiency Factors											
1)73% Waste Rock & 27% Compost	16	7.3	5.2	9	27	58	511	2549	417	1.5	4.3	13	13	7.0	28846
	164	High		1.1		3.1	3.2	1.2	1.5	0.9	0.7	1.0	0.2		
2)20% Waste, 20% Pit 1 Fine Greenstone, 40% Fines, 20% Compost	17	7.4	6.4	12	24	45	427	2282	255	1.9	5.3	12	14	4.0	28847
	141	High		1.1		2.2	2.7	1.1	1.0	1.2	0.8	0.8	0.2		
3)35% Pit 1 Fine Greenstone, 41% Plant Fines, 24% Compost	16	7.3	7.3	11	23	31	376	2174	253	1.7	4.3	11	13	5.6	28848
	137	High		1.1		1.6	2.7	1.2	1.0	1.2	0.8	0.9	0.2		
4)81% Pit 1 Fine Greenstone & 19% Compost	11	7.6	3.5	11	18	31	273	2138	214	1.1	1.2	8	9	5.1	28849
	153	None		1.4		2.5	2.1	1.2	0.9	0.8	0.2	0.7	0.2		
5)36% Waste, 43% Pit 1 Fine Greenstone, 21% Compost	13	7.4	5.3	10	26	32	378	2263	285	1.1	3.0	9	11	8.5	28850
	155	Medium		1.4		2.1	2.7	1.3	1.2	0.8	0.5	0.8	0.2		
6)32% Waste, 68% East Dump	22	7.7	1.9	118	46	24	167	3282	141	1.2	2.7	3	9	5.1	28851
	174	Medium		3.8		0.9	0.8	1.2	0.4	0.5	0.3	0.1	0.1		

Saturation Extract Values						SAR	Gravel %		Percent of Sample Passing 2 mm Screen					USDA Soil Classification	Lab No.
Ca meq/L	Mg meq/L	Na meq/L	K meq/L	B ppm	SO_4 meq/L		Coarse 5 - 12	Fine 2 - 5	Sand Very Coarse 1 - 2	Sand Coarse 0.5 - 1	Sand Med. to Very Fine 0.05 - 0.5	Silt .002-.05	Clay 0-.002		
29.0	17.4	10.9	8.1	0.46	23.5	2.3	58.9	12.9	22.6	14.0	29.1	17.4	16.8	Very Gravelly Sandy Loam	28846
29.5	15.5	28.1	7.9	0.47	26.2	5.9	32.4	9.3	11.1	8.5	31	26.5	22.9	Very Gravelly Sandy Clay Loam	28847
30.0	15.3	34.0	9.8	0.51	26.2	7.1	47.6	8.1	13.6	9.7	25.4	29.5	21.8	Very Gravelly Loam	28848
7.1	2.9	26.5	2.5	0.65	15.1	11.8	28.8	27.8	28.4	23.1	32.2	9.4	6.9	Very Gravelly Sandy Loam	28849
19.9	10.0	29.2	5.3	0.54	22.2	7.6	34.5	28.7	30.6	17.3	28.7	12.4	10.9	Very Gravelly Sandy Loam	28850
17.1	3.0	2.2	0.5	0.08	16.6	0.7	39.0	9.1	11.5	12.5	39.6	20.5	15.9	Very Gravelly Sandy Loam	28851

Sufficiency factor (1.0=sufficient for average crop) below each nutrient value. N factor based on 200 ppm constant feed. SAR = Sodium adsorption ratio. Half Saturation %=approx field moisture capacity. Nitrogen(N), Potassium(K), Calcium(Ca) and Magnesium(Mg) by sodium chloride extraction. Phosphorus(P) by sodium bicarbonate extraction. Copper(Cu), Zinc(Zn), Manganese(Mn) & Iron(Fe) by DTPA extraction. Sat. ext. method for salinity (ECe as dS/m),Boron (B), Sulfate(SO_4), Sodium(Na). Gravel fraction expressed as percent by weight of oven-dried sample passing a 12mm(1/2 inch) sieve. Particle sizes in millimeters. Organic percentage determined by Walkley-Black or Loss on Ignition.

* LOW , SUFFICIENT , HIGH

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Project : Hanson Permanente - Soil Development

Report No : **08-196-9046**
Purchase Order :
Date Recd : 07/14/2008
Date Printed : 04/14/2009

COMPREHENSIVE SOIL ANALYSIS

Sample Description - Sample ID	Half Sat % / TEC	pH / Qual Lime	ECe dS/m	NO_3-N ppm	NH_4-N ppm	PO_4-P ppm	K ppm	Ca ppm	Mg ppm	Cu ppm	Zn ppm	Mn ppm	Fe ppm	Organic % dry wt.	Lab No.
				Sufficiency Factors											
7)25% Pit 1 Fine Greenstone, 75% East Dump	22	8.2	1.0	103	40	29	177	2986	84	1.0	2.9	2	9	10.1	28852
	170	Medium		3.2		1.1	0.8	1.1	0.2	0.5	0.3	0.1	0.1		
8)28% West Main, 50% Plant Fines, 22% Compost	21	7.2	5.9	13	27	47	616	3025	450	1.9	5.7	16	16	6.3	28853
	183	High		1.0		1.9	2.8	1.1	1.2	0.8	0.6	0.8	0.2		
9)16% Pit 1 Fine Greenstone, 16% West Main, 46% Fines, 22% Compost	18	7.3	6.7	12	25	50	469	2739	405	1.7	4.8	12	15	6.8	28854
	172	High		1.0		2.3	2.6	1.1	1.3	0.9	0.7	0.8	0.2		

Saturation Extract Values						SAR	Gravel %		Percent of Sample Passing 2 mm Screen					USDA Soil Classification	Lab No.
									Sand						
Ca meq/L	Mg meq/L	Na meq/L	K meq/L	B ppm	SO_4 meq/L		Coarse 5 - 12	Fine 2 - 5	Very Coarse 1 - 2	Coarse 0.5 - 1	Med. to Very Fine 0.05 - 0.5	Silt .002-.05	Clay 0-.002		
4.1	0.5	7.0	0.4	0.07	4.5	4.6	39.3	13.2	17.1	13.8	37.7	18.4	13.0	Very Gravelly Sandy Loam	28852
34.0	25.1	11.1	4.6	0.40	25.3	2.0	44.6	9.5	10.7	4.8	21	36.5	27.0	Very Gravelly Loam	28853
32.9	22.6	23.2	6.3	0.44	25.8	4.4	31.1	26.8	13.4	8.9	23.4	30.4	23.9	Very Gravelly Loam	28854

Sufficiency factor (1.0=sufficient for average crop) below each nutrient value. N factor based on 200 ppm constant feed. SAR = Sodium adsorption ratio. Half Saturation %=approx field moisture capacity. Nitrogen(N), Potassium(K), Calcium(Ca) and Magnesium(Mg) by sodium chloride extraction. Phosphorus(P) by sodium bicarbonate extraction. Copper(Cu), Zinc(Zn), Manganese(Mn) & Iron(Fe) by DTPA extraction. Sat. ext. method for salinity (ECe as dS/m),Boron (B), Sulfate(SO_4), Sodium(Na). Gravel fraction expressed as percent by weight of oven-dried sample passing a 12mm(1/2 inch) sieve. Particle sizes in millimeters. Organic percentage determined by Walkley-Black or Loss on Ignition.

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SANTA CLARA OFFICE
February 27, 2009
Report 09-054-0030

WRA ENVIRONMENTAL
2169-G E. Francisco Blvd.
San Rafael, CA 94901

Attn: Geoff Smick

RE: PERMANENTE QUARRY – CUPERTINO, JOB NO. 16143

Background

The 10 samples received 2/23 represent native topsoil that will be striped and stockpiled and later spread in areas for re-vegetation with California natives. The sample descriptions provided are referenced on the attached data sheets.

Analytical Results

Particle size data for Samples 09, G4, C8, 05 and C5-wetter show clay loam classifications by USDA standards. The abundance of silt and clay at about 60% indicates characteristics of high moisture retention and slow drainage. Slightly higher sand fractions for C7 and G3 place these into the sandy clay loam textural class. Even greater sand content and less silt and clay in Samples 07, 06 and C5-dryer place these into the sandy loam classification.

Gravel fractions are only slightly elevated in Sample G4 qualifying this as “gravelly” and only slightly increases the susceptibility to consolidation. Gravel content is moderate in Samples 06 and G3 qualifying these as “gravelly”, and combined with elevated coarse sands the susceptibility to consolidation is moderate. Highly excessive gravel content in Sample C5-drier qualifies this as “very gravelly” which significantly increases the susceptibility to consolidation.

The infiltration rates are an estimation based upon soil texture and the clay loam classifications are estimated to have an infiltration rate of 0.22 inch per hour. The sandy clay loam for C7 is estimated at 0.27 inch per hour while high gravel content in G3 makes this slightly slower at 0.21 inch per hour. The sandy loam of Samples 07 is estimated at 0.36 inch per hour while higher gravel content in Sample 06 makes this slower at 0.28 inch per hour. Even higher gravel content in Sample C5-drier decreases the infiltration rate to 0.22 inch per hour.

Organic content for Sample G3 is low for natives while Samples 05 and 06 are ample in organic matter. Organic content is sufficient for natives in Samples C7 and 07. All other areas are a bit low given their corresponding fine textures and greater clay. Modest supplementation would be of benefit to improve soil structure.

The reaction levels for Samples G4, C8, G3 and C5-wetter fall into the slightly alkaline range preferred by most plants, including natives. All other areas are moderately alkaline and a bit higher than preferred by natives. Natural lime is favorably low in Samples 06 and C5-drier and otherwise absent. This will allow for some beneficial pH adjustment where desired. Potentially troublesome salinity, sodium and boron are very safely low throughout and the SAR values indicate calcium and magnesium properly balance soluble sodium.

Available nutrient levels show nitrogen, manganese, sulfate and boron low throughout with the exception of sufficient nitrogen in Sample 07 and sufficient sulfate in 09. Boron deficiency is extremely rare. Zinc is also low in all but C7 and C5-drier. Phosphorus is fair in Sample 09 and otherwise sufficient to well supplied. Potassium is low in Samples 09, G4, C8, G3 and C5-wetter. Calcium is particularly ample in Samples 07, G4, 06 and C5-wetter & drier. Magnesium is low in Samples 07, 06 and C5-drier in comparison to the ample calcium levels. Magnesium is ample in Sample C8 and C5-wetter, though adequately balanced with sufficient calcium. In Sample G3, magnesium is excessive with calcium just equal in the saturation extract. Copper is low in Samples 05, 06, G3 and C5-wetter. Iron is low in Samples G4, G3 and C5-wetter while iron is ample in C7 and 07. All other major and minor elements are otherwise sufficient.

Comments

Samples C7 and 07 are the most favorable topsoil candidates given their desirable soil compositions with adequate organic matter. The elevated alkalinity will readily adjust into the slightly alkaline range given the adequate inclusion of soil sulfur as suggested below. No other supplementation would be required.

Sample 05 is also quite favorable given the ample organic content and suitable soil texture. A modest rate of soil sulfur would slightly adjust the alkalinity and no other amendments would be required.

Samples 09, G4, C8 and C5-wetter contain greater clay content and therefore higher moisture retention characteristics. However overall texture is quite suitable and increasing organic content very modestly would help improve soil structure for the long term. Utilizing green waste compost abundant in nutrients and particularly potassium at the modest rate suggested below would address the potassium deficits and sufficiently boost organic content to improve soil structure. A modest rate of soil sulfur is also suggested for Sample 09 for some beneficial pH adjustment.

Organic content in Sample 06 is quite ample and favorable however excessive gravel and coarse sand fractions moderately increase the susceptibility for soil particles to consolidate over time and the result would be decreased porosity and drainage capacity. The ample organic matter would be of benefit to offset the gravel fractions, in the short term at least. Sample 06 is a marginal topsoil candidate based on the texture limitations and if you choose to utilize this soil then the recommendation for adjusting pH with soil sulfur is the only requirement.

Sample G3 is not a desirable topsoil candidate given the combination of poor soil structure and serpentine like characteristics where magnesium is excessive and potassium deficient. Calcium is insufficient relative to the magnesium excess, which can impair plant development. An abundant addition of agricultural gypsum as well as organic matter would be required to begin to correct the shortcomings and plant survivability given the serpentine character may still be questionable.

Sample C5-drier is an unsuitable topsoil candidate given the very poor soil structure and high tendency to lock up and provide inadequate aeration and drainage. Increasing organic content could help offset the gravel fractions in the short term though long term suitability would be marginal at best. This soil is not suggested for use.

Recommendations

The soil sulfur treatment could be broadcast along the surface prior to stripping and stockpiling the soils and should get mixed sufficiently during the stockpiling process. This would provide a jump start on pH adjustment. The organic amendment could also be handled in the same manner.

The following rates of soil sulfur and amendment should be applied to the following areas as indicated. The following rates are to treat a soil depth of 6-inches.

	Amount / 1000 square feet	
Samples C7 & 07:	8 pounds	Soil Sulfur
Samples G4, C8 & C5-wetter:	2-1/2 cubic yards	Green waste Compost
Sample 09:	2-1/2 cubic yards	Green waste Compost
	8 pounds	Soil Sulfur
Sample 05:	8 pounds	Soil Sulfur
Sample 06:	12 pounds	Soil Sulfur
*Sample G3:	4 cubic yards	Green waste Compost
	130 pounds	Agricultural Gypsum

* Using the G3 soil is not suggested however.

The Green waste compost will adequately supplement potassium nutrition while the soil sulfur will adjust pH closer to 7.3.

Nitrogen fertilization may be left to your discretion and could rely upon a very modest rate of an organic fertilizer such as Blood Meal or Alfalfa Meal used at 1/3 of the suggested rate.

Heidi Fisher

HEIDI FISHER
Email 6 pages.

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Project : Permanente - Cupertino - 16143

Report No : **09-054-0030**
Purchase Order :
Date Recd : 02/23/2009
Date Printed : 02/26/2009

COMPREHENSIVE SOIL ANALYSIS

Sample Description - Sample ID	Half Sat % / TEC	pH / Qual Lime	ECe dS/m	NO_3-N ppm	NH_4-N ppm	PO_4-P ppm	K ppm	Ca ppm	Mg ppm	Cu ppm	Zn ppm	Mn ppm	Fe ppm	Organic % dry wt.	Lab No.
				Sufficiency Factors											
Soil Sample 1 - C7 1/27/09	17	7.9	0.7	15	4	27	151	1950	200	2.0	8.6	6	224	3.5	32855
	116	None		0.6		1.4	1.1	1.1	0.8	1.4	1.6	0.5	4.2		
Soil Sample 2 - 07 1/27/09	11	8.0	0.5	14	5	25	155	2399	63	1.0	2.8	5	161	2.6	32856
	128	None		0.9		1.9	1.3	1.6	0.3	0.8	0.6	0.5	3.5		
Soil Sample 4 - 09 1/27/09	22	7.9	0.6	10	4	15	105	2847	833	2.0	2.1	9	145	2.8	32857
	211	None		0.3		0.6	0.4	0.9	2.0	0.8	0.2	0.4	1.5		
Soil Sample 5 - G4 1/27/09	21	7.6	0.4	11	4	19	67	5712	865	2.4	1.3	6	42	2.2	32858
	356	None		0.4		0.7	0.2	1.4	1.6	0.7	0.1	0.2	0.3		
Soil Sample 6 - C8 1/27/09	19	7.6	0.5	10	4	20	52	2843	1374	1.9	1.1	8	85	2.5	32859
	255	None		0.4		0.9	0.2	0.9	3.3	0.7	0.1	0.4	0.9		
05 - 02/12/09	22	7.8	0.5	10	15	27	221	4607	947	1.8	5.0	8	129	7.1	32860
	312	None		0.6		1.0	0.7	1.1	1.8	0.5	0.4	0.3	1.1		

Saturation Extract Values						SAR	Gravel %		Percent of Sample Passing 2 mm Screen					USDA Soil Classification	Lab No.
									Sand						
Ca meq/L	Mg meq/L	Na meq/L	K meq/L	B ppm	SO_4 meq/L		Coarse 5 - 12	Fine 2 - 5	Very Coarse 1 - 2	Coarse 0.5 - 1	Med. to Very Fine 0.05 - 0.5	Silt .002-.05	Clay 0-.002		
4.3	1.3	1.0	0.3	0.05	0.9	0.6	5.0	9.0	5.6	8.0	38.2	26.6	21.6	Sandy Clay Loam	32855
2.9	0.8	0.6	0.4	0.09	0.7	0.5	8.0	4.6	3.0	8.0	47.6	23.8	17.6	Sandy Loam	32856
4.0	2.3	0.8	0.1	0.05	2.2	0.5	9.8	4.6	9.0	6.2	22.9	22.3	39.6	Clay Loam	32857
2.0	1.2	0.5	0.1	0.04	0.6	0.4	9.2	6.4	7.0	9.4	27.8	18.3	37.4	Gravelly Clay Loam	32858
2.4	1.5	0.6	0.1	0.05	0.7	0.5	5.8	8.4	5.6	6.6	31.9	20.4	35.5	Clay Loam	32859
3.0	1.6	0.7	0.2	0.08	0.8	0.5	4.6	9.0	7.4	7.6	28.9	28.4	27.7	Clay Loam	32860

Sufficiency factor (1.0=sufficient for average crop) below each nutrient value. N factor based on 200 ppm constant feed. SAR = Sodium adsorption ratio. Half Saturation %=approx field moisture capacity. Nitrogen(N), Potassium(K), Calcium(Ca) and Magnesium(Mg) by sodium chloride extraction. Phosphorus(P) by sodium bicarbonate extraction. Copper(Cu), Zinc(Zn), Manganese(Mn) & Iron(Fe) by DTPA extraction. Sat. ext. method for salinity (ECe as dS/m),Boron (B), Sulfate(SO_4), Sodium(Na). Gravel fraction expressed as percent by weight of oven-dried sample passing a 12mm(1/2 inch) sieve. Particle sizes in millimeters. Organic percentage determined by Walkley-Black or Loss on Ignition.

* LOW , SUFFICIENT , HIGH

WRA Environmental
2169-G E. Francisco Blvd.

San Rafael CA 94901

Soil & Plant Laboratory, Inc.
Leaders in Soil & Plant Testing Since 1946
352 Mathew Street Santa Clara, CA 95050 408-727-0330 (phone) 408-727-5125 (fax)
www.soilandplantlaboratory.com

Project : Permanente - Cupertino - 16143

Report No : **09-054-0030**
Purchase Order :
Date Recd : 02/23/2009
Date Printed : 02/26/2009

COMPREHENSIVE SOIL ANALYSIS

Sample Description - Sample ID	Half Sat % / TEC	pH / Qual Lime	ECe dS/m	NO_3-N ppm	NH_4-N ppm	PO_4-P ppm	K ppm	Ca ppm	Mg ppm	Cu ppm	Zn ppm	Mn ppm	Fe ppm	Organic % dry wt.	Lab No.
				Sufficiency Factors											
06 - 02/12/09	26	8.1	0.7	10	6	41	289	4904	123	1.3	5.1	9	124	5.5	32861
	258	Low		0.3		1.3	0.9	1.2	0.2	0.4	0.4	0.3	1.0		
G3 - 02/12/09	18	7.2	0.5	9	3	19	48	3975	2773	1.5	1.2	12	64	0.7	32862
	429	None		0.3		0.9	0.1	0.9	4.7	0.4	0.1	0.4	0.5		
C5 - 02/12/09 (wetter)	18	7.3	0.5	10	4	25	43	4287	1482	1.8	1.1	8	45	2.4	32863
	337	None		0.4		1.2	0.2	1.2	3.1	0.6	0.1	0.3	0.4		
C5 - 02/12/09 (drier)	21	8.0	0.8	14	5	54	281	2726	45	2.3	5.7	5	60	2.5	32864
	144	Low		0.5		2.2	1.6	1.2	0.1	1.2	0.8	0.3	0.9		

Saturation Extract Values						SAR	Gravel %		Percent of Sample Passing 2 mm Screen					USDA Soil Classification	Lab No.
									Sand						
Ca meq/L	Mg meq/L	Na meq/L	K meq/L	B ppm	SO_4 meq/L		Coarse 5 - 12	Fine 2 - 5	Very Coarse 1 - 2	Coarse 0.5 - 1	Med. to Very Fine 0.05 - 0.5	Silt .002-.05	Clay 0-.002		
4.5	0.7	0.6	0.7	0.11	1.1	0.3	14.2	13.2	10.8	9.0	41.1	24.3	14.8	Gravelly Sandy Loam	32861
1.6	1.6	0.9	0.1	0.05	0.5	0.7	13.0	14.0	12.2	12.0	30.6	16.0	29.2	Gravelly Sandy Clay Loam	32862
1.6	1.3	0.8	0.1	0.04	0.6	0.7	2.8	8.2	5.2	8.6	29.1	23.9	33.2	Clay Loam	32863
5.9	0.6	0.5	0.4	0.04	1.5	0.3	25.2	15.6	11.0	12.4	45.5	21.9	9.2	Very Gravelly Sandy Loam	32864

Sufficiency factor (1.0=sufficient for average crop) below each nutrient value. N factor based on 200 ppm constant feed. SAR = Sodium adsorption ratio. Half Saturation %=approx field moisture capacity. Nitrogen(N), Potassium(K), Calcium(Ca) and Magnesium(Mg) by sodium chloride extraction. Phosphorus(P) by sodium bicarbonate extraction. Copper(Cu), Zinc(Zn), Manganese(Mn) & Iron(Fe) by DTPA extraction. Sat. ext. method for salinity (ECe as dS/m),Boron (B), Sulfate(SO_4), Sodium(Na). Gravel fraction expressed as percent by weight of oven-dried sample passing a 12mm(1/2 inch) sieve. Particle sizes in millimeters. Organic percentage determined by Walkley-Black or Loss on Ignition.

* LOW , SUFFICIENT , HIGH

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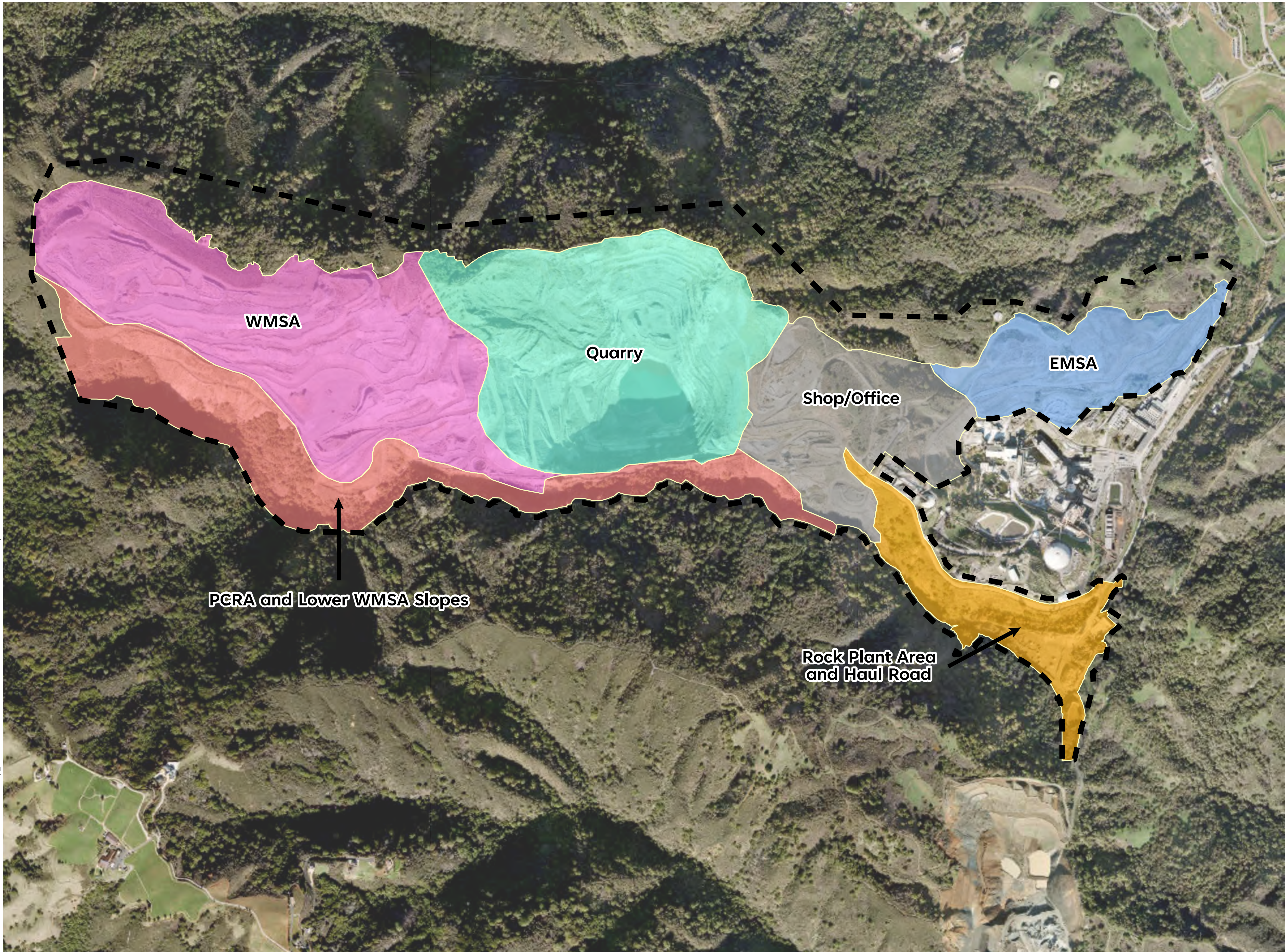
APPENDIX C. REVEGETATION PLAN FIGURES

Figure 1.
Revegetation Areas

Lehigh Permanente Quarry,
Santa Clara County,
California



Reclamation Plan Boundary - 921 ac.

Phase 1 - 398 ac.:

WMSA - 210 ac.

EMSA - 65 ac.

PCRA and Lower WMSA Slopes - 123 ac.

Phase 2 - 93 ac.:

Shop/Office - 93 ac.

Phase 3 - 255 ac.:

Quarry - 198 ac.

Rock Plant Area and Haul Road - 57 ac.

N

0 1,000 2,000
Feet

wra
Environmental Consultants

Path: L:\Acad 2000 Files\16000\16143-18\GIS\ArcMap_Pro\Perm 2023 Reclamation Plan\Perm 2023 Reclamation Plan.aprx

Sources: Digital Globe 2017 Aerial, WRA | Prepared By: rochelle, 6/9/2023

Figure 2. Soil Sample Locations

Lehigh Permanente Quarry,
Santa Clara County,
California

Reclamation Plan Boundary - 921 ac.

Reclamation Plan Components - 746 ac.

Soil Sample Locations

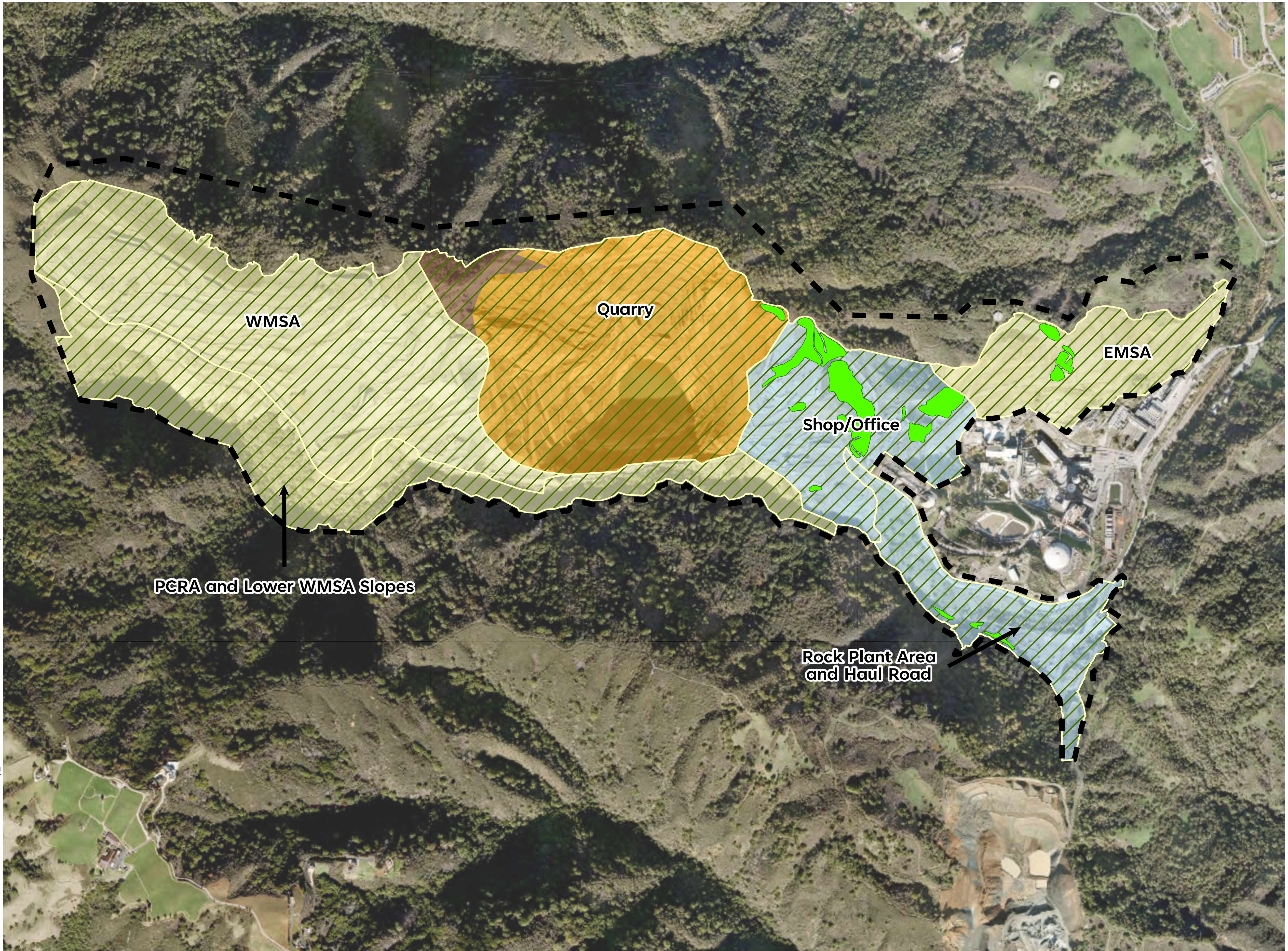
wra
Environmental Consultants

Path: L:\Acad 2000 Files\16000\16143-18\GIS\ArcMap_Pro\Perm 2023 Reclamation Plan\Perm 2023 Reclamation Plan.aprx

Sources: Digital Globe 2017 Aerial, WRA | Prepared By: rochelle, 6/9/2023

Figure 3. Revegetation Plan

Lehigh Permanente Quarry, Santa Clara County, California



Reclamation Plan Boundary - 921 ac.

Reclamation Plan Components - 746 ac.

Areas Already Vegetated - 18 ac.

Soil Treatment Areas

Coarse Overburden with Cover - 396 ac.

General Compacted Soils - 134 ac.

Highwall Benches - 14 ac.

Soil Backfill - 184 ac.

Revegetation Plan

Shrubs and Grasses - 727 ac.

N

0 1,000 2,000

Feet

wra Environmental Consultants

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Sources: Digital Globe 2017 Aerial, WRA | Prepared By: rochelle, 6/9/2023

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APPENDIX D. TEST PLOT MONITORING RESULTS REPORT

Revegetation Test Plot Summary

Permanente Quarry

SANTA CLARA COUNTY, CALIFORNIA

Prepared For:
Lehigh Southwest Cement Company
24001 Stevens Creek Blvd.
Cupertino, CA 95014

WRA Contact:
Geoff Smick
smick@wra-ca.com

Date:
January 2019

WRA Project Number:
16143-15

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LIST OF APPENDICES

1.0 Introduction

The California Code of Regulations Section 3705 (b) requires that test plots be implemented if a proposed revegetation plan has not been demonstrated to work in similar situations elsewhere. A test plot program has been established in the RPA to determine appropriate materials and techniques to improve revegetation success throughout areas to be reclaimed. The specific objectives of the test plots are to assess the response of native seed mixes and container tree and shrub plantings to various soil blends and depths, using the available materials evaluated as described in Section 3.0.

Sixteen test plots were constructed on top of bare graded overburden rock at two locations within the RPA in the fall of 2008. Plots 1-12 and 16 were constructed at the relatively flat “Yeager Yard” site, and plots 13-15 were constructed at a sloped location within the EMSA (Figure 1). To test the response of the seed mixes and plantings to various soil treatments, the test plots each differ by soil composition and depth of soil. The soil treatments consisted of a combination of materials, including overburden rock, North Quarry fine greenstone material, rock plant fines, and imported compost. Each test plot was divided into four equal quadrants upon which four different native seed mixes were applied, followed by straw mulch and a hydroslurry of fertilizers and a tackifier. In addition, container plantings were installed in the 24- inch depth test plots (11, 12, and 16) in November 2009.

A summary of the test plot program is provided below. Additional details on design, construction, maintenance, and monitoring can be found in the *Revegetation Test Plot Program As-built Report* (WRA 2010). Results were assessed to evaluate the performance of each soil blend and planting palette to inform future revegetation efforts. This program has therefore met or exceeded compliance with section 3705(b).

2.0 Test Plot Design and Soil Treatments

The basic test plot design is similar at both the Yeager Yard and EMSA sites. The border of each test plot was outlined by certified weed-free straw bales. At Yeager Yard, plots 1-12 are each 50-foot (ft.) by 50-ft. squares, and plot 16 is a 25-ft. by 25-ft. square. At the EMSA, plots 13 and 14 are 100-ft. by 100-ft. squares, and plot 15 is a slightly reduced size due to site constraints (100 ft. x 100 ft. x 100 ft. x 40 ft.). The soil materials specific to each plot treatment were laid down and mixed on site as described below.

Test plot soil blends are comprised of various combinations of overburden rock, North Quarry fine greenstone, and Rock Plant fines originating from Quarry operations, as well as compost delivered from offsite. Compost was used in the test plots as a proxy for added topsoil intended for larger scale application. The soil treatments for all plots are listed in Table 1. Plots 1-6 and 10 are six inches in depth, plots 7-9 are 12 inches in depth, and plots 11, 12, and 16 are 24 inches in depth. At the EMSA site, plots 13, 14, and 15 are all six inches in depth.

The materials were blended together with construction equipment within each test plot to achieve a relatively uniform consistency. For the plots with multiple materials blended together, each material was added separately and then ripped or blended with the other material in sequence. The rock plant fines material included some consolidated chunks which required pulverizing before blending. Rocks over six inches in diameter were removed from the plots to the extent possible. The plots were compacted to approximately 90% and were finish graded to a smooth surface.

Following application of the soil blends, each plot was divided into four quadrants of equal area using six-inch certified weed-free straw wattles. Plots were numbered with a sign at the center of each plot. A stake was placed in the center of each quadrant and painted green, red, yellow, or blue to indicate the native seed mix applied to that quadrant. The test plot layouts at the Yeager Yard site and the EMSA are shown in Figures 2 and 3, respectively.

Table 1. Test plot soil treatments.

PLOT NUMBER	PLOT SIZE	SOIL TREATMENT DEPTH	MATERIAL COMPONENTS	COMPONENT PROPORTIONS	COMPONENT DEPTH (BEFORE BLENDING)
YEAGER YARD (flat)					
1	50' x 50'	6”	overburden rock	100%	6"
2	50' x 50'	6”	overburden rock compost	75% 25%	4.5" 1.5"
3	50' x 50'	6”	overburden rock compost	50% 50%	3" 3"
4	50' x 50'	6”	overburden rock Rock Plant fines Compost	35% 40% 25%	2" 2.5" 1.5"
5	50' x 50'	6”	fine greenstone compost	75% 25%	4.5" 1.5"
6	50' x 50'	6”	overburden rock Rock Plant fines fine greenstone compost	33% 17% 25% 25%	2" 1" 1.5" 1.5
7	50' x 50'	12”	overburden rock compost	75% 25%	9" 3"
8	50' x 50'	12”	overburden rock fine greenstone	37.5% 37.5%	4.5" 4.5"
			compost	25%	3"
9	50' x 50'	12”	overburden rock Rock Plant fines fine greenstone compost	25% 25% 25% 25%	3" 3" 3" 3"
10	50' x 50'	24”	overburden rock compost	75% 25%	18" 6"
11	50' x 50'	24”	fine greenstone compost	75% 25%	18" 6"
12	50' x 50'	24”	overburden rock Rock Plant fines fine greenstone compost	25% 25% 25% 25%	6" 6" 6" 6"
16	25' x 25'	24”	overburden rock fine greenstone compost	37.5% 37.5%	9" 9" 6"

				25%	
EMSA (sloped)					
13	100’ x 100’	6”	overburden rock	75%	4.5"
			compost	25%	1.5"
14	100’ x 100’	6”	overburden rock Rock Plant fines Compost	35% 40% 20%	2" 2.5" 1.5"
15	100’ x 100’ x	6”	fine greenstone	75%	4.5"
	100’ x 40’		compost	25%	1.5"

3.0 Seed and Amendment Application

A native shrub mix was applied manually with a belly grinder to all of the plots; the components of this mix are listed in Table 2. Four different native grass and herbaceous seed mixes were then applied manually with a belly grinder within the allocated quadrants of each plot. Components of these seed mixes are provided in Table 3. Following seeding at the test plots, straw mulch and a hydroslurry consisting of fertilizers and a tackifier was applied to all of the plots. At the EMSA site only, a mycchorhizal inoculant was included in the hydroslurry. The application rates of the straw and hydroslurry components are listed in Table 4.

Table 2. Native shrub seed mix applied to all test plots.

SCIENTIFIC NAME	COMMON NAME	PURE LIVE SEED (lb / acre)
Adenostoma fasciculatum	Chamise	1.50
Artemisia californica	California sagebrush	1.00
Artemisia douglasiana	Mugwort	0.10
Baccharis pilularis	coyote brush	0.10
Ceanothus cuneatus	Buckbrush	2.00
Eriodictyon californicum	yerba santa	0.50
Eriogonum fasciculatum	California buckwheat	1.50
Heteromeles arbutifolia	toyon	3.00
Mimulus aurantiacus	sticky monkeyflower	0.10
Salvia mellifera	black sage	1.00
	TOTAL	**10.80**

Table 3. Grass and herbaceous seed mixes applied to test plot quadrants.

SCIENTIFIC NAME	COMMON NAME	PURE LIVE SEED (lb / acre)
Native Seed Mix #1 (green quadrant)		
Achillea millefolium	white yarrow	0.75
Bromus carinatus	California brome	8.00
Clarkia purpurea ssp. *quadrivulnera*	clarkia	0.75
Elymus glaucus	blue wildrye	6.50
Heterotheca grandiflora	telegraph weed	0.15
Lotus purshianus	Spanish clover	2.50
Lotus scoparius	deerweed	4.00
Lupinus nanus	sky lupine	1.50
Nassella pulchra	purple needlegrass	3.00
Oenothera hookeri	evening primrose	1.25
Plantago erecta	California plantain	2.50
Vulpia microstachys	three weeks fescue	4.00
	TOTAL	**34.90**
Native Seed Mix #2 (red quadrant)		

Bromus carinatus	California brome	20.00
Elymus glaucus	blue wildrye	8.00
Vulpia microstachys	three weeks fescue	6.00
Trifolium willdenovii	tomcat clover	4.00
	TOTAL	**38.00**
Native Seed Mix #3 (yellow quadrant)		
Achillea millefolium	white yarrow	1.00
Bromus carinatus	California brome	10.00
Clarkia purpurea ssp. *quadrivulnera*	clarkia	0.76
Elymus glaucus	blue wildrye	10.00
Lotus purshianus	Spanish clover	3.00
Lotus scoparius	deerweed	6.00
Lupinus nanus	sky lupine	3.00
Oenothera hookeri	evening primrose	2.00
Vulpia microstachys	three weeks fescue	4.00
	TOTAL	**39.76**
Native Seed Mix #4 (blue quadrant)		
Achillea millefolium	yarrow	1.00
Bromus carinatus	California brome	9.00
Elymus glaucus	blue wildrye	8.00
Eriogonum nudum	naked buckwheat	0.25
Eriophyllum confertiflorum	golden yarrow	0.05
Festuca occidentalis	western fescue	6.00
Leymus triticoides	creeping wildrye	2.00
Lotus purshianus	Spanish clover	3.00
Melica californica	California melic	3.00
Plantago erecta	California plantain	3.00
Poa secunda	one-sided bluegrass	3.00
Scrophularia californica	beeplant	0.25
Sisyrinchium bellum	blue eyed grass	1.00
Vulpia microstachys	three weeks fescue	8.00
	TOTAL	**47.55**

Table 4. Mulch and hydroslurry application rates used in test plots.

TREATMENT	APPLICATION RATE (lb / acre)
Weed-free sterile wheat straw mulch	4000
“Fiber Wood” organic mulch	2000
Plantago-based M-binder (tackifier)	200
42-0-0 Sulphur-coated urea	175
0-0-50 Sulfate “potash”	175
mychorrhizal inoculant (EMSA site only)	120

4.0 Test Plot Plantings

Plants were installed in the test plots by a landscape contractor in November 2009. Plants were installed in 24 inch-deep soil treatment plots 11, 12, and 16. The planting design was arranged to ensure that two of each species was tested within each soil and plant care treatment combination. Planting space was very limited in the smaller-sized Plot 16, so a simplified planting and treatment scheme was devised for this plot. A plant list for the completed plant installation is provided in Table 5.

Table 5. Trees and shrubs installed in test plots in November 2009.

SCIENTIFIC NAME	COMMON NAME	SIZE*	PLOT 11	PLOT 12	PLOT 16	TOTAL NUMBER
Arbutus menziesii	Pacific madrone	DP	8	8	3	19
Pinus sabiniana	grey pine	TB	8	8	3	19
Quercus agrifolia	coast live oak	TP	8	8	3	19
Quercus douglasii	blue oak	LT6 (two LT4)	8	8	3	19
Cercocarpus betuloides	mountain mahogany	TB	8	8	3	19
Heteromeles arbutifolia	toyon	1G	8	8	3	19
Quercus berberidifolia	scrub oak	TB	8	8	3	19
Rhamnus californica	coffeeberry	TB	8	8	3	19
Ribes californicum	hillside gooseberry	TB	8	8	3	19
		TOTAL	72	72	27	171

*DP = 10” tall DeePot; TB = 5.5” tall treeband; TP = 14” tall 1 gallon Treepot; LT6(4) = 6(4)” deep leach tube; 1G = one gallon pot

General planting guidelines for RPA revegetation specify planting trees on a minimum of 9-foot centers, with shrubs interspersed among the trees at 4.5-foot centers. The test plots are not likely to be maintained for more than 5 to 10 years, so the test plot design did not need to account for the expected full-grown size of these specimens. Therefore, plants were installed in a grid pattern with spacing between plants ranging from 3.5 to 5 feet. The plantings were concentrated in the center of each plot to prevent competition with seed treatments on a portion of each plot quadrant. Small container sizes with high depth to width ratios were selected, as availability allowed, to improve survival and mimic likely large-scale planting conditions.

In addition to planting, two types of plant care treatments were installed in various combinations in each plot. These treatments include applying mulch and using DriWater gel pacs, a biodegradable silica-based product that is buried next to the plants and slowly releases stored water into the soil. The straw wattles delimiting the four seed treatment quadrants in each plot were used to designate plant care treatment combinations. Each plot includes four different treatment combinations: mulch only (yellow quadrant), DriWater only (green quadrant), mulch and DriWater (blue quadrant), and no treatment (red quadrant). Due to the small size of Plot 16, planting was limited to one individual of each species per treatment, and a combined mulch and DriWater treatment was not installed in the blue quadrant.

Weed control in areas surrounding the test plots was conducted to prevent invasion from species that will also be targeted in future revegetation efforts. Weeding within plots was conducted in all plots for uniformity.

5.0 Test Plot Results

Observed trends indicate that all soil materials added to overburden rock help to increase total plant cover and grass cover in particular. While shrub cover was low after the first two years, shrub density was fairly high with many small individuals observed. A higher cover of grasses appears to suppress shrub establishment, which is particularly true in plots with higher percentages of compost. Deeper and richer compost-laden plots mimic grassland soils more so than typical scrub soils which promotes grass growth. Test plots with larger amounts of overburden rock supported lower cover, fewer grasses, and a greater number of shrub seedlings, although they are small and develop slowly. In particular, species that were seeded but never observed were omitted from the proposed plant palette while species that performed well were retained. The quantity of some native annual grass seed was reduced to prevent overcompetition with shrubs, a target natural community.

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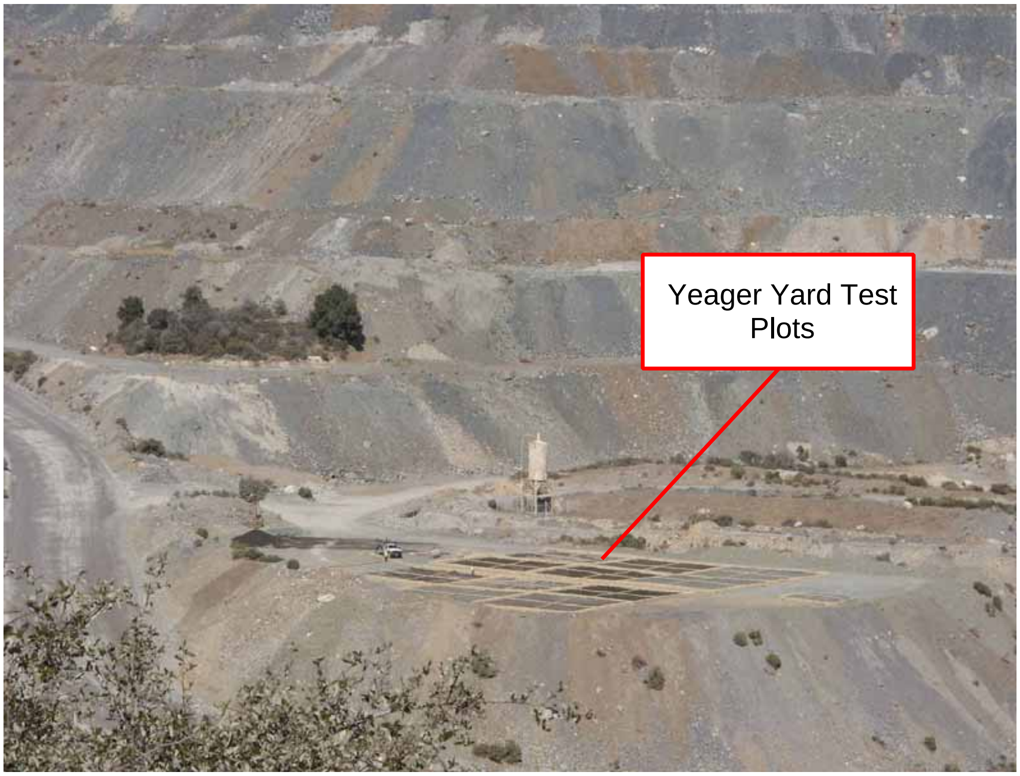
Appendix A Photos



Appendix A - Revegetation and Test Plot Photographs

Top: Yeager Yard Test Plots (October 21, 2008)

Bottom: EMSA Test Plots (October 21, 2008)

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Top: Test plot construction at Yeager Yard: Blending soil materials (October 17, 2008)

Bottom: Early spring growth of hydroseed in the EMSA test plots (February 2, 2009)

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Previous successful revegetation areas supporting dense cover of native shrubs.

Top: East Quarry Revegetation area (photo May 27, 2008).

Bottom: Revegetation site above the "boneyard" in the EMSA (photo February 12, 2009).

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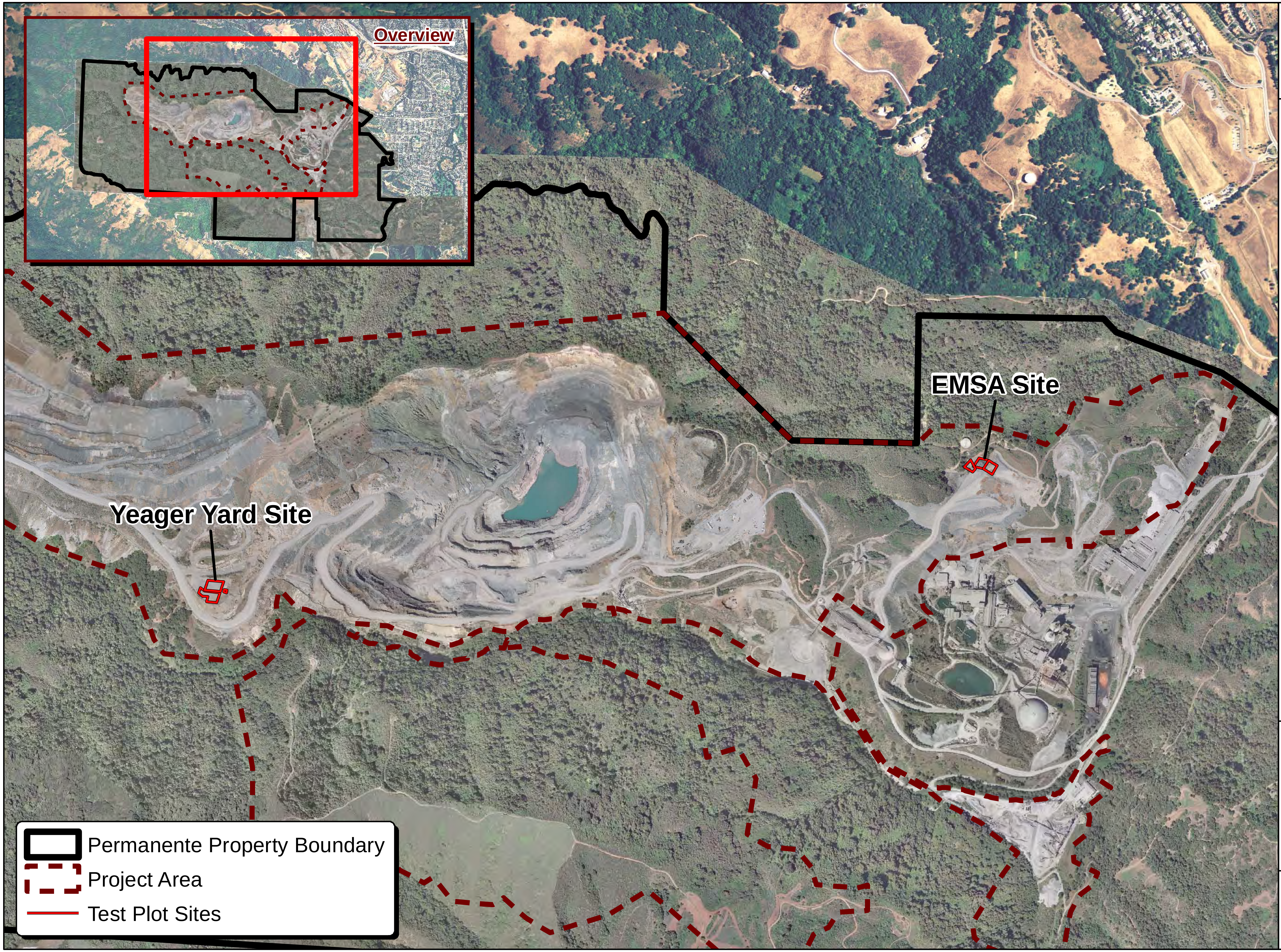
Appendix B Figures



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Lehigh Permanente Quarry,
Santa Clara County,
California

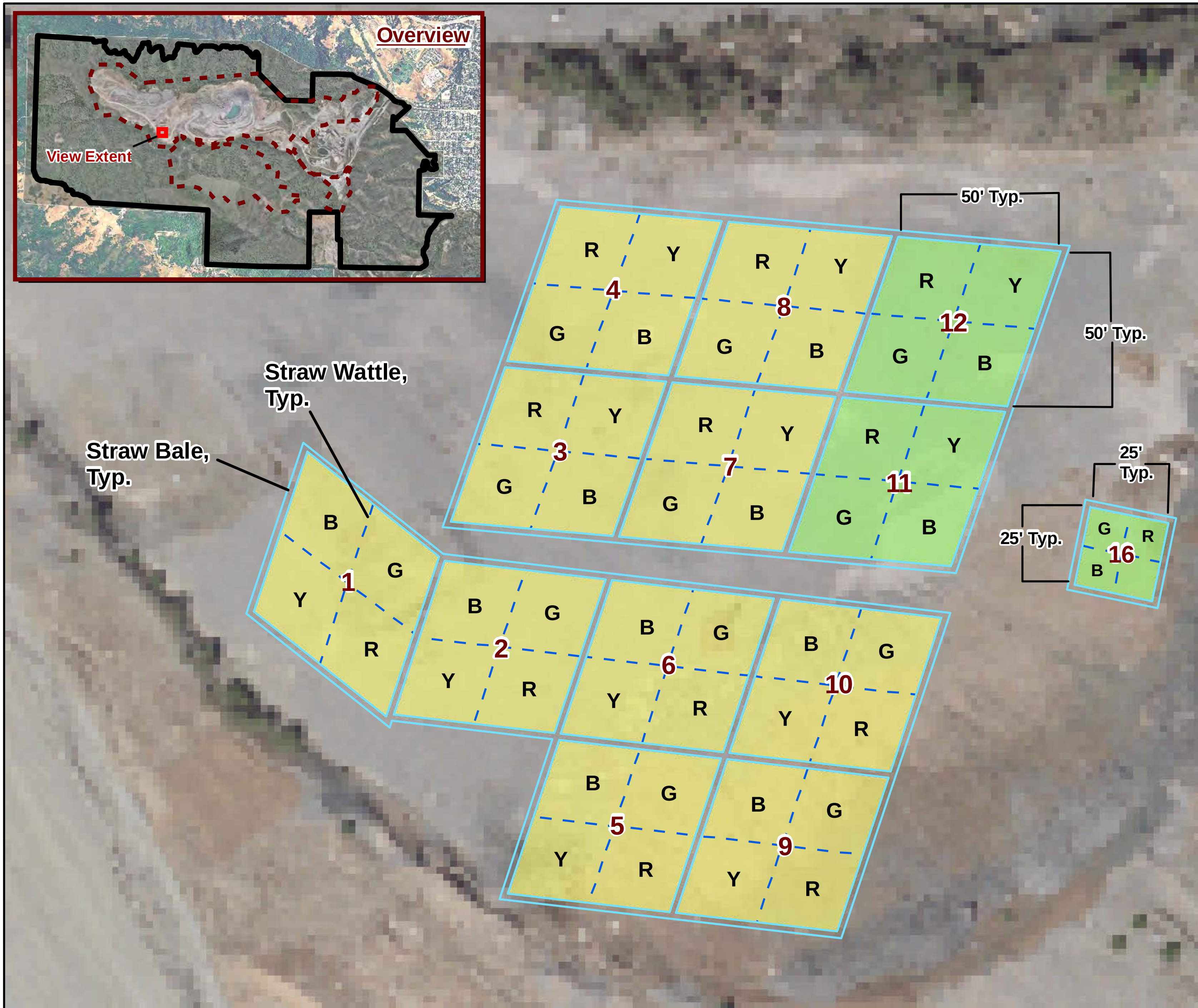
Figure 1.

Test Plot
Location Map

N
W E
S

0 500 1,000 2,000
Feet

Date: May 2010
Map by: Michael Rochelle
Image Date: April 2007
File path; I:\Acad2000\16000\16143\gis\arcmap\
2010 Reports\Revegetation\Test Plot Location.mxd



Green = 24” soil treatments with hydroseed and container plantings installed
Yellow = 6” to 12” soil treatments with hydroseed only

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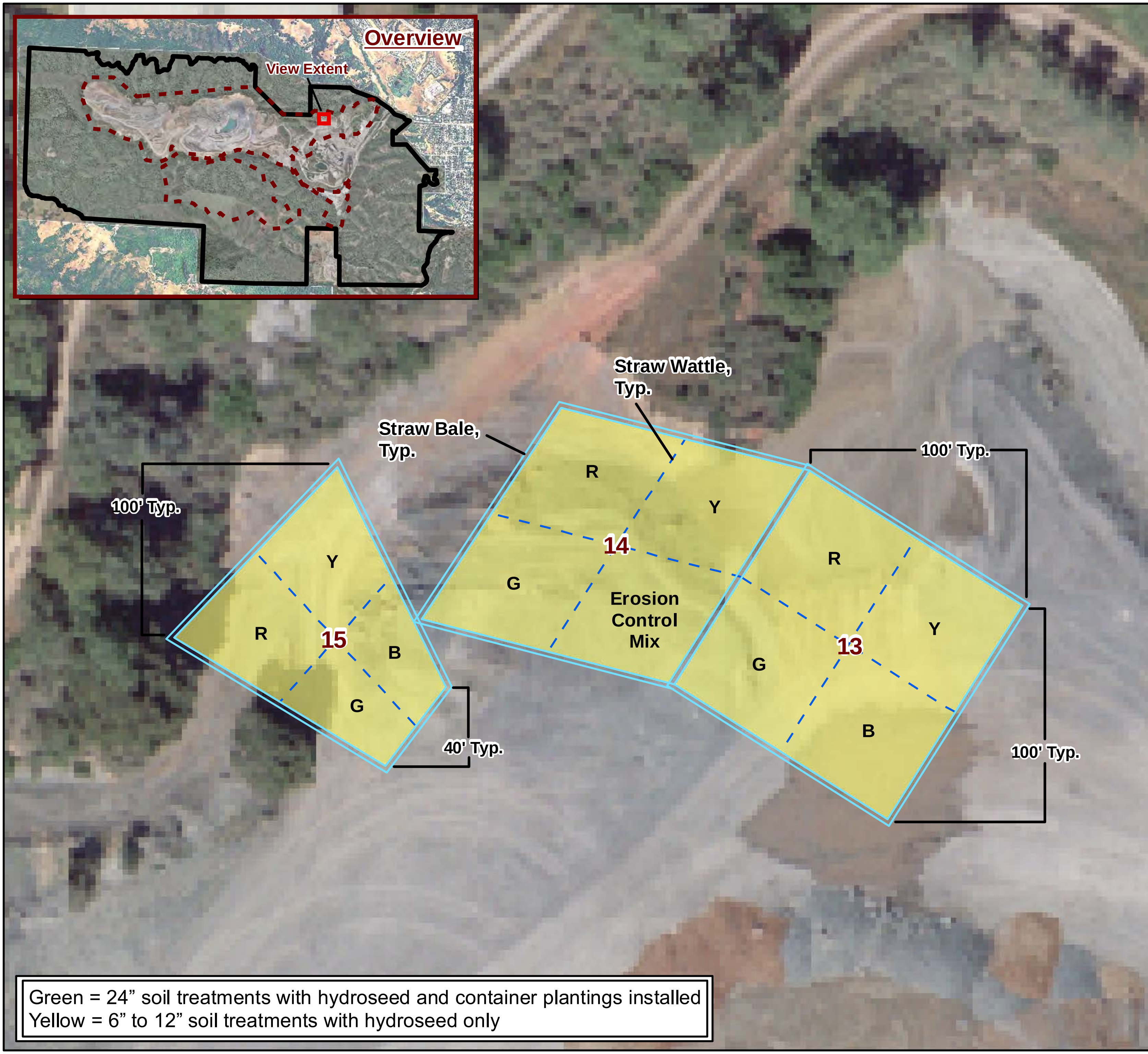
Lehigh Permanente Quarry,
Santa Clara County,
California

Figure 2.

Test Plot Layout
at Yeager Yard Site

0 25 50 Feet

Date: May 2010
Map by: Michael Rochelle
Image Date: April 2007
File path; I:\Acad2000\16000\16143\gis\arcmap\2010 Figures\Reveg Plan\Yeager_Site.mxd



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Lehigh Permanente Quarry,
Santa Clara County,
California

Figure 3.

Test Plot Layout
at EMSA Site

0 15 30 60 Feet

Date: May 2010
Map by: Michael Rochelle
Image Date: April 2007
File path; I:\Acad2000\16000\16143\gis\arcmap\
2010 Report\Reveg Plan\EMSA_Site.mxd

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APPENDIX I
DRAINAGE REPORT

APPENDIX I-1
DRAINAGE REPORT

DRAINAGE REPORT
FOR THE
PERMANENTE QUARRY
RECLAMATION PLAN AMENDMENT

May 8, 2023

Will sign and stamp upon approval

Wayne W. Chang, MS, PE 46548

ChangConsultants
Civil Engineering ◦ Hydrology ◦ Hydraulics ◦ Sedimentation

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FOR REVIEW ONLY

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APPENDICES

MAP POCKET

INTRODUCTION

Heidelberg Materials (Heidelberg) operates the Permanente Quarry (Quarry), which is a limestone and aggregate mining operation located within the county of Santa Clara foothills west of the city of Cupertino (see Figure 1, "Regional Location," Figure 2, "Site Location," and Figure 3, "Existing Conditions Aerial and Nomenclature" at the back of this report). Heidelberg can operate the Quarry under an approved 2012 *Reclamation Plan Amendment for Permanente Quarry* (2012 RPA). The primary feature of the 2012 RPA is to reclaim the central mining excavation, known as the North Quarry, by backfilling the excavation with 48 million tons of overburden that is currently stockpiled on-site in an area known as the West Materials Storage Area (WMSA).

The WMSA is at the western end of the 2012 RPA area and north of Permanente Creek. The WMSA has historically been used for overburden material storage. The North Quarry is immediately east of the WMSA and also north of Permanente Creek. The North Quarry has historically been used for extraction. Under the 2012 RPA, the majority of the storm runoff from the North Quarry and WMSA will ultimately be conveyed to Permanente Creek.

Additional areas include the East Materials Storage Area (EMSA) and Rock Plant. The EMSA is north of Permanente Creek and has also historically been used for overburden material storage. The Rock Plant was an active rock processing facility for construction aggregates located on the south side of Permanente Creek. Storm runoff from these two areas is ultimately conveyed to Permanente Creek.

The current application proposes to update the reclamation plan. The amendment will address new California Surface Mining and Reclamation Act (SMARA) requirements adopted since the prior plan approval, begin the quarry closure process, address geotechnical stability needs revealed by detailed investigation completed between 2018 and 2023, retain the quarry north wall ridgeline, reclaim pre-SMARA slopes along Permanente Creek excluded in the 2012 plan, ensure interim and long-term water quality, provide quarry cover and backfill requirements, and provide a regional location to beneficially reuse imported soil materials from off-site regional projects. Primary activities under this reclamation plan involve removing aggregates stockpiles, grading steep areas for stability, backfilling the quarry, covering surfaces of the WMSA and quarry with suitable closure material (generated on-site and imported), buttressing quarry walls with imported fill, and revegetating.

This report contains planning-level drainage analyses of the post-reclamation flow rates from the proposed North Quarry, WMSA, EMSA, and Rock Plant (Study Area). The reclamation grading has been prepared by Stantec. Stantec also provided proposed drainage basin boundaries and proposed drainage conveyance locations. In some instances, the drainage basin boundaries and conveyances vary from drainage patterns reflected by the proposed grading and topography. Stantec indicated that the drainage basin boundaries and conveyances anticipate final refinements to the reclamation plan such as the addition of slope benches, etc. The drainage analyses in this report give precedence to Stantec's drainage basin boundaries and conveyances over their grading. The analyses results are intended to provide a planning-level assessment of the drainage conditions. The drainage discrepancies will be rectified as the project progresses from the planning to final engineering stage.

The majority of the post-reclamation flows will be conveyed to Permanente Creek. Santa Clara County's 2007 *Drainage Manual* indicates that new storm drain systems and channels shall be designed to convey the 10-year storm without surcharge and a safe release shall be provided for the 100-year flow. Furthermore, SMARA states that erosion control methods shall be designed for the 20-year storm and shall control erosion and sedimentation during operations as well as after reclamation is complete (see *California Code of Regulations*, Title 14, Section 3706). The *Drainage Manual* provides parameters for the 25-year storm event, but not the 20-year event. The 25-year event was analyzed in this report in order to satisfy the requirements for the 10- and 20-year events. Since the 25-year event is greater than these two events, the 25-year results will provide a greater factor-of-safety in the drainage design. The 100-year event was also analyzed in accordance with the *Drainage Manual* criteria.

Furthermore, this report contains analyses for temporary desiltation basins that will capture storm runoff from the combined North Quarry/WMSA and the Rock Plant. The basins, as well as other interim erosion control measures, will be used until the vegetation establishes. The desiltation basins have been sized according to criteria from the State Water Resources Control Board (SWRCB) and the Santa Clara Valley Urban Runoff Pollution Prevention Program (SCVURPPP).

HYDROLOGIC ANALYSES

Hydrologic analyses were performed for existing (pre-project) conditions in the North Quarry and WMSA (see next section). In addition, hydrologic analyses were performed for proposed (post-project or reclaimed) conditions in the North Quarry, WMSA, EMSA as well as the Rock Plant. The area containing the existing shop and office between the North Quarry and EMSA was also analyzed. Existing and proposed conditions are similar for the EMSA and Rock Plant, so only proposed conditions were modeled. The Santa Clara County 2007 *Drainage Manual* allows the rational method for drainage areas smaller than 200 acres (with no detention, no substantial surface storage effect, and no large areas of pervious soils) and the unit hydrograph method for areas greater than 200 acres. Stantec designed the reclamation grading with six major drainage basins tributary to six independent discharge locations to Permanente Creek. Each of the major drainage basins covers less than 200 acres, so the rational method was used for proposed conditions.

For existing conditions, the unit hydrograph method (described in the second half of this section) was used to analyze the portion of the combined North Quarry and WMSA drainage basin since it is larger than 200 acres. The hydrologic analyses were performed for the 25- and 100-year storm events.

Rational Method

The rational method input parameters are summarized below, and the supporting data is included in Appendix A:

- Rainfall Intensity: The 25- and 100-year intensity-duration-frequency curves were established using the Return Period-Duration-Specific (TDS) Regional Equation. The mean annual precipitation value used in the TDS equation is 28 inches.

- Drainage area: The proposed condition (post-reclamation) drainage basins were provided by Stantec and reflect their anticipated ultimate configuration. The Proposed Condition Hydrologic Work Map in the map pocket at the back of this report contains the existing topography, proposed grading, Stantec's drainage basins, rational method node numbers, and basin areas. Some of Stantec's drainage basins were further subdivided to determine flow rates at key locations.

- Hydrologic soil groups: The hydrologic soil group was determined from "Figure B-1, Soil Texture and Mean Annual Precipitation Depths for the Santa Clara Basin" in SCVURPPP's June 2016, *C.3. Stormwater Handbook.* The soil type at the site is entirely within group B. Discussions with Golder indicated that the reclaimed hydrologic soil group will be similar to the undisturbed soil group.

- Runoff coefficients: The current and proposed site conditions within the Study Area contain negligible impervious surfaces and a surface condition representative of a mineral extraction site. Santa Clara County's *Drainage Manual* provides a table (Table 3-1) of runoff coefficients for various land uses ranging from natural cover (parks, agricultural, open space, and shrub land) to development types (residential, commercial, industrial, and paved/impervious surfaces). The project site does not specifically fall within any of the *Drainage Manual's* land use categories. The current site contains hilly terrain, with exposed rock/gravel surfaces, limited vegetal cover, and little surface storage. The post-project site will contain hilly terrain, gravel/rock surfaces, hydroseeded and planted surfaces, and little surface storage. Since the current *Drainage Manual* does not specifically address the current and post-project conditions, Land Development Engineering provided Table 4 from the County's previous drainage manual as a guideline to develop a runoff coefficient for mined areas.

  For proposed conditions at the North Quarry, WMSA, EMSA, and Rock Plant as well as their tributary areas, the selected values from Table 4 are a relief of 0.40, soil infiltration of 0.15, vegetal cover of 0.15, and surface storage of 0.15. This yields a runoff coefficient of 0.85. It should be noted that the runoff coefficients from Table 4 can be higher (i.e., more conservative) than runoff coefficients based on the *Drainage Manual.*

- Flow lengths and elevations: The flow lengths and elevations were obtained from the topographic mapping and Reclamation Plan Amendment reclamation grading. In some areas, the proposed flow lengths were adjusted to align with the drainage conveyances proposed by Stantec. The initial time of concentration for each initial subarea was calculated using a spreadsheet based on the Kirpich equation from the *Drainage Manual.*

The flow lengths in an initial subarea start at the most hydraulically distant (or highest) point in a drainage basin in accordance with the typical rational method procedure (this is discussed on page 17 of the *Drainage Manual)*.

The rational method analyses were performed using the CivilDesign Universal Rational Method Hydrology Program. This program was customized to meet the Santa Clara County hydrologic criteria. The County's intensity-duration data was input into the program. The times of concentration for initial subareas were calculated using a spreadsheet of the Kirpich equation, which is included in Appendix A. The initial time of concentration values from the spreadsheet were entered as user-specified data in the program. After the initial subarea is modeled, the program can route the flow in channels, streets, pipes, etc. The channel routing routine was used to model the flow in natural drainages and proposed flow paths. The program also allows for flow in separate streams to be confluenced.

The CivilDesign program requires a land use to be entered (e.g., undeveloped dense cover, etc.). However, the runoff coefficients used by the program were based on user-defined value of 0.85 defined above, rather than the program specified land use and soil group. Therefore, while the land uses listed in the output provide a general description of the land use, they were not used for determination of the runoff coefficients.

The overall 25- and 100-year proposed condition rational method output are included in Appendix A and summarized in Table 1 for each major drainage basin.

Rational Method Node (source / flow direction)	Area, acres	25-Year Flow, cfs[1]	100-Year Flow, cfs[1]
106 (from WMSA to south)	65.45	96	117
212 (from WMSA/NQ to south)	106.73	182	223
314 (from NQ to south)	143.43	222	273
410 (from Shop/Office to south)	92.13	103	125
514 (from EMSA to east)	99.83	165	202
606 (from RP to north)	91.43	155	190

[1]cubic feet per second

Table 1. Summary of Overall Existing Condition Rational Method Results

Unit Hydrograph Method

The majority of the existing condition North Quarry and WMSA are located within a single large drainage area that will ultimately flow into Permanente Creek after the site is reclaimed. This existing condition drainage area is larger than 200 acres, so the unit hydrograph method was used to analyze these regions. The unit hydrograph input parameters are summarized below, and the supporting data is included in Appendix B:

- Rainfall Pattern: The 24-hour, 5-minute rainfall pattern given in Appendix D of the *Drainage Manual* was used. The 25- and 100-year, 24-hour precipitation values were determined using the TDS equation and are 6.15 and 7.63 inches, respectively.

- Drainage area: The existing condition (pre-project) drainage basin was delineated from the base topography prepared for the site. The Existing Condition Hydrologic Work Map in the map pocket at the back of this report contains the existing topography, basin boundaries, flow path, centroid, and North Quarry/WMSA basin area.

- Hydrologic soil groups: The hydrologic soil group was determined from "Figure 1, Soil Texture and Mean Annual Precipitation Depths for the Santa Clara Basin" in SCVURPPP's June 2016, *C.3. Stormwater Handbook.* The soil type at the site is entirely within group B.

- Curve Number: The existing conditions within the project footprint contain negligible impervious surfaces. The existing condition was assigned a curve number of 86, which reflects barren cover (rock, eroded, and graded land) under soil group B and antecedent moisture condition II. The CN was adjusted to AMC II-1/2 (CN = 90) in accordance with County procedures. The initial abstraction was equal to 0.2[(1000/CN) − 10] inches or 0.22 for the existing condition.

- SCS Lag: The SCS lag was calculated using the formula in the *Drainage Manual.* The flow length, elevations, effective slope, and the centroid were obtained from the topographic mapping. The existing condition watershed roughness was assigned a value of 0.070 to represent a drainage basin with minimal urbanization. The duration of the unit hydrograph was calculated based on 1/4 the lag time. From this, the SCS was estimated to be 0.46 hours for existing conditions.

The US Army Corps of Engineers' HEC-1 program was used for the unit hydrograph analyses. The results are included in Appendix B and summarized in Table 2.

Region	Area, ac	25-Year Flow, cfs	100-Year Flow, cfs
WMSA/North Quarry	361.01	320	416

Table 2. Summary of Existing Condition Unit Hydrograph Method Results

Under existing conditions, the majority of the North Quarry and WMSA runoff is captured in the quarry pit. Historically, before quarry operations, the majority of the North Quarry and WMSA runoff would enter Permanente Creek without being captured by a pit. The proposed project will ultimately fill the pit, so reclamation will eliminate pit capture and reestablish surface runoff to Permanente Creek. The Federal Emergency Management Agency (FEMA) has established an existing condition 100-year flow rate in Permanente Creek below the site and delineated the associated floodplain. Hydrologic analyses performed for the 2012 RPA demonstrated that the post-reclamation condition will not adversely increase the FEMA 100-year flow rate nor floodplain. Therefore, the project will not increase the risk of downstream flooding as defined by FEMA.

The existing condition hydrology beyond the existing condition North Quarry/WMSA drainage basin will be similar to proposed conditions since the drainage patterns and land cover are similar. The overall drainage basin boundary is included on the Existing Condition Hydrologic Work Map for reference.

DESILTATION BASIN ANALYSES

A primary water quality pollutant generated from the proposed major drainage basins will be sediment. The final slopes, benches, and pads will be planted with grasses, shrubs, and trees to prevent erosion. In the interim period before the vegetation has established, best management practices including temporary desiltation basins will be installed. A temporary desiltation basin will be constructed near the locations where storm runoff discharges from each major drainage basin within the North Quarry, WMSA, and Rock Plant areas. The proposed grading within the EMSA only involves perimeter slopes, so a desiltation basin is not proposed. The desiltation basins will be maintained until the vegetation has established. Two methodologies have been considered for sizing each desiltation basin. First, SCVURPPP outlines volume-based treatment control sizing in their *C.3. Stormwater Handbook.* Second, the State Water Resources Control Board (SWRCB) *Water Quality Order 99-08-DWQ* (as amended by *2010-0014-DWQ* and *2012-0006-DWQ*) provides sediment basin sizing criteria.

The SCVURPPP's preferred method for sizing volume-based treatment controls is to use the California Stormwater Quality Association Stormwater BMP Handbook approach, which is included in the *C.3. Stormwater Handbook.* An analysis using this approach is given in Appendix C for the drainage area tributary to the North Quarry, WMSA, and Rock Plant desiltation basins. A spreadsheet is included in Appendix C containing the results for each basin.

The SWRCB procedure is recommended for construction sites with exposed surfaces, which is appropriate for the project. Their procedure is based on the equation:

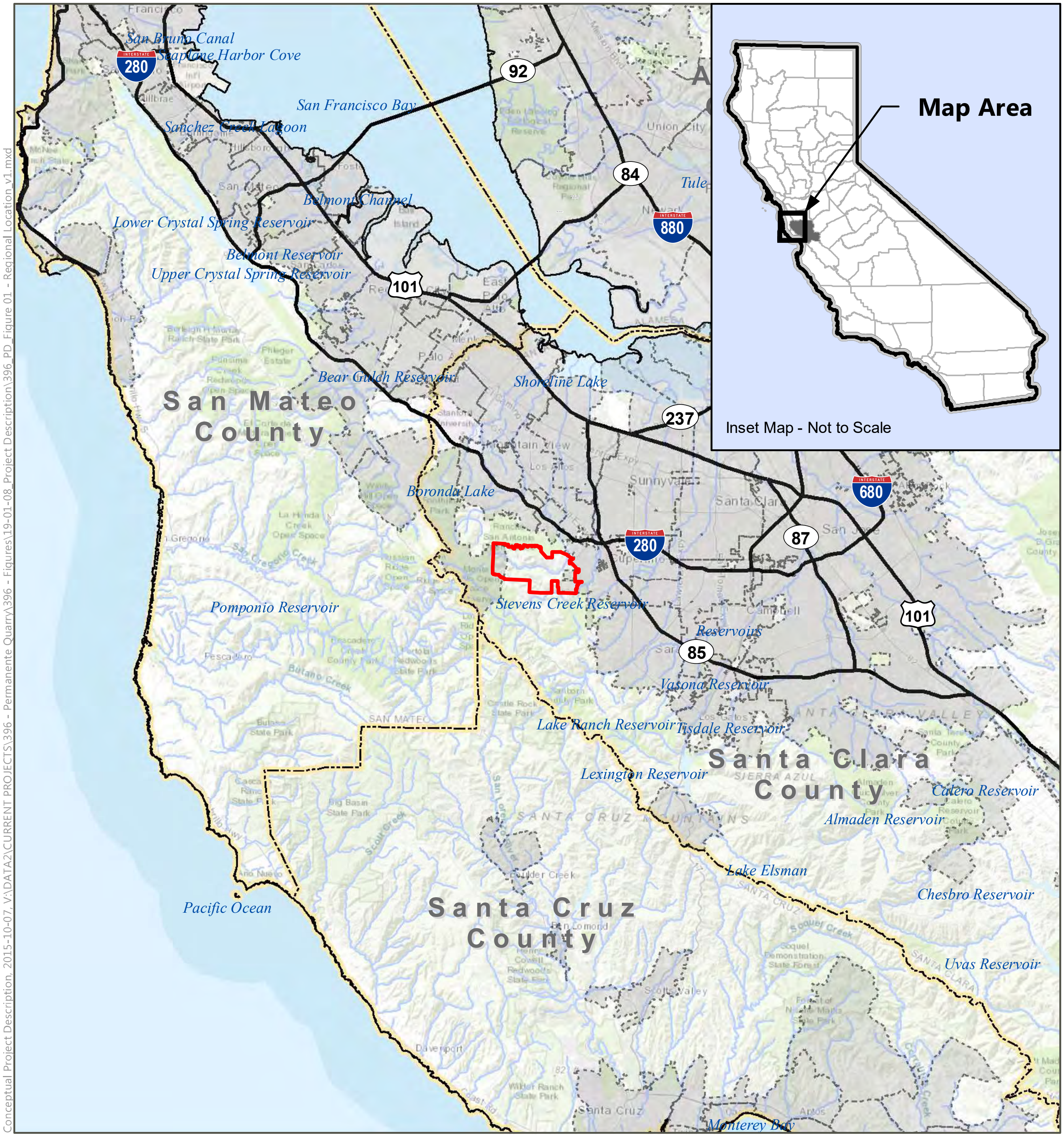
$A_S = 1.2Q / V_S$ where A_S is the minimum surface area for trapping soil particles of a certain size, sf
Q is the discharge, cfs
V_S is the settling velocity, fps

SWRCB recommends that Q be based on the 10-year event. However, the 25-year event was used in order to meet the Surface Mining and Reclamation Act's 20-year event requirement for erosion control. A particle size distribution was previously provided by Golder Associates, Inc. that generally represents the waste rock that will be stored. The distribution is included in Appendix C and shows that nearly 93 percent of the material will be larger than 0.074 mm (No. 200 sieve size). Sediment smaller than the No. 200 sieve typically occur in suspension and are less prone to settling. The Regional Water Quality Control Board, San Francisco Bay Region's *Erosion and Sediment Control Field Manual* provides settling velocities for several particle sizes. The settling velocity for a particle size of 0.05 mm (0.0062 feet per second) was selected because this size is smaller than 0.074 mm. A spreadsheet was created for the SWRCB equation and is included in Appendix C.

The desiltation basins shall be constructed to exceed the volume from the SCVURPPP equation or the surface area from the SWRCB equation. The SWRCB recommends that the basin length be twice the width, and the storage depth be between 3 to 5 feet. The SCVURPPP method results in smaller sizing. The contractor will be responsible for field fitting the basins based on the actual topographic conditions encountered during grading. At least one-foot of freeboard shall be provided in the basins. The outlet works for the desiltation basins shall be sized to pass the 100-year flow rates. A riser shall be installed within each desiltation basin to allow sediment to be captured in the basins. The basins shall be designed with adequate freeboard to provide the necessary head.

CONCLUSION

Drainage analyses have been performed for the North Quarry, West Materials Storage Area, East Materials Storage Area, and Rock Plant at the Permanente Quarry. The reclamation will ultimately include revegetation. There are minimal impervious areas proposed under the Reclamation Plan Amendment. As a result, the proposed reclamation will have a low runoff potential and will not impact the overall surface flow volumes. Temporary best management practices will be installed at the site discharge locations post-reclamation until the vegetation is established. The BMPs include desiltation basins, which have been sized based on the SCVURPPP and SWRCB guidelines. As a result, the site has been designed for both the required design and water quality flow rates, and meets SMARA's current standards (*California Code of Regulations*, Title 14, Section 3706) for erosion and sediment control. Since reclamation will not occur for many years, the BMPs shall be re-evaluated during reclamation and redesigned to meet water quality standards at the time of construction, as needed. Therefore, the BMP sizing included herein provide a conservative estimate and could be reduced.



SOURCES: ESRI World Shaded Relief accessed Jan. 2019, ESRI World Topographic Map accessed Jan. 2019; ESRI World Streetmap, 2009; compiled by Benchmark Resources in 2019

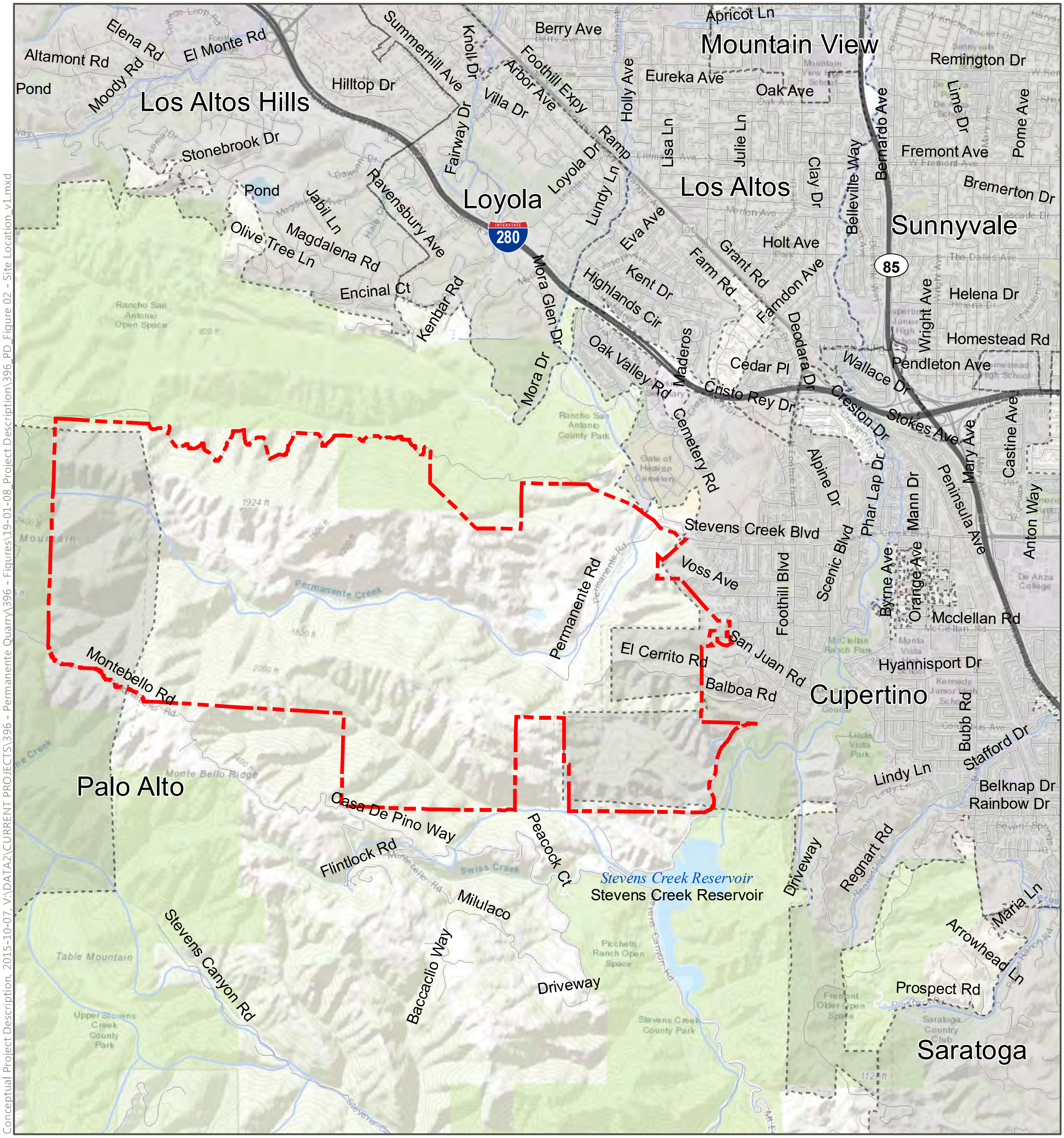
NOTES: This figure was prepared for land use planning and informational purposes only. The information shown and its accuracy are refelctive of the date the data was accessed or produced.

Site Boundary
City Boundary
County Boundary
Major Highway
River
Water Body

BENCHMARK RESOURCES

0 3 6 12 Miles

Regional Location
PERMANENTE QUARRY
PROJECT DESCRIPTION
Figure 1



SOURCES: ESRI World Shaded Relief accessed Jan.l 2019, ESRI World Topographic Map accessed Jan 2019; ESRI World Streetmap, 2009; adapted by Benchmark Resources in 2019

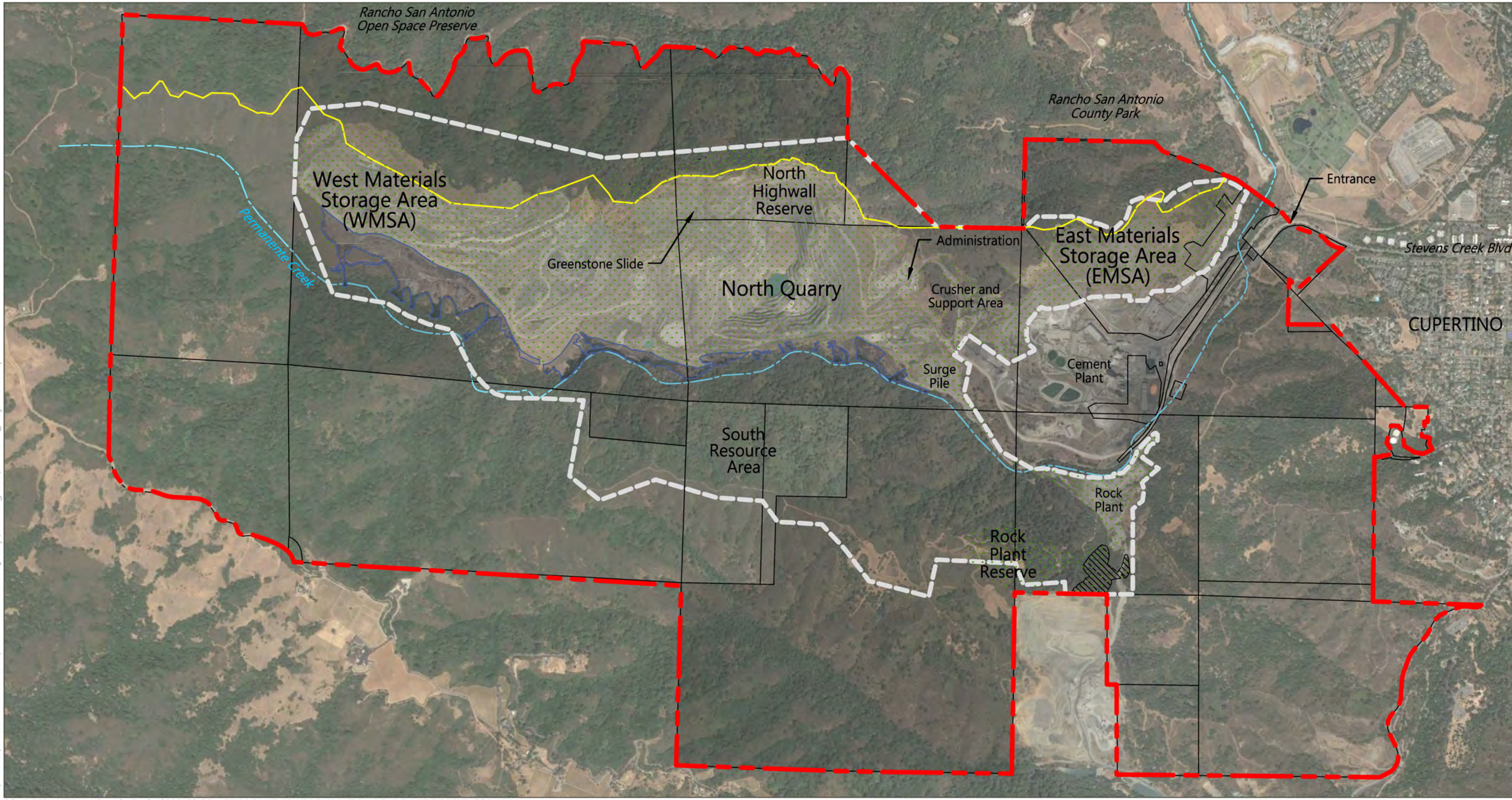
NOTES: This figure was prepared for land use planning and informational purposes only. The information shown and its accuracy are refelctive of the date the data was accessed or produced.

Site Boundary		Interstate	
City Boundary		Street	
Water Body		River	

BENCHMARK RESOURCES

0 2,000 4,000 8,000 Feet

Site Location
PERMANENTE QUARRY
PROJECT DESCRIPTION
Figure 2



SOURCES: AERIAL: Google Earth (2018-08-09); SITE BOUNDARY/RECLAMATION BOUNDARIES/RESERVES/HAUL ROUTE AREAS: Lehigh Southwest Cement Company, generated in 2018; compiled by Benchmark Resources in 2019

NOTES:

1. Reclamation plan boundary includes *Rock Plant Haul Road Reclamation Plan Amendment* modifications.

Property Boundary
Reclamation Plan Boundary
Permanente Parcels
Permanente Ridge
Permanente Creek
Vested Parcels
Rock Plant Haul Road Reclamation Plan Amendment Area

BENCHMARK RESOURCES

0 700 1,400 2,800 Feet

Existing Conditions Aerial and Nomenclature

PERMANENTE QUARRY PROJECT DESCRIPTION

Figure 3

APPENDIX A

HYDROLOGIC INPUT DATA

AND ANALYSES

RATIONAL METHOD INPUT DATA

25-Year Return Period

Duration	A	B	MAP, in	x, in	I, in/hr
5	0.230641	0.002691	28	0.3060	3.672
10	0.287566	0.004930	28	0.4256	2.554
15	0.348021	0.005594	28	0.5047	2.019
30	0.443761	0.008719	28	0.6879	1.376
60	0.508791	0.016680	28	0.9758	0.976
120	0.612629	0.031025	28	1.4813	0.741
180	0.689252	0.044264	28	1.9286	0.643
360	0.693566	0.083195	28	3.0230	0.504
24-hour	0.675008	0.195496	28	6.1489	for UH calc

100-Year Return Period

Duration	A	B	MAP, in	x, in	I, in/hr
5	0.269993	0.003580	28	0.3702	4.443
10	0.315263	0.007312	28	0.5200	3.120
15	0.421360	0.006957	28	0.6162	2.465
30	0.553934	0.009857	28	0.8299	1.660
60	0.626608	0.019201	28	1.1642	1.164
120	0.732944	0.036193	28	1.7463	0.873
180	0.816471	0.051981	28	2.2719	0.757
360	0.776677	0.101053	28	3.6062	0.601
24-hour	0.814046	0.243391	28	7.6290	for UH calc

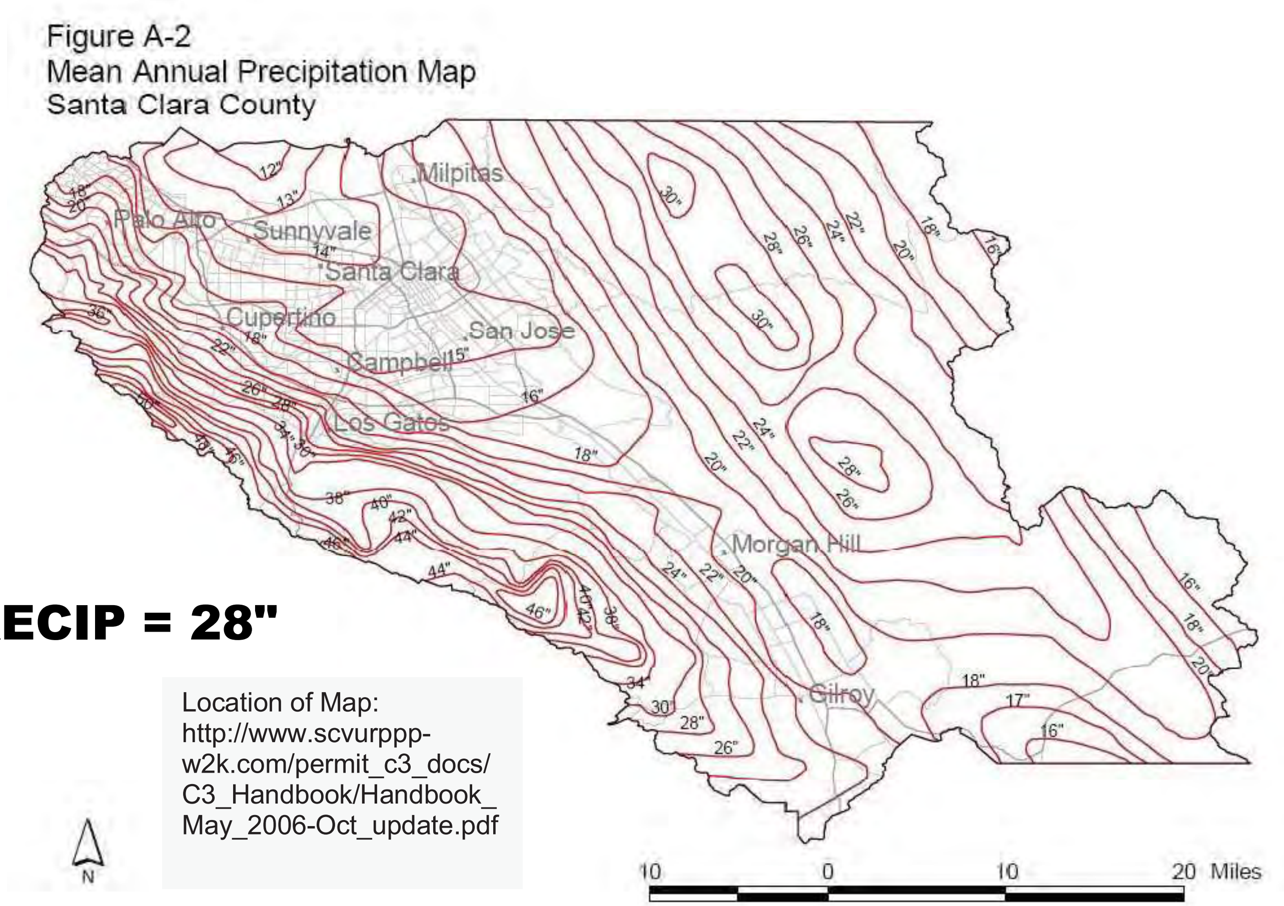
KIRPICH EQUATION FOR INITIAL SUBAREAS

Proposed Conditions

Nodes	Up Elev., ft	Down Elev., ft	L, feet	S, ft/ft	Tc, min
100-102	1,981.5	1,970.0	995	0.0116	18.8
200-202	1,941.0	1,675.0	869	0.3061	12.3
300-302	1,399.0	1,123.0	716	0.3855	11.8
400-402	1,440.0	1,438.0	624	0.0032	20.1

Table B-2: Parameters $A_{T,D}$ and $B_{T,D}$ for TDS Equation

Return Period/Duration	$A_{T,D}$	$B_{T,D}$
25-YR RETURN PERIOD		
5-min	0.230641	0.002691
10-min	0.287566	0.004930
15-min	0.348021	0.005594
30-min	0.443761	0.008719
1-hr	0.508791	0.016680
2-hr	0.612629	0.031025
3-hr	0.689252	0.044264
6-hr	0.693566	0.083195
12-hr	0.725892	0.132326
24-hr	0.675008	0.195496
48-hr	0.989588	0.264703
72-hr	0.967854	0.316424
50-YR RETURN PERIOD		
5-min	0.249324	0.003241
10-min	0.300971	0.006161
15-min	0.384016	0.006315
30-min	0.496301	0.009417
1-hr	0.568345	0.017953
2-hr	0.672662	0.033694
3-hr	0.754661	0.048157
6-hr	0.740666	0.092105
12-hr	0.779967	0.147303
24-hr	0.747121	0.219673
48-hr	1.108358	0.295510
72-hr	1.075643	0.353143
100-YR RETURN PERIOD		
5-min	0.269993	0.003580
10-min	0.315263	0.007312
15-min	0.421360	0.006957
30-min	0.553934	0.009857
1-hr	0.626608	0.019201
2-hr	0.732944	0.036193
3-hr	0.816471	0.051981
6-hr	0.776677	0.101053
12-hr	0.821859	0.162184
24-hr	0.814046	0.243391
48-hr	1.210895	0.325943
72-hr	1.175000	0.389038



PRECIP = 28"

SOURCE: Santa Clara Valley Water District, Mean Annual Precipitation Map, San Francisco & Monterey Bay Region, 1998

Figure A-2: Mean Annual Precipitation, Santa Clara County

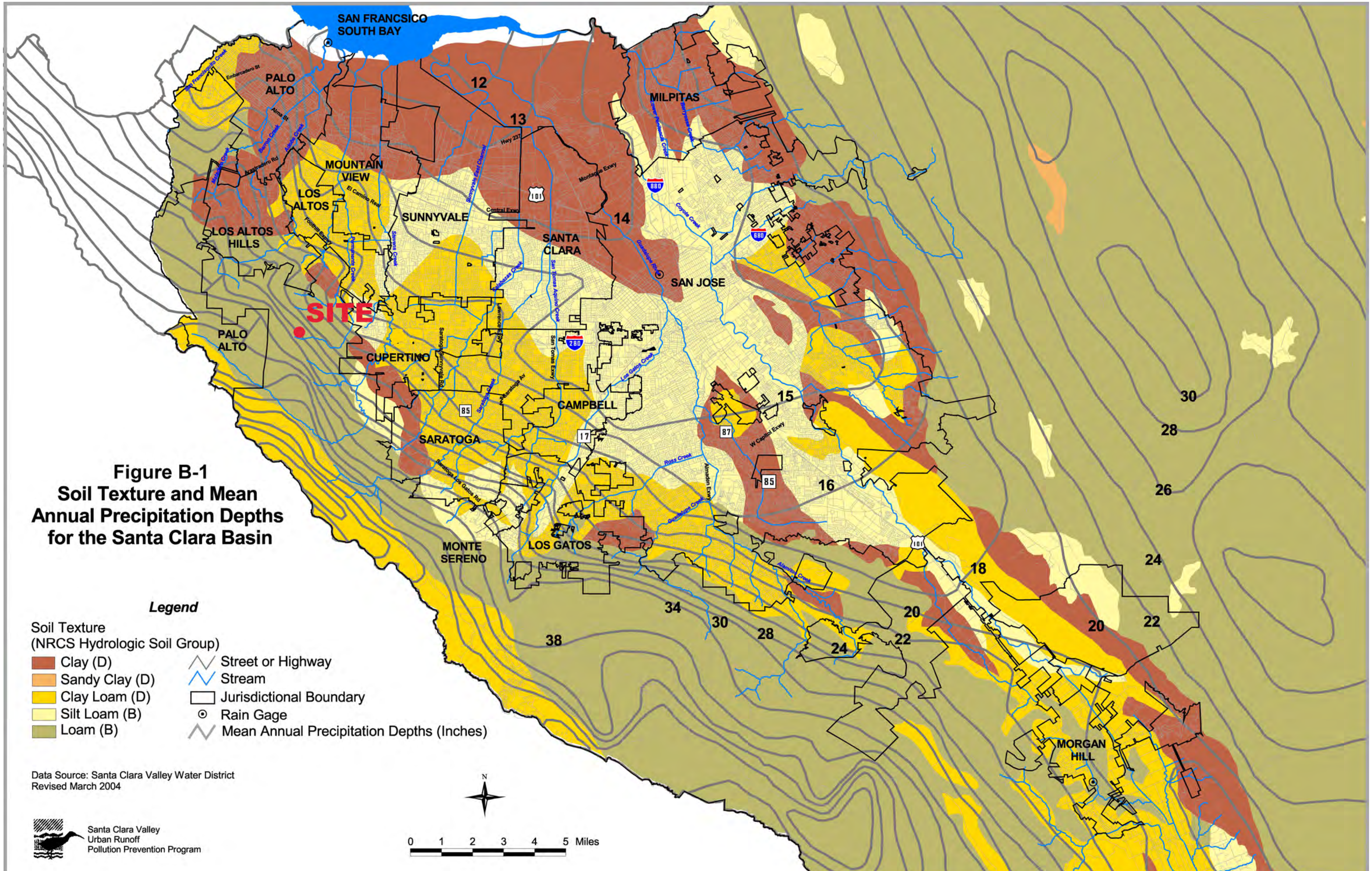


Figure B-1
Soil Texture and Mean Annual Precipitation Depths for the Santa Clara Basin

Table 4

Runoff Coefficients for Agricultural and Open Areas *

RUNOFF PRODUCING CHARACTERISTICS	WATERSHED CHARACTERISTICS A RELIEF	B SOIL INFILTRATION	C VEGETAL COVER	D SURFACE STORAGE
EXTREME	0.40 Steep rugged terrain average slopes greater than 30%	0.20 No effective soil cover; either rock or thin soil mantle negligible infiltration capacity	0.20 No effective plant cover; bare or very sparse soil cover	0.20 Negligible; surface depression few and shallow; drainage ways steep and small, no ponds or marshes
HIGH	0.30 Hilly with average slopes of 10 to 30%	0.15 Slow to take up water; clay or other soil of low infiltration capacity such as heavy gumbo	0.15 Poor to fair; clean cultivated crops or poor natural cover; less than 10% of area under good cover	0.15 Low; well defined system of small drainage ways; no ponds or marshes
NORMAL	0.20 Rolling with average slopes of 5 to 10%	0.10 Normal, deep loam	0.10 Fair to good; about 50% of area in good grass land, woodland or equivalent cover	0.10 Normal; considerable surface depression storage; typical of prairie lands; lakes, ponds and marshes less than 20% of area
LOW	0.10 Relatively flat land average slopes 0 to 5%	0.05 High; deep sand or other soil that takes up water readily and rapidly	0.05 Good to excellent; about 90% of area in good grass land, woodland or equivalent cover	0.05 High; surface depression storage high; drainage system not sharply defined, Lg. flood plain storage; large number of ponds and marshes

NOTE: Runoff coefficient is equal to sum of coefficients from the appropriate block in Rows A, B, C and D.

* After H. L. Cook, as published in Engineering for Agricultural Drainage, by Harry B. Roe and Quincy C. Ayres, McGraw-Hill Book Co., Inc., New York, 1954, p. 105.

```
           UNIVERSAL RATIONAL METHOD HYDROLOGY PROGRAM

 CIVILCADD/CIVILDESIGN  Engineering Software, (c) 1989- 2005 Version 7.1
     Rational Hydrology Study       Date: 05/08/23
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Permanente Quarry
Proposed Conditions
25-Year Flow Rate
County of Santa Clara Rational Method

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------------------------------------------------------------------------
 *********   Hydrology Study Control Information **********

------------------------------------------------------------------------


Program License Serial Number 4028

------------------------------------------------------------------------
Rational hydrology study storm event year is    25.0
Number of [time,intensity] data pairs = 8
No.           Time      -      Intensity

1                 5.000                     3.672(In.)
2                10.000                     2.554(In.)
3                15.000                     2.019(In.)
4                30.000                     1.376(In.)
5                60.000                     0.976(In.)
6               120.000                     0.741(In.)
7               180.000                     0.643(In.)
8               360.000                     0.504(In.)
English Input Units Used
English Output Units Used:
Area = acres, Distance = feet, Flow q = ft^3/s, Pipe diam. = inches
Runoff coefficient method used:
Runoff coefficient 'C' value calculated for the
equation Q=KCIA [K=unit constant(1 if English Units, 1/360 if SI Units),
I=rainfall intensity, A=area];
by the following method:
Manual entry of 'C' values

Rational Hydrology Method used:

The rational hydrology method is used where the area
of each subarea in a stream, subarea 'C' value, and rain-
fall intensity for each subarea is used to determine the
subarea flow rate q, of which values are summed for total Q

Stream flow confluence option used:

Stream flow confluence method of 2 - 5 streams:
Note: in all cases, if the time of concentration
or TC of all streams are identical, then q = sum of stream flows
```

```
Variables p=peak; i=intensity; Fm=loss rate; a=area; 1...n flows
q = flow rate, t = time in minutes
Stream flows summed; qp = q1 + q2 + ..... qn
TC = t of stream with largest q


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      100.000 to Point/Station      102.000
**** INITIAL AREA EVALUATION ****
______________________________________________________________________
UNDEVELOPED (poor cover) subarea
Initial subarea data:
Equations shown use english units, converted if necessary to (SI)
Initial area flow distance =   995.000(Ft.)
Top (of initial area) elevation =  1981.500(Ft.)
Bottom (of initial area) elevation =  1970.000(Ft.)
Difference in elevation =    11.500(Ft.)
Slope =    0.01156  s(%)=       1.16
Manual entry of initial area time of concentration, TC
Initial area time of concentration =   18.800 min.
Rainfall intensity =      1.856(In/Hr) for a    25.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.850
Subarea runoff =     10.003(CFS)
Total initial stream area =        6.340(Ac.)


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Process from Point/Station      102.000 to Point/Station      104.000
**** IMPROVED CHANNEL TRAVEL TIME ****
______________________________________________________________________
Upstream point elevation =  1970.000(Ft.)
Downstream point elevation =  1920.000(Ft.)
Channel length thru subarea  =   168.000(Ft.)
Channel base width    =    1.000(Ft.)
Slope or 'Z' of left channel bank =   1.000
Slope or 'Z' of right channel bank =   1.000
Manning's 'N'    = 0.015
Maximum depth of channel  =    1.000(Ft.)
Flow(q) thru subarea =     10.003(CFS)
Depth of flow =   0.354(Ft.), Average velocity =  20.851(Ft/s)
Channel flow top width =    1.708(Ft.)
Flow Velocity =   20.85(Ft/s)
Travel time  =    0.13 min.
Time of concentration =   18.93 min.
Critical depth =      1.031(Ft.)


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Process from Point/Station      104.000 to Point/Station      106.000
**** IMPROVED CHANNEL TRAVEL TIME ****
______________________________________________________________________
Upstream point elevation =  1920.000(Ft.)
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Downstream point elevation =  1295.300(Ft.)
Channel length thru subarea  =  4768.000(Ft.)
Channel base width    =    1.000(Ft.)
Slope or 'Z' of left channel bank =   1.000
Slope or 'Z' of right channel bank =   1.000
Estimated mean flow rate at midpoint of channel =     56.631(CFS)
Manning's 'N'    = 0.015
Maximum depth of channel  =    3.000(Ft.)
Flow(q) thru subarea =     56.631(CFS)
Depth of flow =   1.102(Ft.), Average velocity =  24.441(Ft/s)
Channel flow top width =    3.204(Ft.)
Flow Velocity =   24.44(Ft/s)
Travel time  =    3.25 min.
Time of concentration =   22.19 min.
Critical depth =      2.438(Ft.)
 Adding area flow to channel
UNDEVELOPED (poor cover) subarea
Rainfall intensity =      1.711(In/Hr) for a    25.0 year storm
Subarea runoff =     85.966(CFS) for     59.110(Ac.)
Total runoff =     95.968(CFS)   Total area =      65.450(Ac.)


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Process from Point/Station      200.000 to Point/Station      202.000
**** INITIAL AREA EVALUATION ****
______________________________________________________________________
UNDEVELOPED (poor cover) subarea
Initial subarea data:
Equations shown use english units, converted if necessary to (SI)
Initial area flow distance =   869.000(Ft.)
Top (of initial area) elevation =  1941.000(Ft.)
Bottom (of initial area) elevation =  1675.000(Ft.)
Difference in elevation =   266.000(Ft.)
Slope =    0.30610  s(%)=      30.61
Manual entry of initial area time of concentration, TC
Initial area time of concentration =   12.300 min.
Rainfall intensity =      2.308(In/Hr) for a    25.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.850
Subarea runoff =      4.806(CFS)
Total initial stream area =        2.450(Ac.)


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Process from Point/Station      202.000 to Point/Station      204.000
**** IMPROVED CHANNEL TRAVEL TIME ****
______________________________________________________________________
Upstream point elevation =  1675.000(Ft.)
Downstream point elevation =  1530.000(Ft.)
Channel length thru subarea  =  1936.000(Ft.)
Channel base width    =    1.000(Ft.)
Slope or 'Z' of left channel bank =   1.000
Slope or 'Z' of right channel bank =   1.000
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Estimated mean flow rate at midpoint of channel =     38.930(CFS)
Manning's 'N'    = 0.030
Maximum depth of channel  =    3.000(Ft.)
Flow(q) thru subarea =     38.930(CFS)
Depth of flow =   1.470(Ft.), Average velocity =  10.726(Ft/s)
Channel flow top width =    3.939(Ft.)
Flow Velocity =   10.73(Ft/s)
Travel time  =    3.01 min.
Time of concentration =   15.31 min.
Critical depth =      2.047(Ft.)
 Adding area flow to channel
UNDEVELOPED (poor cover) subarea
Rainfall intensity =      2.006(In/Hr) for a    25.0 year storm
Subarea runoff =     59.314(CFS) for     34.790(Ac.)
Total runoff =     64.120(CFS)   Total area =      37.240(Ac.)


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Process from Point/Station      206.000 to Point/Station      204.000
**** SUBAREA FLOW ADDITION ****
______________________________________________________________________
UNDEVELOPED (poor cover) subarea
Time of concentration =    15.31 min.
Rainfall intensity =      2.006(In/Hr) for a    25.0 year storm
Subarea runoff =     20.203(CFS) for     11.850(Ac.)
Total runoff =     84.324(CFS)   Total area =      49.090(Ac.)


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Process from Point/Station      204.000 to Point/Station      208.000
**** IMPROVED CHANNEL TRAVEL TIME ****
______________________________________________________________________
Upstream point elevation =  1530.000(Ft.)
Downstream point elevation =  1350.000(Ft.)
Channel length thru subarea  =   463.000(Ft.)
Channel base width    =    1.000(Ft.)
Slope or 'Z' of left channel bank =   1.000
Slope or 'Z' of right channel bank =   1.000
Manning's 'N'    = 0.015
Maximum depth of channel  =    3.000(Ft.)
Flow(q) thru subarea =     84.324(CFS)
Depth of flow =   1.026(Ft.), Average velocity =  40.586(Ft/s)
Channel flow top width =    3.051(Ft.)
Flow Velocity =   40.59(Ft/s)
Travel time  =    0.19 min.
Time of concentration =   15.50 min.
Critical depth =      2.938(Ft.)


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Process from Point/Station      208.000 to Point/Station      208.000
**** SUBAREA FLOW ADDITION ****
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________________________________________________________________________
UNDEVELOPED (poor cover) subarea
Time of concentration =    15.50 min.
Rainfall intensity =      1.998(In/Hr) for a    25.0 year storm
Subarea runoff =     66.646(CFS) for     39.250(Ac.)
Total runoff =    150.970(CFS)   Total area =      88.340(Ac.)


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Process from Point/Station      208.000 to Point/Station      210.000
**** IMPROVED CHANNEL TRAVEL TIME ****
________________________________________________________________________
Upstream point elevation =  1350.000(Ft.)
Downstream point elevation =  1348.000(Ft.)
Channel length thru subarea  =    79.000(Ft.)
Channel base width    =    1.000(Ft.)
Slope or 'Z' of left channel bank =   1.000
Slope or 'Z' of right channel bank =   1.000
Manning's 'N'    = 0.015
Maximum depth of channel  =    3.000(Ft.)
Flow(q) thru subarea =    150.970(CFS)
Depth of flow =   2.540(Ft.), Average velocity =  16.785(Ft/s)
Channel flow top width =    6.081(Ft.)
Flow Velocity =   16.78(Ft/s)
Travel time  =    0.08 min.
Time of concentration =   15.58 min.
Critical depth =      3.719(Ft.)


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Process from Point/Station      210.000 to Point/Station      210.000
**** SUBAREA FLOW ADDITION ****
________________________________________________________________________
UNDEVELOPED (poor cover) subarea
Time of concentration =    15.58 min.
Rainfall intensity =      1.994(In/Hr) for a    25.0 year storm
Subarea runoff =     15.222(CFS) for      8.980(Ac.)
Total runoff =    166.192(CFS)   Total area =      97.320(Ac.)


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Process from Point/Station      210.000 to Point/Station      212.000
**** IMPROVED CHANNEL TRAVEL TIME ****
________________________________________________________________________
Upstream point elevation =  1348.000(Ft.)
Downstream point elevation =  1271.000(Ft.)
Channel length thru subarea  =  1480.000(Ft.)
Channel base width    =    1.000(Ft.)
Slope or 'Z' of left channel bank =   1.000
Slope or 'Z' of right channel bank =   1.000
Estimated mean flow rate at midpoint of channel =    174.227(CFS)
Manning's 'N'    = 0.015
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Maximum depth of channel  =    3.000(Ft.)
Flow(q) thru subarea =    174.227(CFS)
Depth of flow =   2.308(Ft.), Average velocity =  22.812(Ft/s)
Channel flow top width =    5.617(Ft.)
Flow Velocity =   22.81(Ft/s)
Travel time  =    1.08 min.
Time of concentration =   16.66 min.
Critical depth =      3.969(Ft.)
 Adding area flow to channel
UNDEVELOPED (poor cover) subarea
Rainfall intensity =      1.948(In/Hr) for a    25.0 year storm
Subarea runoff =     15.580(CFS) for      9.410(Ac.)
Total runoff =    181.772(CFS)   Total area =     106.730(Ac.)


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Process from Point/Station      300.000 to Point/Station      302.000
**** INITIAL AREA EVALUATION ****
______________________________________________________________________
UNDEVELOPED (poor cover) subarea
Initial subarea data:
Equations shown use english units, converted if necessary to (SI)
Initial area flow distance =   716.000(Ft.)
Top (of initial area) elevation =  1399.000(Ft.)
Bottom (of initial area) elevation =  1123.000(Ft.)
Difference in elevation =   276.000(Ft.)
Slope =    0.38547  s(%)=      38.55
Manual entry of initial area time of concentration, TC
Initial area time of concentration =   11.800 min.
Rainfall intensity =      2.361(In/Hr) for a    25.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.850
Subarea runoff =      7.085(CFS)
Total initial stream area =        3.530(Ac.)


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Process from Point/Station      302.000 to Point/Station      304.000
**** IMPROVED CHANNEL TRAVEL TIME ****
______________________________________________________________________
Upstream point elevation =  1123.000(Ft.)
Downstream point elevation =  1052.000(Ft.)
Channel length thru subarea  =  2012.000(Ft.)
Channel base width    =    1.000(Ft.)
Slope or 'Z' of left channel bank =   1.000
Slope or 'Z' of right channel bank =   1.000
Estimated mean flow rate at midpoint of channel =     42.362(CFS)
Manning's 'N'    = 0.030
Maximum depth of channel  =    3.000(Ft.)
Flow(q) thru subarea =     42.362(CFS)
Depth of flow =   1.820(Ft.), Average velocity =   8.251(Ft/s)
Channel flow top width =    4.641(Ft.)
Flow Velocity =    8.25(Ft/s)
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Travel time  =    4.06 min.
Time of concentration =   15.86 min.
Critical depth =      2.125(Ft.)
 Adding area flow to channel
UNDEVELOPED (poor cover) subarea
Rainfall intensity =      1.982(In/Hr) for a    25.0 year storm
Subarea runoff =     59.216(CFS) for     35.150(Ac.)
Total runoff =     66.301(CFS)   Total area =      38.680(Ac.)


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Process from Point/Station      304.000 to Point/Station      306.000
**** IMPROVED CHANNEL TRAVEL TIME ****
______________________________________________________________________
Upstream point elevation =  1052.000(Ft.)
Downstream point elevation =  1020.000(Ft.)
Channel length thru subarea  =   102.000(Ft.)
Channel base width    =    1.000(Ft.)
Slope or 'Z' of left channel bank =   1.000
Slope or 'Z' of right channel bank =   1.000
Manning's 'N'    = 0.015
Maximum depth of channel  =    3.000(Ft.)
Flow(q) thru subarea =     66.301(CFS)
Depth of flow =   0.960(Ft.), Average velocity =  35.251(Ft/s)
Channel flow top width =    2.919(Ft.)
Flow Velocity =   35.25(Ft/s)
Travel time  =    0.05 min.
Time of concentration =   15.91 min.
Critical depth =      2.625(Ft.)


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Process from Point/Station      306.000 to Point/Station      308.000
**** IMPROVED CHANNEL TRAVEL TIME ****
______________________________________________________________________
Upstream point elevation =  1020.000(Ft.)
Downstream point elevation =   990.000(Ft.)
Channel length thru subarea  =  1704.000(Ft.)
Channel base width    =    1.000(Ft.)
Slope or 'Z' of left channel bank =  20.000
Slope or 'Z' of right channel bank =   1.000
Estimated mean flow rate at midpoint of channel =    122.755(CFS)
Manning's 'N'    = 0.030
Maximum depth of channel  =    3.000(Ft.)
Flow(q) thru subarea =    122.755(CFS)
Depth of flow =   1.437(Ft.), Average velocity =   5.312(Ft/s)
Channel flow top width =   31.169(Ft.)
Flow Velocity =    5.31(Ft/s)
Travel time  =    5.35 min.
Time of concentration =   21.26 min.
Critical depth =      1.484(Ft.)
 Adding area flow to channel
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UNDEVELOPED (poor cover) subarea
Rainfall intensity =      1.751(In/Hr) for a    25.0 year storm
Subarea runoff =     98.022(CFS) for     65.870(Ac.)
Total runoff =    164.323(CFS)   Total area =     104.550(Ac.)


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Process from Point/Station      310.000 to Point/Station      308.000
**** SUBAREA FLOW ADDITION ****
______________________________________________________________________
UNDEVELOPED (poor cover) subarea
Time of concentration =    21.26 min.
Rainfall intensity =      1.751(In/Hr) for a    25.0 year storm
Subarea runoff =     45.596(CFS) for     30.640(Ac.)
Total runoff =    209.918(CFS)   Total area =     135.190(Ac.)


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Process from Point/Station      312.000 to Point/Station      308.000
**** SUBAREA FLOW ADDITION ****
______________________________________________________________________
UNDEVELOPED (poor cover) subarea
Time of concentration =    21.26 min.
Rainfall intensity =      1.751(In/Hr) for a    25.0 year storm
Subarea runoff =     12.262(CFS) for      8.240(Ac.)
Total runoff =    222.180(CFS)   Total area =     143.430(Ac.)


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Process from Point/Station      308.000 to Point/Station      314.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________
Upstream point/station elevation =   990.000(Ft.)
Downstream point/station elevation =   946.500(Ft.)
Pipe length  =   235.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =   222.180(CFS)
Nearest computed pipe diameter  =     33.00(In.)
Calculated individual pipe flow  =   222.180(CFS)
Normal flow depth in pipe =   26.39(In.)
Flow top width inside pipe =   26.41(In.)
Critical depth could not be calculated.
Pipe flow velocity =     43.66(Ft/s)
Travel time through pipe =    0.09 min.
Time of concentration (TC) =    21.35 min.


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Process from Point/Station      400.000 to Point/Station      402.000
**** INITIAL AREA EVALUATION ****
______________________________________________________________________
UNDEVELOPED (poor cover) subarea
Initial subarea data:
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Equations shown use english units, converted if necessary to (SI)
Initial area flow distance =   624.000(Ft.)
Top (of initial area) elevation =  1440.000(Ft.)
Bottom (of initial area) elevation =  1438.000(Ft.)
Difference in elevation =      2.000(Ft.)
Slope =    0.00321  s(%)=       0.32
Manual entry of initial area time of concentration, TC
Initial area time of concentration =   20.100 min.
Rainfall intensity =      1.800(In/Hr) for a    25.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.850
Subarea runoff =      6.580(CFS)
Total initial stream area =        4.300(Ac.)


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Process from Point/Station      402.000 to Point/Station      404.000
**** IMPROVED CHANNEL TRAVEL TIME ****
______________________________________________________________________
Upstream point elevation =  1438.000(Ft.)
Downstream point elevation =  1430.000(Ft.)
Channel length thru subarea  =  3165.000(Ft.)
Channel base width    =    1.000(Ft.)
Slope or 'Z' of left channel bank =   1.000
Slope or 'Z' of right channel bank =   1.000
Estimated mean flow rate at midpoint of channel =     15.992(CFS)
Manning's 'N'    = 0.015
Maximum depth of channel  =    3.000(Ft.)
Flow(q) thru subarea =     15.992(CFS)
Depth of flow =   1.549(Ft.), Average velocity =   4.051(Ft/s)
Channel flow top width =    4.097(Ft.)
Flow Velocity =    4.05(Ft/s)
Travel time  =   13.02 min.
Time of concentration =   33.12 min.
Critical depth =      1.328(Ft.)
 Adding area flow to channel
UNDEVELOPED (poor cover) subarea
Rainfall intensity =      1.334(In/Hr) for a    25.0 year storm
Subarea runoff =     13.951(CFS) for     12.300(Ac.)
Total runoff =     20.532(CFS)   Total area =      16.600(Ac.)


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Process from Point/Station      404.000 to Point/Station      406.000
**** IMPROVED CHANNEL TRAVEL TIME ****
______________________________________________________________________
Upstream point elevation =  1430.000(Ft.)
Downstream point elevation =  1092.000(Ft.)
Channel length thru subarea  =  3590.000(Ft.)
Channel base width    =    1.000(Ft.)
Slope or 'Z' of left channel bank =   1.000
Slope or 'Z' of right channel bank =   1.000
Estimated mean flow rate at midpoint of channel =     41.440(CFS)
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Manning's 'N'    = 0.015
Maximum depth of channel  =    3.000(Ft.)
Flow(q) thru subarea =     41.440(CFS)
Depth of flow =   1.025(Ft.), Average velocity =  19.966(Ft/s)
Channel flow top width =    3.050(Ft.)
Flow Velocity =   19.97(Ft/s)
Travel time  =    3.00 min.
Time of concentration =   36.12 min.
Critical depth =      2.094(Ft.)
 Adding area flow to channel
UNDEVELOPED (poor cover) subarea
Rainfall intensity =      1.294(In/Hr) for a    25.0 year storm
Subarea runoff =     37.200(CFS) for     33.810(Ac.)
Total runoff =     57.732(CFS)   Total area =      50.410(Ac.)


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Process from Point/Station      408.000 to Point/Station      406.000
**** SUBAREA FLOW ADDITION ****
______________________________________________________________________
UNDEVELOPED (poor cover) subarea
Time of concentration =    36.12 min.
Rainfall intensity =      1.294(In/Hr) for a    25.0 year storm
Subarea runoff =     24.206(CFS) for     22.000(Ac.)
Total runoff =     81.938(CFS)   Total area =      72.410(Ac.)


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Process from Point/Station      406.000 to Point/Station      410.000
**** IMPROVED CHANNEL TRAVEL TIME ****
______________________________________________________________________
Upstream point elevation =  1092.000(Ft.)
Downstream point elevation =   576.900(Ft.)
Channel length thru subarea  =  3545.000(Ft.)
Channel base width    =    1.000(Ft.)
Slope or 'Z' of left channel bank =   1.000
Slope or 'Z' of right channel bank =   1.000
Estimated mean flow rate at midpoint of channel =     93.095(CFS)
Manning's 'N'    = 0.015
Maximum depth of channel  =    3.000(Ft.)
Flow(q) thru subarea =     93.095(CFS)
Depth of flow =   1.367(Ft.), Average velocity =  28.768(Ft/s)
Channel flow top width =    3.734(Ft.)
Flow Velocity =   28.77(Ft/s)
Travel time  =    2.05 min.
Time of concentration =   38.17 min.
Critical depth =      3.047(Ft.)
 Adding area flow to channel
UNDEVELOPED (poor cover) subarea
Rainfall intensity =      1.267(In/Hr) for a    25.0 year storm
Subarea runoff =     21.238(CFS) for     19.720(Ac.)
Total runoff =    103.176(CFS)   Total area =      92.130(Ac.)
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Process from Point/Station      500.000 to Point/Station      502.000
**** INITIAL AREA EVALUATION ****
______________________________________________________________________
UNDEVELOPED (poor cover) subarea
Initial subarea data:
Equations shown use english units, converted if necessary to (SI)
Initial area flow distance =   893.000(Ft.)
Top (of initial area) elevation =  1464.000(Ft.)
Bottom (of initial area) elevation =  1300.000(Ft.)
Difference in elevation =   164.000(Ft.)
Slope =    0.18365  s(%)=      18.37
Manual entry of initial area time of concentration, TC
Initial area time of concentration =   12.800 min.
Rainfall intensity =      2.254(In/Hr) for a    25.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.850
Subarea runoff =      4.752(CFS)
Total initial stream area =        2.480(Ac.)


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Process from Point/Station      502.000 to Point/Station      504.000
**** IMPROVED CHANNEL TRAVEL TIME ****
______________________________________________________________________
Upstream point elevation =  1300.000(Ft.)
Downstream point elevation =   926.000(Ft.)
Channel length thru subarea  =  1319.000(Ft.)
Channel base width    =    3.000(Ft.)
Slope or 'Z' of left channel bank =   2.000
Slope or 'Z' of right channel bank =   2.000
Estimated mean flow rate at midpoint of channel =     22.775(CFS)
Manning's 'N'    = 0.040
Maximum depth of channel  =    5.000(Ft.)
Flow(q) thru subarea =     22.775(CFS)
Depth of flow =   0.525(Ft.), Average velocity =  10.701(Ft/s)
Channel flow top width =    5.102(Ft.)
Flow Velocity =   10.70(Ft/s)
Travel time  =    2.05 min.
Time of concentration =   14.85 min.
Critical depth =      0.969(Ft.)
 Adding area flow to channel
UNDEVELOPED (poor cover) subarea
Rainfall intensity =      2.035(In/Hr) for a    25.0 year storm
Subarea runoff =     32.530(CFS) for     18.810(Ac.)
Total runoff =     37.282(CFS)   Total area =      21.290(Ac.)


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Process from Point/Station      504.000 to Point/Station      506.000
**** IMPROVED CHANNEL TRAVEL TIME ****
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________________________________________________________________________
Upstream point elevation =   926.000(Ft.)
Downstream point elevation =   890.000(Ft.)
Channel length thru subarea  =   532.000(Ft.)
Channel base width    =    1.000(Ft.)
Slope or 'Z' of left channel bank =   1.000
Slope or 'Z' of right channel bank =   1.000
Estimated mean flow rate at midpoint of channel =     43.429(CFS)
Manning's 'N'    = 0.015
Maximum depth of channel  =    3.000(Ft.)
Flow(q) thru subarea =     43.429(CFS)
Depth of flow =   1.138(Ft.), Average velocity =  17.854(Ft/s)
Channel flow top width =    3.276(Ft.)
Flow Velocity =   17.85(Ft/s)
Travel time  =    0.50 min.
Time of concentration =   15.35 min.
Critical depth =      2.156(Ft.)
 Adding area flow to channel
UNDEVELOPED (poor cover) subarea
Rainfall intensity =      2.004(In/Hr) for a    25.0 year storm
Subarea runoff =     11.958(CFS) for      7.020(Ac.)
Total runoff =     49.240(CFS)   Total area =      28.310(Ac.)


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Process from Point/Station      506.000 to Point/Station      508.000
**** IMPROVED CHANNEL TRAVEL TIME ****
________________________________________________________________________
Upstream point elevation =   890.000(Ft.)
Downstream point elevation =   860.000(Ft.)
Channel length thru subarea  =   106.000(Ft.)
Channel base width    =    1.000(Ft.)
Slope or 'Z' of left channel bank =   1.000
Slope or 'Z' of right channel bank =   1.000
Estimated mean flow rate at midpoint of channel =     62.980(CFS)
Manning's 'N'    = 0.015
Maximum depth of channel  =    3.000(Ft.)
Flow(q) thru subarea =     62.980(CFS)
Depth of flow =   0.960(Ft.), Average velocity =  33.482(Ft/s)
Channel flow top width =    2.920(Ft.)
Flow Velocity =   33.48(Ft/s)
Travel time  =    0.05 min.
Time of concentration =   15.40 min.
Critical depth =      2.563(Ft.)
 Adding area flow to channel
UNDEVELOPED (poor cover) subarea
Rainfall intensity =      2.002(In/Hr) for a    25.0 year storm
Subarea runoff =     26.883(CFS) for     15.800(Ac.)
Total runoff =     76.122(CFS)   Total area =      44.110(Ac.)


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Process from Point/Station      508.000 to Point/Station      510.000
**** IMPROVED CHANNEL TRAVEL TIME ****
______________________________________________________________________
Upstream point elevation =   860.000(Ft.)
Downstream point elevation =   795.000(Ft.)
Channel length thru subarea  =  1965.000(Ft.)
Channel base width    =    1.000(Ft.)
Slope or 'Z' of left channel bank =   1.000
Slope or 'Z' of right channel bank =   1.000
Estimated mean flow rate at midpoint of channel =     81.015(CFS)
Manning's 'N'    = 0.015
Maximum depth of channel  =    3.000(Ft.)
Flow(q) thru subarea =     81.015(CFS)
Depth of flow =   1.810(Ft.), Average velocity =  15.928(Ft/s)
Channel flow top width =    4.620(Ft.)
Flow Velocity =   15.93(Ft/s)
Travel time  =    2.06 min.
Time of concentration =   17.46 min.
Critical depth =      2.875(Ft.)
 Adding area flow to channel
UNDEVELOPED (poor cover) subarea
Rainfall intensity =      1.914(In/Hr) for a    25.0 year storm
Subarea runoff =      9.222(CFS) for      5.670(Ac.)
Total runoff =     85.345(CFS)   Total area =      49.780(Ac.)


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Process from Point/Station      512.000 to Point/Station      510.000
**** SUBAREA FLOW ADDITION ****
______________________________________________________________________
UNDEVELOPED (poor cover) subarea
Time of concentration =    17.46 min.
Rainfall intensity =      1.914(In/Hr) for a    25.0 year storm
Subarea runoff =     29.245(CFS) for     17.980(Ac.)
Total runoff =    114.590(CFS)   Total area =      67.760(Ac.)


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Process from Point/Station      510.000 to Point/Station      514.000
**** IMPROVED CHANNEL TRAVEL TIME ****
______________________________________________________________________
Upstream point elevation =   795.000(Ft.)
Downstream point elevation =   451.000(Ft.)
Channel length thru subarea  =  3079.000(Ft.)
Channel base width    =    1.000(Ft.)
Slope or 'Z' of left channel bank =   1.000
Slope or 'Z' of right channel bank =   1.000
Estimated mean flow rate at midpoint of channel =    141.707(CFS)
Manning's 'N'    = 0.015
Maximum depth of channel  =    3.000(Ft.)
Flow(q) thru subarea =    141.707(CFS)
Depth of flow =   1.769(Ft.), Average velocity =  28.917(Ft/s)
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Channel flow top width =    4.539(Ft.)
Flow Velocity =   28.92(Ft/s)
Travel time  =    1.77 min.
Time of concentration =   19.23 min.
Critical depth =      3.625(Ft.)
 Adding area flow to channel
UNDEVELOPED (poor cover) subarea
Rainfall intensity =      1.837(In/Hr) for a    25.0 year storm
Subarea runoff =     50.089(CFS) for     32.070(Ac.)
Total runoff =    164.678(CFS)   Total area =      99.830(Ac.)


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Process from Point/Station      600.000 to Point/Station      602.000
**** INITIAL AREA EVALUATION ****
______________________________________________________________________
UNDEVELOPED (poor cover) subarea
Initial subarea data:
Equations shown use english units, converted if necessary to (SI)
Initial area flow distance =   938.000(Ft.)
Top (of initial area) elevation =  1543.000(Ft.)
Bottom (of initial area) elevation =  1290.000(Ft.)
Difference in elevation =   253.000(Ft.)
Slope =    0.26972  s(%)=      26.97
Manual entry of initial area time of concentration, TC
Initial area time of concentration =   12.500 min.
Rainfall intensity =      2.287(In/Hr) for a    25.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.850
Subarea runoff =     13.294(CFS)
Total initial stream area =        6.840(Ac.)


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Process from Point/Station      602.000 to Point/Station      604.000
**** IMPROVED CHANNEL TRAVEL TIME ****
______________________________________________________________________
Upstream point elevation =  1290.000(Ft.)
Downstream point elevation =   695.000(Ft.)
Channel length thru subarea  =  2357.000(Ft.)
Channel base width    =    3.000(Ft.)
Slope or 'Z' of left channel bank =   2.000
Slope or 'Z' of right channel bank =   2.000
Estimated mean flow rate at midpoint of channel =     47.616(CFS)
Manning's 'N'    = 0.040
Maximum depth of channel  =    5.000(Ft.)
Flow(q) thru subarea =     47.616(CFS)
Depth of flow =   0.809(Ft.), Average velocity =  12.748(Ft/s)
Channel flow top width =    6.235(Ft.)
Flow Velocity =   12.75(Ft/s)
Travel time  =    3.08 min.
Time of concentration =   15.58 min.
Critical depth =      1.453(Ft.)
```

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 Adding area flow to channel
UNDEVELOPED (poor cover) subarea
Rainfall intensity =      1.994(In/Hr) for a    25.0 year storm
Subarea runoff =     59.866(CFS) for     35.320(Ac.)
Total runoff =     73.160(CFS)   Total area =      42.160(Ac.)


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Process from Point/Station      604.000 to Point/Station      606.000
**** IMPROVED CHANNEL TRAVEL TIME ****
______________________________________________________________________
Upstream point elevation =   695.000(Ft.)
Downstream point elevation =   571.000(Ft.)
Channel length thru subarea  =  1482.000(Ft.)
Channel base width    =    1.000(Ft.)
Slope or 'Z' of left channel bank =   1.000
Slope or 'Z' of right channel bank =   1.000
Estimated mean flow rate at midpoint of channel =    115.909(CFS)
Manning's 'N'    = 0.015
Maximum depth of channel  =    3.000(Ft.)
Flow(q) thru subarea =    115.909(CFS)
Depth of flow =   1.724(Ft.), Average velocity =  24.679(Ft/s)
Channel flow top width =    4.448(Ft.)
Flow Velocity =   24.68(Ft/s)
Travel time  =    1.00 min.
Time of concentration =   16.58 min.
Critical depth =      3.328(Ft.)
 Adding area flow to channel
UNDEVELOPED (poor cover) subarea
Rainfall intensity =      1.951(In/Hr) for a    25.0 year storm
Subarea runoff =     81.714(CFS) for     49.270(Ac.)
Total runoff =    154.874(CFS)   Total area =      91.430(Ac.)
End of computations, total study area =         599.000 (Ac.)
```

UNIVERSAL RATIONAL METHOD HYDROLOGY PROGRAM

CIVILCADD/CIVILDESIGN Engineering Software, (c) 1989- 2005 Version 7.1
Rational Hydrology Study Date: 05/08/23

Permanente Quarry
Proposed Conditions
100-Year Flow Rate
County of Santa Clara Rational Method

********* Hydrology Study Control Information **********

Program License Serial Number 4028

Rational hydrology study storm event year is 100.0
Number of [time,intensity] data pairs = 8

No.	Time	-	Intensity
1	5.000		4.443(In.)
2	10.000		3.120(In.)
3	15.000		2.465(In.)
4	30.000		1.660(In.)
5	60.000		1.164(In.)
6	120.000		0.873(In.)
7	180.000		0.757(In.)
8	360.000		0.601(In.)

English Input Units Used
English Output Units Used:
Area = acres, Distance = feet, Flow q = ft^3/s, Pipe diam. = inches
Runoff coefficient method used:
Runoff coefficient 'C' value calculated for the
equation Q=KCIA [K=unit constant(1 if English Units, 1/360 if SI Units),
I=rainfall intensity, A=area];
by the following method:
Manual entry of 'C' values

Rational Hydrology Method used:

The rational hydrology method is used where the area
of each subarea in a stream, subarea 'C' value, and rain-
fall intensity for each subarea is used to determine the
subarea flow rate q, of which values are summed for total Q

Stream flow confluence option used:

Stream flow confluence method of 2 - 5 streams:
Note: in all cases, if the time of concentration
or TC of all streams are identical, then q = sum of stream flows

```
Variables p=peak; i=intensity; Fm=loss rate; a=area; 1...n flows
q = flow rate, t = time in minutes
Stream flows summed; qp = q1 + q2 + ..... qn
TC = t of stream with largest q


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Process from Point/Station      100.000 to Point/Station      102.000
**** INITIAL AREA EVALUATION ****
______________________________________________________________________
UNDEVELOPED (poor cover) subarea
Initial subarea data:
Equations shown use english units, converted if necessary to (SI)
Initial area flow distance =   995.000(Ft.)
Top (of initial area) elevation =  1981.500(Ft.)
Bottom (of initial area) elevation =  1970.000(Ft.)
Difference in elevation =    11.500(Ft.)
Slope =    0.01156  s(%)=       1.16
Manual entry of initial area time of concentration, TC
Initial area time of concentration =   18.800 min.
Rainfall intensity =      2.261(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.850
Subarea runoff =     12.185(CFS)
Total initial stream area =        6.340(Ac.)


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Process from Point/Station      102.000 to Point/Station      104.000
**** IMPROVED CHANNEL TRAVEL TIME ****
______________________________________________________________________
Upstream point elevation =  1970.000(Ft.)
Downstream point elevation =  1920.000(Ft.)
Channel length thru subarea  =   168.000(Ft.)
Channel base width    =    1.000(Ft.)
Slope or 'Z' of left channel bank =   1.000
Slope or 'Z' of right channel bank =   1.000
Manning's 'N'    = 0.015
Maximum depth of channel  =    1.000(Ft.)
Flow(q) thru subarea =     12.185(CFS)
Depth of flow =   0.396(Ft.), Average velocity =  22.054(Ft/s)
Channel flow top width =    1.792(Ft.)
Flow Velocity =   22.05(Ft/s)
Travel time  =    0.13 min.
Time of concentration =   18.93 min.
Critical depth =      1.133(Ft.)


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Process from Point/Station      104.000 to Point/Station      106.000
**** IMPROVED CHANNEL TRAVEL TIME ****
______________________________________________________________________
Upstream point elevation =  1920.000(Ft.)
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Downstream point elevation =  1295.300(Ft.)
Channel length thru subarea  =  4768.000(Ft.)
Channel base width    =    1.000(Ft.)
Slope or 'Z' of left channel bank =   1.000
Slope or 'Z' of right channel bank =   1.000
Estimated mean flow rate at midpoint of channel =     68.987(CFS)
Manning's 'N'    = 0.015
Maximum depth of channel  =    3.000(Ft.)
Flow(q) thru subarea =     68.987(CFS)
Depth of flow =   1.214(Ft.), Average velocity =  25.680(Ft/s)
Channel flow top width =    3.427(Ft.)
Flow Velocity =   25.68(Ft/s)
Travel time  =    3.09 min.
Time of concentration =   22.02 min.
Critical depth =      2.656(Ft.)
 Adding area flow to channel
UNDEVELOPED (poor cover) subarea
Rainfall intensity =      2.088(In/Hr) for a   100.0 year storm
Subarea runoff =    104.918(CFS) for     59.110(Ac.)
Total runoff =    117.103(CFS)   Total area =      65.450(Ac.)


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Process from Point/Station      200.000 to Point/Station      202.000
**** INITIAL AREA EVALUATION ****
______________________________________________________________________
UNDEVELOPED (poor cover) subarea
Initial subarea data:
Equations shown use english units, converted if necessary to (SI)
Initial area flow distance =   869.000(Ft.)
Top (of initial area) elevation =  1941.000(Ft.)
Bottom (of initial area) elevation =  1675.000(Ft.)
Difference in elevation =   266.000(Ft.)
Slope =    0.30610  s(%)=      30.61
Manual entry of initial area time of concentration, TC
Initial area time of concentration =   12.300 min.
Rainfall intensity =      2.819(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.850
Subarea runoff =      5.870(CFS)
Total initial stream area =        2.450(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      202.000 to Point/Station      204.000
**** IMPROVED CHANNEL TRAVEL TIME ****
______________________________________________________________________
Upstream point elevation =  1675.000(Ft.)
Downstream point elevation =  1530.000(Ft.)
Channel length thru subarea  =  1936.000(Ft.)
Channel base width    =    1.000(Ft.)
Slope or 'Z' of left channel bank =   1.000
Slope or 'Z' of right channel bank =   1.000
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Estimated mean flow rate at midpoint of channel =     47.547(CFS)
Manning's 'N'    = 0.030
Maximum depth of channel  =    3.000(Ft.)
Flow(q) thru subarea =     47.547(CFS)
Depth of flow =   1.614(Ft.), Average velocity =  11.270(Ft/s)
Channel flow top width =    4.228(Ft.)
Flow Velocity =   11.27(Ft/s)
Travel time  =    2.86 min.
Time of concentration =   15.16 min.
Critical depth =      2.250(Ft.)
 Adding area flow to channel
UNDEVELOPED (poor cover) subarea
Rainfall intensity =      2.456(In/Hr) for a   100.0 year storm
Subarea runoff =     72.635(CFS) for     34.790(Ac.)
Total runoff =     78.505(CFS)   Total area =      37.240(Ac.)


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Process from Point/Station      206.000 to Point/Station      204.000
**** SUBAREA FLOW ADDITION ****
______________________________________________________________________
UNDEVELOPED (poor cover) subarea
Time of concentration =    15.16 min.
Rainfall intensity =      2.456(In/Hr) for a   100.0 year storm
Subarea runoff =     24.741(CFS) for     11.850(Ac.)
Total runoff =    103.246(CFS)   Total area =      49.090(Ac.)


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Process from Point/Station      204.000 to Point/Station      208.000
**** IMPROVED CHANNEL TRAVEL TIME ****
______________________________________________________________________
Upstream point elevation =  1530.000(Ft.)
Downstream point elevation =  1350.000(Ft.)
Channel length thru subarea  =   463.000(Ft.)
Channel base width    =    1.000(Ft.)
Slope or 'Z' of left channel bank =   1.000
Slope or 'Z' of right channel bank =   1.000
Manning's 'N'    = 0.015
Maximum depth of channel  =    3.000(Ft.)
Flow(q) thru subarea =    103.246(CFS)
Depth of flow =   1.133(Ft.), Average velocity =  42.706(Ft/s)
Channel flow top width =    3.267(Ft.)
Flow Velocity =   42.71(Ft/s)
Travel time  =    0.18 min.
Time of concentration =   15.34 min.
Critical depth =      3.188(Ft.)


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Process from Point/Station      208.000 to Point/Station      208.000
**** SUBAREA FLOW ADDITION ****
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________________________________________________________________________
UNDEVELOPED (poor cover) subarea
Time of concentration =    15.34 min.
Rainfall intensity =      2.447(In/Hr) for a   100.0 year storm
Subarea runoff =     81.623(CFS) for     39.250(Ac.)
Total runoff =    184.869(CFS)   Total area =      88.340(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      208.000 to Point/Station      210.000
**** IMPROVED CHANNEL TRAVEL TIME ****
________________________________________________________________________
Upstream point elevation =  1350.000(Ft.)
Downstream point elevation =  1348.000(Ft.)
Channel length thru subarea  =    79.000(Ft.)
Channel base width    =    1.000(Ft.)
Slope or 'Z' of left channel bank =   1.000
Slope or 'Z' of right channel bank =   1.000
Manning's 'N'    = 0.015
Maximum depth of channel  =    3.000(Ft.)
Flow(q) thru subarea =    184.869(CFS)
Depth of flow =   2.776(Ft.), Average velocity =  17.642(Ft/s)
Channel flow top width =    6.551(Ft.)
Flow Velocity =   17.64(Ft/s)
Travel time  =    0.07 min.
Time of concentration =   15.42 min.
Critical depth =      4.063(Ft.)


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Process from Point/Station      210.000 to Point/Station      210.000
**** SUBAREA FLOW ADDITION ****
________________________________________________________________________
UNDEVELOPED (poor cover) subarea
Time of concentration =    15.42 min.
Rainfall intensity =      2.443(In/Hr) for a   100.0 year storm
Subarea runoff =     18.644(CFS) for      8.980(Ac.)
Total runoff =    203.513(CFS)   Total area =      97.320(Ac.)


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Process from Point/Station      210.000 to Point/Station      212.000
**** IMPROVED CHANNEL TRAVEL TIME ****
________________________________________________________________________
Upstream point elevation =  1348.000(Ft.)
Downstream point elevation =  1271.000(Ft.)
Channel length thru subarea  =  1480.000(Ft.)
Channel base width    =    1.000(Ft.)
Slope or 'Z' of left channel bank =   1.000
Slope or 'Z' of right channel bank =   1.000
Estimated mean flow rate at midpoint of channel =    213.352(CFS)
Manning's 'N'    = 0.015
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Maximum depth of channel  =    3.000(Ft.)
Flow(q) thru subarea =    213.352(CFS)
Depth of flow =   2.525(Ft.), Average velocity =  23.977(Ft/s)
Channel flow top width =    6.049(Ft.)
Flow Velocity =   23.98(Ft/s)
Travel time  =    1.03 min.
Time of concentration =   16.45 min.
Critical depth =      4.344(Ft.)
 Adding area flow to channel
UNDEVELOPED (poor cover) subarea
Rainfall intensity =      2.387(In/Hr) for a   100.0 year storm
Subarea runoff =     19.095(CFS) for      9.410(Ac.)
Total runoff =    222.608(CFS)   Total area =     106.730(Ac.)


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Process from Point/Station      300.000 to Point/Station      302.000
**** INITIAL AREA EVALUATION ****
______________________________________________________________________
UNDEVELOPED (poor cover) subarea
Initial subarea data:
Equations shown use english units, converted if necessary to (SI)
Initial area flow distance =   716.000(Ft.)
Top (of initial area) elevation =  1399.000(Ft.)
Bottom (of initial area) elevation =  1123.000(Ft.)
Difference in elevation =   276.000(Ft.)
Slope =    0.38547  s(%)=      38.55
Manual entry of initial area time of concentration, TC
Initial area time of concentration =   11.800 min.
Rainfall intensity =      2.884(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.850
Subarea runoff =      8.654(CFS)
Total initial stream area =        3.530(Ac.)


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Process from Point/Station      302.000 to Point/Station      304.000
**** IMPROVED CHANNEL TRAVEL TIME ****
______________________________________________________________________
Upstream point elevation =  1123.000(Ft.)
Downstream point elevation =  1052.000(Ft.)
Channel length thru subarea  =  2012.000(Ft.)
Channel base width    =    1.000(Ft.)
Slope or 'Z' of left channel bank =   1.000
Slope or 'Z' of right channel bank =   1.000
Estimated mean flow rate at midpoint of channel =     51.740(CFS)
Manning's 'N'    = 0.030
Maximum depth of channel  =    3.000(Ft.)
Flow(q) thru subarea =     51.740(CFS)
Depth of flow =   1.994(Ft.), Average velocity =   8.668(Ft/s)
Channel flow top width =    4.988(Ft.)
Flow Velocity =    8.67(Ft/s)
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Travel time  =    3.87 min.
Time of concentration =   15.67 min.
Critical depth =      2.344(Ft.)
 Adding area flow to channel
UNDEVELOPED (poor cover) subarea
Rainfall intensity =      2.429(In/Hr) for a   100.0 year storm
Subarea runoff =     72.576(CFS) for     35.150(Ac.)
Total runoff =     81.230(CFS)   Total area =      38.680(Ac.)


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Process from Point/Station      304.000 to Point/Station      306.000
**** IMPROVED CHANNEL TRAVEL TIME ****
______________________________________________________________________
Upstream point elevation =  1052.000(Ft.)
Downstream point elevation =  1020.000(Ft.)
Channel length thru subarea  =   102.000(Ft.)
Channel base width    =    1.000(Ft.)
Slope or 'Z' of left channel bank =   1.000
Slope or 'Z' of right channel bank =   1.000
Manning's 'N'    = 0.015
Maximum depth of channel  =    3.000(Ft.)
Flow(q) thru subarea =     81.230(CFS)
Depth of flow =   1.062(Ft.), Average velocity =  37.106(Ft/s)
Channel flow top width =    3.124(Ft.)
Flow Velocity =   37.11(Ft/s)
Travel time  =    0.05 min.
Time of concentration =   15.71 min.
Critical depth =      2.875(Ft.)


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Process from Point/Station      306.000 to Point/Station      308.000
**** IMPROVED CHANNEL TRAVEL TIME ****
______________________________________________________________________
Upstream point elevation =  1020.000(Ft.)
Downstream point elevation =   990.000(Ft.)
Channel length thru subarea  =  1704.000(Ft.)
Channel base width    =    1.000(Ft.)
Slope or 'Z' of left channel bank =  20.000
Slope or 'Z' of right channel bank =   1.000
Estimated mean flow rate at midpoint of channel =    150.395(CFS)
Manning's 'N'    = 0.030
Maximum depth of channel  =    3.000(Ft.)
Flow(q) thru subarea =    150.395(CFS)
Depth of flow =   1.554(Ft.), Average velocity =   5.589(Ft/s)
Channel flow top width =   33.633(Ft.)
Flow Velocity =    5.59(Ft/s)
Travel time  =    5.08 min.
Time of concentration =   20.80 min.
Critical depth =      1.617(Ft.)
 Adding area flow to channel
```

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UNDEVELOPED (poor cover) subarea
Rainfall intensity =      2.154(In/Hr) for a   100.0 year storm
Subarea runoff =    120.598(CFS) for     65.870(Ac.)
Total runoff =    201.828(CFS)   Total area =     104.550(Ac.)


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Process from Point/Station      310.000 to Point/Station      308.000
**** SUBAREA FLOW ADDITION ****
______________________________________________________________________
UNDEVELOPED (poor cover) subarea
Time of concentration =    20.80 min.
Rainfall intensity =      2.154(In/Hr) for a   100.0 year storm
Subarea runoff =     56.097(CFS) for     30.640(Ac.)
Total runoff =    257.926(CFS)   Total area =     135.190(Ac.)


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Process from Point/Station      312.000 to Point/Station      308.000
**** SUBAREA FLOW ADDITION ****
______________________________________________________________________
UNDEVELOPED (poor cover) subarea
Time of concentration =    20.80 min.
Rainfall intensity =      2.154(In/Hr) for a   100.0 year storm
Subarea runoff =     15.086(CFS) for      8.240(Ac.)
Total runoff =    273.012(CFS)   Total area =     143.430(Ac.)


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Process from Point/Station      308.000 to Point/Station      314.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________
Upstream point/station elevation =   990.000(Ft.)
Downstream point/station elevation =   946.500(Ft.)
Pipe length  =   235.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =   273.012(CFS)
Nearest computed pipe diameter  =     36.00(In.)
Calculated individual pipe flow  =   273.012(CFS)
Normal flow depth in pipe =   28.03(In.)
Flow top width inside pipe =   29.89(In.)
Critical depth could not be calculated.
Pipe flow velocity =     46.20(Ft/s)
Travel time through pipe =    0.08 min.
Time of concentration (TC) =    20.88 min.


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Process from Point/Station      400.000 to Point/Station      402.000
**** INITIAL AREA EVALUATION ****
______________________________________________________________________
UNDEVELOPED (poor cover) subarea
Initial subarea data:
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Equations shown use english units, converted if necessary to (SI)
Initial area flow distance =   624.000(Ft.)
Top (of initial area) elevation =  1440.000(Ft.)
Bottom (of initial area) elevation =  1438.000(Ft.)
Difference in elevation =     2.000(Ft.)
Slope =    0.00321  s(%)=       0.32
Manual entry of initial area time of concentration, TC
Initial area time of concentration =   20.100 min.
Rainfall intensity =      2.191(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.850
Subarea runoff =      8.009(CFS)
Total initial stream area =        4.300(Ac.)


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Process from Point/Station      402.000 to Point/Station      404.000
**** IMPROVED CHANNEL TRAVEL TIME ****
______________________________________________________________________
Upstream point elevation =  1438.000(Ft.)
Downstream point elevation =  1430.000(Ft.)
Channel length thru subarea  =  3165.000(Ft.)
Channel base width    =    1.000(Ft.)
Slope or 'Z' of left channel bank =   1.000
Slope or 'Z' of right channel bank =   1.000
Estimated mean flow rate at midpoint of channel =     19.464(CFS)
Manning's 'N'    = 0.015
Maximum depth of channel  =    3.000(Ft.)
Flow(q) thru subarea =     19.464(CFS)
Depth of flow =   1.697(Ft.), Average velocity =   4.253(Ft/s)
Channel flow top width =    4.394(Ft.)
Flow Velocity =    4.25(Ft/s)
Travel time  =   12.40 min.
Time of concentration =   32.50 min.
Critical depth =      1.453(Ft.)
 Adding area flow to channel
UNDEVELOPED (poor cover) subarea
Rainfall intensity =      1.619(In/Hr) for a   100.0 year storm
Subarea runoff =     16.923(CFS) for     12.300(Ac.)
Total runoff =     24.932(CFS)   Total area =      16.600(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      404.000 to Point/Station      406.000
**** IMPROVED CHANNEL TRAVEL TIME ****
______________________________________________________________________
Upstream point elevation =  1430.000(Ft.)
Downstream point elevation =  1092.000(Ft.)
Channel length thru subarea  =  3590.000(Ft.)
Channel base width    =    1.000(Ft.)
Slope or 'Z' of left channel bank =   1.000
Slope or 'Z' of right channel bank =   1.000
Estimated mean flow rate at midpoint of channel =     50.322(CFS)
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```
Manning's 'N'    = 0.015
Maximum depth of channel  =    3.000(Ft.)
Flow(q) thru subarea =     50.322(CFS)
Depth of flow =   1.128(Ft.), Average velocity =  20.966(Ft/s)
Channel flow top width =    3.256(Ft.)
Flow Velocity =   20.97(Ft/s)
Travel time  =    2.85 min.
Time of concentration =   35.36 min.
Critical depth =      2.313(Ft.)
 Adding area flow to channel
UNDEVELOPED (poor cover) subarea
Rainfall intensity =      1.571(In/Hr) for a   100.0 year storm
Subarea runoff =     45.161(CFS) for     33.810(Ac.)
Total runoff =     70.093(CFS)   Total area =      50.410(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      408.000 to Point/Station      406.000
**** SUBAREA FLOW ADDITION ****
______________________________________________________________________
UNDEVELOPED (poor cover) subarea
Time of concentration =    35.36 min.
Rainfall intensity =      1.571(In/Hr) for a   100.0 year storm
Subarea runoff =     29.386(CFS) for     22.000(Ac.)
Total runoff =     99.479(CFS)   Total area =      72.410(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      406.000 to Point/Station      410.000
**** IMPROVED CHANNEL TRAVEL TIME ****
______________________________________________________________________
Upstream point elevation =  1092.000(Ft.)
Downstream point elevation =   576.900(Ft.)
Channel length thru subarea  =  3545.000(Ft.)
Channel base width    =    1.000(Ft.)
Slope or 'Z' of left channel bank =   1.000
Slope or 'Z' of right channel bank =   1.000
Estimated mean flow rate at midpoint of channel =    113.024(CFS)
Manning's 'N'    = 0.015
Maximum depth of channel  =    3.000(Ft.)
Flow(q) thru subarea =    113.024(CFS)
Depth of flow =   1.499(Ft.), Average velocity =  30.187(Ft/s)
Channel flow top width =    3.997(Ft.)
Flow Velocity =   30.19(Ft/s)
Travel time  =    1.96 min.
Time of concentration =   37.31 min.
Critical depth =      3.281(Ft.)
 Adding area flow to channel
UNDEVELOPED (poor cover) subarea
Rainfall intensity =      1.539(In/Hr) for a   100.0 year storm
Subarea runoff =     25.798(CFS) for     19.720(Ac.)
Total runoff =    125.277(CFS)   Total area =      92.130(Ac.)
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++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      500.000 to Point/Station      502.000
**** INITIAL AREA EVALUATION ****
______________________________________________________________________
UNDEVELOPED (poor cover) subarea
Initial subarea data:
Equations shown use english units, converted if necessary to (SI)
Initial area flow distance =   893.000(Ft.)
Top (of initial area) elevation =  1464.000(Ft.)
Bottom (of initial area) elevation =  1300.000(Ft.)
Difference in elevation =   164.000(Ft.)
Slope =    0.18365  s(%)=      18.37
Manual entry of initial area time of concentration, TC
Initial area time of concentration =   12.800 min.
Rainfall intensity =      2.753(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.850
Subarea runoff =      5.804(CFS)
Total initial stream area =        2.480(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      502.000 to Point/Station      504.000
**** IMPROVED CHANNEL TRAVEL TIME ****
______________________________________________________________________
Upstream point elevation =  1300.000(Ft.)
Downstream point elevation =   926.000(Ft.)
Channel length thru subarea  =  1319.000(Ft.)
Channel base width    =    3.000(Ft.)
Slope or 'Z' of left channel bank =   2.000
Slope or 'Z' of right channel bank =   2.000
Estimated mean flow rate at midpoint of channel =     27.814(CFS)
Manning's 'N'    = 0.040
Maximum depth of channel  =    5.000(Ft.)
Flow(q) thru subarea =     27.814(CFS)
Depth of flow =   0.587(Ft.), Average velocity =  11.362(Ft/s)
Channel flow top width =    5.346(Ft.)
Flow Velocity =   11.36(Ft/s)
Travel time  =    1.93 min.
Time of concentration =   14.73 min.
Critical depth =      1.086(Ft.)
 Adding area flow to channel
UNDEVELOPED (poor cover) subarea
Rainfall intensity =      2.500(In/Hr) for a   100.0 year storm
Subarea runoff =     39.967(CFS) for     18.810(Ac.)
Total runoff =     45.771(CFS)   Total area =      21.290(Ac.)


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Process from Point/Station      504.000 to Point/Station      506.000
**** IMPROVED CHANNEL TRAVEL TIME ****
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____________________________________________________________________
Upstream point elevation =   926.000(Ft.)
Downstream point elevation =   890.000(Ft.)
Channel length thru subarea  =   532.000(Ft.)
Channel base width    =    1.000(Ft.)
Slope or 'Z' of left channel bank =   1.000
Slope or 'Z' of right channel bank =   1.000
Estimated mean flow rate at midpoint of channel =     53.317(CFS)
Manning's 'N'    = 0.015
Maximum depth of channel  =    3.000(Ft.)
Flow(q) thru subarea =     53.317(CFS)
Depth of flow =   1.257(Ft.), Average velocity =  18.794(Ft/s)
Channel flow top width =    3.514(Ft.)
Flow Velocity =   18.79(Ft/s)
Travel time  =    0.47 min.
Time of concentration =   15.21 min.
Critical depth =      2.375(Ft.)
 Adding area flow to channel
UNDEVELOPED (poor cover) subarea
Rainfall intensity =      2.454(In/Hr) for a   100.0 year storm
Subarea runoff =     14.643(CFS) for      7.020(Ac.)
Total runoff =     60.413(CFS)   Total area =      28.310(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      506.000 to Point/Station      508.000
**** IMPROVED CHANNEL TRAVEL TIME ****
____________________________________________________________________
Upstream point elevation =   890.000(Ft.)
Downstream point elevation =   860.000(Ft.)
Channel length thru subarea  =   106.000(Ft.)
Channel base width    =    1.000(Ft.)
Slope or 'Z' of left channel bank =   1.000
Slope or 'Z' of right channel bank =   1.000
Estimated mean flow rate at midpoint of channel =     77.272(CFS)
Manning's 'N'    = 0.015
Maximum depth of channel  =    3.000(Ft.)
Flow(q) thru subarea =     77.272(CFS)
Depth of flow =   1.063(Ft.), Average velocity =  35.257(Ft/s)
Channel flow top width =    3.125(Ft.)
Flow Velocity =   35.26(Ft/s)
Travel time  =    0.05 min.
Time of concentration =   15.26 min.
Critical depth =      2.813(Ft.)
 Adding area flow to channel
UNDEVELOPED (poor cover) subarea
Rainfall intensity =      2.451(In/Hr) for a   100.0 year storm
Subarea runoff =     32.920(CFS) for     15.800(Ac.)
Total runoff =     93.333(CFS)   Total area =      44.110(Ac.)


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Process from Point/Station      508.000 to Point/Station      510.000
**** IMPROVED CHANNEL TRAVEL TIME ****
______________________________________________________________________
Upstream point elevation =   860.000(Ft.)
Downstream point elevation =   795.000(Ft.)
Channel length thru subarea  =  1965.000(Ft.)
Channel base width    =    1.000(Ft.)
Slope or 'Z' of left channel bank =   1.000
Slope or 'Z' of right channel bank =   1.000
Estimated mean flow rate at midpoint of channel =     99.332(CFS)
Manning's 'N'    = 0.015
Maximum depth of channel  =    3.000(Ft.)
Flow(q) thru subarea =     99.332(CFS)
Depth of flow =   1.986(Ft.), Average velocity =  16.749(Ft/s)
Channel flow top width =    4.972(Ft.)
Flow Velocity =   16.75(Ft/s)
Travel time  =    1.96 min.
Time of concentration =   17.21 min.
Critical depth =      3.125(Ft.)
 Adding area flow to channel
UNDEVELOPED (poor cover) subarea
Rainfall intensity =      2.346(In/Hr) for a   100.0 year storm
Subarea runoff =     11.308(CFS) for      5.670(Ac.)
Total runoff =    104.641(CFS)   Total area =      49.780(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      512.000 to Point/Station      510.000
**** SUBAREA FLOW ADDITION ****
______________________________________________________________________
UNDEVELOPED (poor cover) subarea
Time of concentration =    17.21 min.
Rainfall intensity =      2.346(In/Hr) for a   100.0 year storm
Subarea runoff =     35.858(CFS) for     17.980(Ac.)
Total runoff =    140.500(CFS)   Total area =      67.760(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      510.000 to Point/Station      514.000
**** IMPROVED CHANNEL TRAVEL TIME ****
______________________________________________________________________
Upstream point elevation =   795.000(Ft.)
Downstream point elevation =   451.000(Ft.)
Channel length thru subarea  =  3079.000(Ft.)
Channel base width    =    1.000(Ft.)
Slope or 'Z' of left channel bank =   1.000
Slope or 'Z' of right channel bank =   1.000
Estimated mean flow rate at midpoint of channel =    173.748(CFS)
Manning's 'N'    = 0.015
Maximum depth of channel  =    3.000(Ft.)
Flow(q) thru subarea =    173.748(CFS)
Depth of flow =   1.942(Ft.), Average velocity =  30.408(Ft/s)
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Channel flow top width =    4.884(Ft.)
Flow Velocity =   30.41(Ft/s)
Travel time  =    1.69 min.
Time of concentration =   18.90 min.
Critical depth =      3.969(Ft.)
 Adding area flow to channel
UNDEVELOPED (poor cover) subarea
Rainfall intensity =      2.256(In/Hr) for a   100.0 year storm
Subarea runoff =     61.490(CFS) for     32.070(Ac.)
Total runoff =    201.990(CFS)   Total area =      99.830(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      600.000 to Point/Station      602.000
**** INITIAL AREA EVALUATION ****
______________________________________________________________________
UNDEVELOPED (poor cover) subarea
Initial subarea data:
Equations shown use english units, converted if necessary to (SI)
Initial area flow distance =   938.000(Ft.)
Top (of initial area) elevation =  1543.000(Ft.)
Bottom (of initial area) elevation =  1290.000(Ft.)
Difference in elevation =   253.000(Ft.)
Slope =    0.26972  s(%)=      26.97
Manual entry of initial area time of concentration, TC
Initial area time of concentration =   12.500 min.
Rainfall intensity =      2.793(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.850
Subarea runoff =     16.236(CFS)
Total initial stream area =        6.840(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      602.000 to Point/Station      604.000
**** IMPROVED CHANNEL TRAVEL TIME ****
______________________________________________________________________
Upstream point elevation =  1290.000(Ft.)
Downstream point elevation =   695.000(Ft.)
Channel length thru subarea  =  2357.000(Ft.)
Channel base width    =    3.000(Ft.)
Slope or 'Z' of left channel bank =   2.000
Slope or 'Z' of right channel bank =   2.000
Estimated mean flow rate at midpoint of channel =     58.154(CFS)
Manning's 'N'    = 0.040
Maximum depth of channel  =    5.000(Ft.)
Flow(q) thru subarea =     58.154(CFS)
Depth of flow =   0.899(Ft.), Average velocity =  13.488(Ft/s)
Channel flow top width =    6.595(Ft.)
Flow Velocity =   13.49(Ft/s)
Travel time  =    2.91 min.
Time of concentration =   15.41 min.
Critical depth =      1.609(Ft.)
```

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 Adding area flow to channel
UNDEVELOPED (poor cover) subarea
Rainfall intensity =      2.443(In/Hr) for a   100.0 year storm
Subarea runoff =     73.340(CFS) for     35.320(Ac.)
Total runoff =     89.575(CFS)   Total area =      42.160(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      604.000 to Point/Station      606.000
**** IMPROVED CHANNEL TRAVEL TIME ****
______________________________________________________________________
Upstream point elevation =   695.000(Ft.)
Downstream point elevation =   571.000(Ft.)
Channel length thru subarea  =  1482.000(Ft.)
Channel base width    =    1.000(Ft.)
Slope or 'Z' of left channel bank =   1.000
Slope or 'Z' of right channel bank =   1.000
Estimated mean flow rate at midpoint of channel =    141.916(CFS)
Manning's 'N'    = 0.015
Maximum depth of channel  =    3.000(Ft.)
Flow(q) thru subarea =    141.916(CFS)
Depth of flow =   1.892(Ft.), Average velocity =  25.943(Ft/s)
Channel flow top width =    4.783(Ft.)
Flow Velocity =   25.94(Ft/s)
Travel time  =    0.95 min.
Time of concentration =   16.36 min.
Critical depth =      3.625(Ft.)
 Adding area flow to channel
UNDEVELOPED (poor cover) subarea
Rainfall intensity =      2.392(In/Hr) for a   100.0 year storm
Subarea runoff =    100.166(CFS) for     49.270(Ac.)
Total runoff =    189.741(CFS)   Total area =      91.430(Ac.)
End of computations, total study area =         599.000 (Ac.)
```

APPENDIX B

UNIT HYDROGRAPH ANALYSES

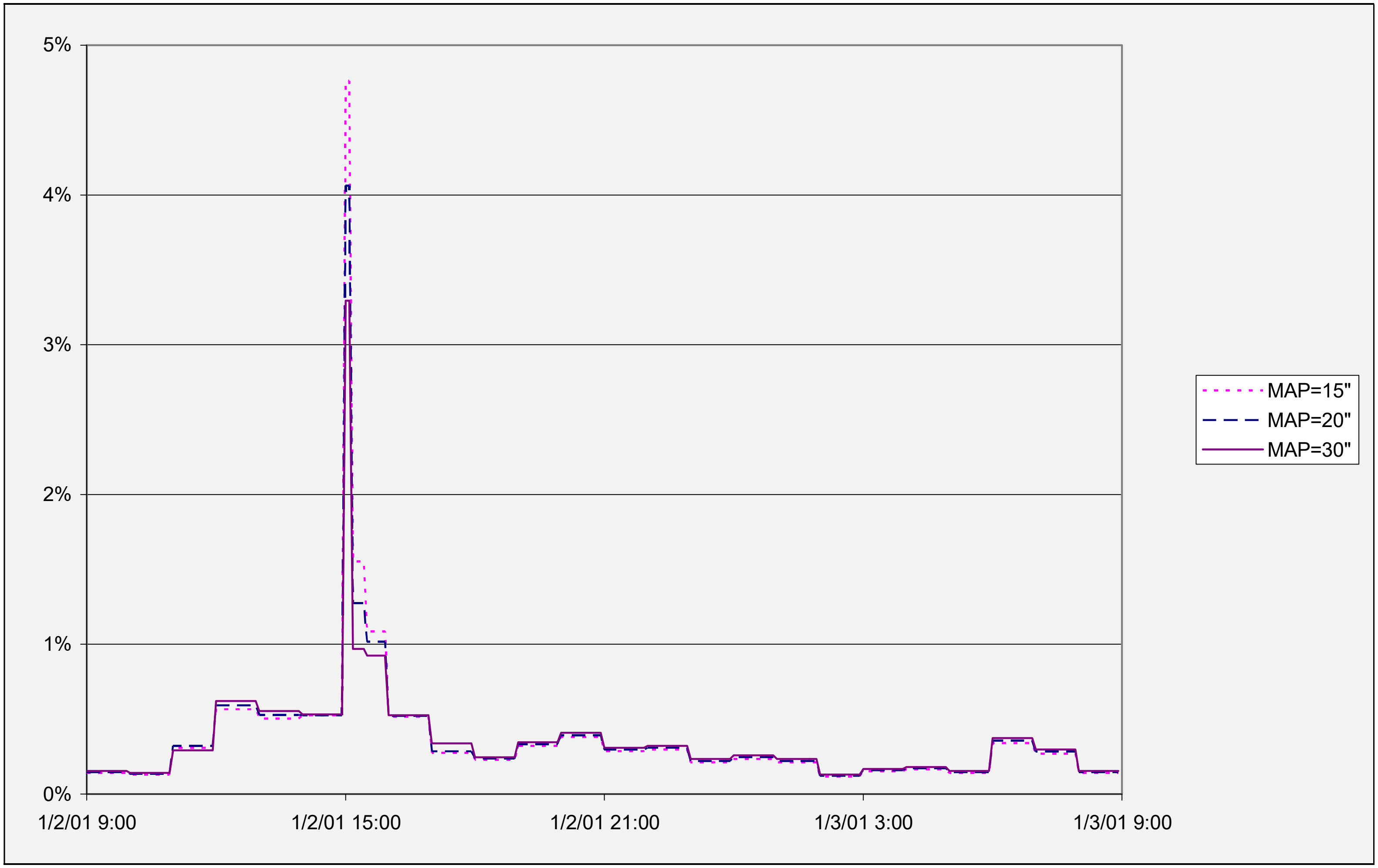

Figure D-1: Normalized Rainfall Pattern

Table D-1: Fractions of Total Rainfall for 24-Hour, 5-Minute Pattern

Time Starting	Fraction of Total Rainfall (%) *MAP=15″*	Fraction of Total Rainfall (%) *MAP=20″*	Fraction of Total Rainfall (%) *MAP=30″*
0:00	0.1412	0.1482	0.1558
1:00	0.1294	0.1358	0.1429
2:00	0.3080	0.3223	0.2945
3:00	0.5667	0.5930	0.6214
4:00	0.5051	0.5285	0.5538
5:00	0.5272	0.5266	0.5324
6:00	4.760	4.060	3.2950
6:10	1.554	1.275	0.9700
6:30	1.085	1.0169	0.9253
7:00	0.5177	0.5229	0.5263
8:00	0.2763	0.2860	0.3410
9:00	0.2302	0.2384	0.2478
10:00	0.3223	0.3337	0.3469
11:00	0.3799	0.3933	0.4089
12:00	0.2878	0.2979	0.3098
13:00	0.2993	0.3099	0.3222
14:00	0.2118	0.2223	0.2338
15:00	0.2353	0.2470	0.2597
16:00	0.2118	0.2223	0.2338
17:00	0.1177	0.1235	0.1299
18:00	0.1530	0.1605	0.1688
19:00	0.1647	0.1729	0.1818
20:00	0.1412	0.1482	0.1558
21:00	0.3412	0.3581	0.3766
22:00	0.2706	0.2840	0.2987
23:00	0.1412	0.1482	0.1558

Table E-1: Curve Numbers for AMC II

Land Use Type	Hydrologic Condition	Hydrologic Soil Group A	B	C	D
Open Water (100% Impervious)	good				
	fair				
	poor				
Low Density Residential (25% Impervious)	good	35	48	66	70
	fair	44	58	71	74
	poor	64	68	78	79
High Density Residential (50% Impervious)	good	35	48	65	70
	fair	44	58	71	74
	poor	64	68	78	79
Commercial/Industrial (80% Impervious)	good	35	48	65	70
	fair	44	58	71	74
	poor	64	68	78	79
Bare Rock/Sand/Clay (Imperviousness Varies)					
Quarries/Gravel Pits (0 % Impervious)	good	0	0	0	0
	fair	0	0	0	0
	poor	0	0	0	0
Deciduous Forest (0% Impervious)	good	27	30	41	48
	fair	35	48	57	63
	poor	48	66	74	79
Evergreen Forest (0% Impervious)	good	37	43	62	70
	fair	45	57	69	80
	poor	58	71	85	90
Mixed Forest	good	32	36	51	59
	fair	40	52	63	72
	poor	53	68	80	85
Shrub Land (0% Impervious)	good	27	43	60	68
	fair	35	51	65	72
	poor	48	62	72	78
Orchards (1% Impervious)	good	39	52	66	71
	fair	43	65	76	82
	poor	57	73	82	86
Vineyards (1% Impervious)	good	64	70	77	80
	fair	67	75	82	85
	poor	71	80	87	90
Grassland (0% Impervious)	good	38	50	69	76
	fair	48	60	74	80
	poor	58	70	80	84
Pasture/Hay (0% Impervious)	good	34	50	69	76
	fair	44	60	74	80
	poor	64	70	80	84
Row Crops (1% Impervious)	good	64	70	77	80
	fair	67	75	82	85
	poor	71	80	87	90
Small Grains (0% Impervious)	good	48	58	70	74
	fair	49	59	71	75
	poor	50	60	71	75
Fallow (1% Impervious)	good	64	68	78	79
	fair	70	77	84	86
	poor	77	86	91	94
Urban Recreational (10% Impervious)	good	34	48	66	70
	fair	44	58	71	74
	poor	64	64	78	79

Table E-2: Conversion of AMC II Curve Numbers to Other AMC Values

AMC II	AMC I	AMC III	AMC II-1/4	AMC II-1/2
100	100	100	100	100
99	97	100	99.5	100
98	94	99	98.5	99
97	91	99	97.5	98
96	89	99	97	98
95	87	98	96	97
94	85	98	95	96
93	83	98	94.5	96
92	81	97	93.5	95
91	80	97	92.5	94
90	78	96	91.5	93
89	76	96	91	93
88	75	95	90	92
87	73	95	89	91
86	72	94	88	90
85	70	94	87.5	90
84	68	93	86.5	89
83	67	93	85.5	88
82	66	92	84.5	87
81	64	92	84	87
80	63	91	83	86
79	62	91	82	85
78	60	90	81	84
77	59	89	80	83
76	58	89	79.5	83
75	57	88	78.5	82
74	55	88	77.5	81
73	54	87	76.5	80
72	53	86	75.5	79
71	52	86	75	79
70	51	85	74	78
69	50	84	73	77
68	48	84	72	76
67	47	83	71	75
66	46	82	70	74
65	45	82	69.5	74
64	44	81	68.5	73
63	43	80	67.5	72

AMC II	AMC I	AMC III	AMC II-1/4	AMC II-1/2
61	41	78	65.5	70
60	40	78	64.5	69
59	39	77	63.5	68
58	38	76	62.5	67
57	37	75	61.5	66
56	36	75	61	66
55	35	74	60	65
54	34	73	59	64
53	33	72	58	63
52	32	71	57	62
51	31	70	56	61
50	31	70	55	60
49	30	69	54	59
48	29	68	53	58
47	28	67	52	57
46	27	66	51	56
45	26	65	50	55
44	25	64	49	54
43	25	63	48	53
42	24	62	47	52
41	23	61	46	51
40	22	60	45	50
39	21	59	44	49
38	21	58	43	48
37	20	57	42	47
36	19	56	41	46
35	18	55	40	45
34	18	54	39	44
33	17	53	38	43
32	16	52	37	42
31	16	51	36	41
30	15	50	35	40
25	12	43	29.5	34
20	9	37	24.5	29
15	6	30	19	23
10	4	22	13	16
5	2	13	7	9
0	0	0	0	0

```
*****************************************                                                         ***************************************
*                                       *                                                         *                                     *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *                                                         *   U.S. ARMY CORPS OF ENGINEERS      *
*             JUN   1998                *                                                         *   HYDROLOGIC ENGINEERING CENTER     *
*           VERSION 4.1                 *                                                         *         609 SECOND STREET           *
*                                       *                                                         *     DAVIS, CALIFORNIA 95616         *
* RUN DATE   08MAY23  TIME  20:24:07    *                                                         *         (916) 756-1104              *
*                                       *                                                         *                                     *
*****************************************                                                         ***************************************




                                                  X     X  XXXXXXX   XXXXX          X
                                                  X     X  X        X     X        XX
                                                  X     X  X        X               X
                                                  XXXXXXX  XXXX     X       XXXXX   X
                                                  X     X  X        X               X
                                                  X     X  X        X     X         X
                                                  X     X  XXXXXXX   XXXXX         XXX




          THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

          THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.
          THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION
          NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,
          DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL   LOSS RATE:GREEN AND AMPT INFILTRATION
          KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM
```

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       LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

                     *DIAGRAM
*** FREE ***
          1          ID   PERMANENTE QUARRY
          2          ID   EXISTING CONDITIONS - NORTH QUARRY/WMSA
          3          ID   25-YEAR FLOW RATE
          4          ID   COUNTY OF SANTA CLARA HYDROGRAPH METHOD
          5          IT       5       0       0     300
          6          IO       5       2

          7          KK   BASIN
          8          IN       5
          9          PB    6.15
         10          PI  0.0015  0.0015  0.0015  0.0015  0.0015  0.0015  0.0015  0.0015  0.0015   0.001
         11          PI  0.0015  0.0015  0.0014  0.0014  0.0014  0.0014  0.0014  0.0014  0.0014   0.001
         12          PI  0.0014  0.0014  0.0014  0.0014  0.0030  0.0030  0.0030  0.0030  0.0030   0.003
         13          PI  0.0030  0.0030  0.0030  0.0030  0.0030  0.0030  0.0062  0.0062  0.0062   0.006
         14          PI  0.0062  0.0062  0.0062  0.0062  0.0062  0.0062  0.0062  0.0062  0.0055   0.005
         15          PI  0.0055  0.0055  0.0055  0.0055  0.0055  0.0055  0.0055  0.0055  0.0055   0.005
         16          PI  0.0053  0.0053  0.0053  0.0053  0.0053  0.0053  0.0053  0.0053  0.0053   0.005
         17          PI  0.0053  0.0053  0.0345  0.0345  0.0103  0.0103  0.0103  0.0103  0.0094   0.009
         18          PI  0.0094  0.0094  0.0094  0.0094  0.0053  0.0053  0.0053  0.0053  0.0053   0.005
         19          PI  0.0053  0.0053  0.0053  0.0053  0.0053  0.0053  0.0033  0.0033  0.0033   0.003
         20          PI  0.0033  0.0033  0.0033  0.0033  0.0033  0.0033  0.0033  0.0033  0.0025   0.002
         21          PI  0.0025  0.0025  0.0025  0.0025  0.0025  0.0025  0.0025  0.0025  0.0025   0.002
         22          PI  0.0034  0.0034  0.0034  0.0034  0.0034  0.0034  0.0034  0.0034  0.0034   0.003
         23          PI  0.0034  0.0034  0.0041  0.0041  0.0041  0.0041  0.0041  0.0041  0.0041   0.004
         24          PI  0.0041  0.0041  0.0041  0.0041  0.0031  0.0031  0.0031  0.0031  0.0031   0.003
         25          PI  0.0031  0.0031  0.0031  0.0031  0.0031  0.0031  0.0032  0.0032  0.0032   0.003
         26          PI  0.0032  0.0032  0.0032  0.0032  0.0032  0.0032  0.0032  0.0032  0.0023   0.002
         27          PI  0.0023  0.0023  0.0023  0.0023  0.0023  0.0023  0.0023  0.0023  0.0023   0.002
         28          PI  0.0026  0.0026  0.0026  0.0026  0.0026  0.0026  0.0026  0.0026  0.0026   0.002
         29          PI  0.0026  0.0026  0.0023  0.0023  0.0023  0.0023  0.0023  0.0023  0.0023   0.002
         30          PI  0.0023  0.0023  0.0023  0.0023  0.0013  0.0013  0.0013  0.0013  0.0013   0.001
         31          PI  0.0013  0.0013  0.0013  0.0013  0.0013  0.0013  0.0017  0.0017  0.0017   0.001
         32          PI  0.0017  0.0017  0.0017  0.0017  0.0017  0.0017  0.0017  0.0017  0.0018   0.001
         33          PI  0.0018  0.0018  0.0018  0.0018  0.0018  0.0018  0.0018  0.0018  0.0018   0.001
         34          PI  0.0015  0.0015  0.0015  0.0015  0.0015  0.0015  0.0015  0.0015  0.0015   0.001
         35          PI  0.0015  0.0015  0.0037  0.0037  0.0037  0.0037  0.0037  0.0037  0.0037   0.003
         36          PI  0.0037  0.0037  0.0037  0.0037  0.0030  0.0030  0.0030  0.0030  0.0030   0.003
         37          PI  0.0030  0.0030  0.0030  0.0030  0.0030  0.0030  0.0015  0.0015  0.0015   0.001
         38          PI  0.0015  0.0015  0.0015  0.0015  0.0015  0.0015  0.0015  0.0015
         39          BA  0.5641
         40          LS    0.22      90
         41          UD    0.46
         42          ZZ
```

```
              SCHEMATIC DIAGRAM OF STREAM NETWORK
INPUT
 LINE      (V) ROUTING          (--->) DIVERSION OR PUMP FLOW

  NO.      (.) CONNECTOR        (<---) RETURN OF DIVERTED OR PUMPED FLOW

   7       BASIN

(***) RUNOFF ALSO COMPUTED AT THIS LOCATION
```

```
*****************************************                      ****************************************
*                                       *                      *                                      *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *                      *   U.S. ARMY CORPS OF ENGINEERS       *
*              JUN   1998               *                      *   HYDROLOGIC ENGINEERING CENTER      *
*           VERSION 4.1                 *                      *         609 SECOND STREET            *
*                                       *                      *      DAVIS, CALIFORNIA 95616         *
*  RUN DATE   08MAY23  TIME  20:24:07   *                      *          (916) 756-1104              *
*                                       *                      *                                      *
*****************************************                      ****************************************
```

```
                         PERMANENTE QUARRY
                         EXISTING CONDITIONS - NORTH QUARRY/WMSA
                         25-YEAR FLOW RATE
                         COUNTY OF SANTA CLARA HYDROGRAPH METHOD

   6 IO         OUTPUT CONTROL VARIABLES
                      IPRNT          5  PRINT CONTROL
                      IPLOT          2  PLOT CONTROL
                      QSCAL         0.  HYDROGRAPH PLOT SCALE

     IT         HYDROGRAPH TIME DATA
                       NMIN          5  MINUTES IN COMPUTATION INTERVAL
                      IDATE      1    0  STARTING DATE
                      ITIME       0000  STARTING TIME
                         NQ        300  NUMBER OF HYDROGRAPH ORDINATES
                     NDDATE      2    0  ENDING DATE
                     NDTIME       0055  ENDING TIME
                     ICENT          19  CENTURY MARK

                  COMPUTATION INTERVAL     .08 HOURS
                       TOTAL TIME BASE   24.92 HOURS

        ENGLISH UNITS
             DRAINAGE AREA         SQUARE MILES
             PRECIPITATION DEPTH   INCHES
             LENGTH, ELEVATION     FEET
             FLOW                  CUBIC FEET PER SECOND
             STORAGE VOLUME        ACRE-FEET
             SURFACE AREA          ACRES
             TEMPERATURE           DEGREES FAHRENHEIT
```

```
                                                        STATION    BASIN

                        (O) OUTFLOW
         0.       40.       80.      120.      160.      200.      240.      280.      320.        0.        0.        0.        0.
                                                                                                  (L) PRECIP,   (X) EXCESS
         .0        .0        .0        .0        .0        .0        .0        .0        .0        .3        .2        .1        .0
DAHRMN PER
 10000   1O---------.---------.---------.---------.---------.---------.---------.---------.---------.---------.---------.---------.
 10005   2O         .         .         .         .         .         .         .         .         .         .         .        L.
 10010   3O         .         .         .         .         .         .         .         .         .         .         .        L.
 10015   4O         .         .         .         .         .         .         .         .         .         .         .        L.
 10020   5O         .         .         .         .         .         .         .         .         .         .         .        L.
 10025   6O         .         .         .         .         .         .         .         .         .         .         .        L.
 10030   7O         .         .         .         .         .         .         .         .         .         .         .        L.
 10035   8O         .         .         .         .         .         .         .         .         .         .         .        L.
 10040   9O         .         .         .         .         .         .         .         .         .         .         .        L.
 10045  10O         .         .         .         .         .         .         .         .         .         .         .        L.
 10050  11O . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .L.
 10055  12O         .         .         .         .         .         .         .         .         .         .         .        L.
 10100  13O         .         .         .         .         .         .         .         .         .         .         .        L.
 10105  14O         .         .         .         .         .         .         .         .         .         .         .        L.
 10110  15O         .         .         .         .         .         .         .         .         .         .         .        L.
 10115  16O         .         .         .         .         .         .         .         .         .         .         .        L.
 10120  17O         .         .         .         .         .         .         .         .         .         .         .        L.
 10125  18O         .         .         .         .         .         .         .         .         .         .         .        L.
 10130  19O         .         .         .         .         .         .         .         .         .         .         .        L.
 10135  20O         .         .         .         .         .         .         .         .         .         .         .        L.
 10140  21O . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .L.
 10145  22O         .         .         .         .         .         .         .         .         .         .         .        L.
 10150  23O         .         .         .         .         .         .         .         .         .         .         .        L.
 10155  24O         .         .         .         .         .         .         .         .         .         .         .        L.
 10200  25O         .         .         .         .         .         .         .         .         .         .         .        L.
 10205  26O         .         .         .         .         .         .         .         .         .         .         .       LL.
 10210  27O         .         .         .         .         .         .         .         .         .         .         .       LL.
 10215  28O         .         .         .         .         .         .         .         .         .         .         .       LL.
 10220  29O         .         .         .         .         .         .         .         .         .         .         .       LL.
 10225  30O         .         .         .         .         .         .         .         .         .         .         .       LL.
 10230  31O . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . LL.
 10235  32.O        .         .         .         .         .         .         .         .         .         .         .       LL.
 10240  33.O        .         .         .         .         .         .         .         .         .         .         .       LL.
 10245  34.O        .         .         .         .         .         .         .         .         .         .         .       LL.
 10250  35. O       .         .         .         .         .         .         .         .         .         .         .       LL.
 10255  36. O       .         .         .         .         .         .         .         .         .         .         .       LL.
 10300  37.  O      .         .         .         .         .         .         .         .         .         .         .       LX.
 10305  38.  O      .         .         .         .         .         .         .         .         .         .         .     LLLX.
 10310  39.   O     .         .         .         .         .         .         .         .         .         .         .     LLLX.
 10315  40.    O    .         .         .         .         .         .         .         .         .         .         .     LLLX.
 10320  41. . . O . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . LLXX.
 10325  42.       O .         .         .         .         .         .         .         .         .         .         .     LLXX.
 10330  43.        O.         .         .         .         .         .         .         .         .         .         .     LLXX.
 10335  44.         .O        .         .         .         .         .         .         .         .         .         .     LLXX.
 10340  45.         .  O      .         .         .         .         .         .         .         .         .         .     LLXX.
 10345  46.         .   O     .         .         .         .         .         .         .         .         .         .     LLXX.
 10350  47.         .     O   .         .         .         .         .         .         .         .         .         .     LLXX.
 10355  48.         .      O  .         .         .         .         .         .         .         .         .         .     LLXX.
 10400  49.         .       O .         .         .         .         .         .         .         .         .         .     LLXX.
 10405  50.         .        O.         .         .         .         .         .         .         .         .         .      LXX.
 10410  51. . . . . . . . . . O . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .LXX.
 10415  52.         .         .O        .         .         .         .         .         .         .         .         .      LXX.
 10420  53.         .         . O       .         .         .         .         .         .         .         .         .      LXX.
 10425  54.         .         . O       .         .         .         .         .         .         .         .         .      LXX.
 10430  55.         .         .  O      .         .         .         .         .         .         .         .         .      LXX.
 10435  56.         .         .  O      .         .         .         .         .         .         .         .         .      LXX.
 10440  57.         .         .  O      .         .         .         .         .         .         .         .         .      LXX.
 10445  58.         .         .   O     .         .         .         .         .         .         .         .         .      LXX.
 10450  59.         .         .   O     .         .         .         .         .         .         .         .         .      LXX.
 10455  60.         .         .    O    .         .         .         .         .         .         .         .         .      LXX.
 10500  61. . . . . . . . . . . . .O. . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .LXX.
 10505  62.         .         .    O    .         .         .         .         .         .         .         .         .      LXX.
 10510  63.         .         .     O   .         .         .         .         .         .         .         .         .      LXX.
 10515  64.         .         .     O   .         .         .         .         .         .         .         .         .      XXX.
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10520  65.         .         .     O   .         .         .         .         .         .         .         .         .      XXX.
10525  66.         .         .     O   .         .         .         .         .         .         .         .         .      XXX.
10530  67.         .         .     O   .         .         .         .         .         .         .         .         .      XXX.
10535  68.         .         .      O  .         .         .         .         .         .         .         .         .      XXX.
10540  69.         .         .      O  .         .         .         .         .         .         .         .         .      XXX.
10545  70.         .         .      O  .         .         .         .         .         .         .         .         .      XXX.
10550  71. . . . . . . . . . . . .O. . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .LXX.
10555  72.         .         .       O .         .         .         .         .         .         .         .         .      XXX.
10600  73.         .         .       O .         .         .         .         .         .         .         .         .      XXX.
10605  74.         .         .        O.         .         .         .         .         .         .        LLLXXXXXXXXXXXXXXXXXX.
10610  75.         .         .         .   O     .         .         .         .         .         .        LLLXXXXXXXXXXXXXXXXXX.
10615  76.         .         .         .         .  O      .         .         .         .         .         .         .   XXXXXX.
10620  77.         .         .         .         .         .    O    .         .         .         .         .         .   XXXXXX.
10625  78.         .         .         .         .         .         .      O  .         .         .         .         .   XXXXXX.
10630  79.         .         .         .         .         .         .         .    O    .         .         .         .   XXXXXX.
10635  80.         .         .         .         .         .         .         .        O.         .         .         .   LXXXXX.
10640  81. . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . O . . . . . . . . . . . . . . . . LXXXXX.
10645  82.         .         .         .         .         .         .         .       O .         .         .         .   LXXXXX.
10650  83.         .         .         .         .         .         .         .   O     .         .         .         .   LXXXXX.
10655  84.         .         .         .         .         .         .        O.         .         .         .         .   LXXXXX.
10700  85.         .         .         .         .         .         .     O   .         .         .         .         .   LXXXXX.
10705  86.         .         .         .         .         .         .   O     .         .         .         .         .      XXX.
10710  87.         .         .         .         .         .         . O       .         .         .         .         .      XXX.
10715  88.         .         .         .         .         .        O.         .         .         .         .         .      XXX.
10720  89.         .         .         .         .         .     O   .         .         .         .         .         .      XXX.
10725  90.         .         .         .         .         . O       .         .         .         .         .         .      XXX.
10730  91. . . . . . . . . . . . . . . . . . . . . . . . O . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .XXX.
10735  92.         .         .         .         .    O    .         .         .         .         .         .         .      XXX.
10740  93.         .         .         .         . O       .         .         .         .         .         .         .      XXX.
10745  94.         .         .         .         O         .         .         .         .         .         .         .      XXX.
10750  95.         .         .         .       O .         .         .         .         .         .         .         .      XXX.
10755  96.         .         .         .      O  .         .         .         .         .         .         .         .      XXX.
10800  97.         .         .         .     O   .         .         .         .         .         .         .         .      XXX.
10805  98.         .         .         .    O    .         .         .         .         .         .         .         .       XX.
10810  99.         .         .         .   O     .         .         .         .         .         .         .         .       XX.
10815 100.         .         .         .  O      .         .         .         .         .         .         .         .       XX.
10820 101. . . . . . . . . . . . . . . . O . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . XX.
10825 102.         .         .         O         .         .         .         .         .         .         .         .       XX.
10830 103.         .         .       O .         .         .         .         .         .         .         .         .       XX.
10835 104.         .         .     O   .         .         .         .         .         .         .         .         .       XX.
10840 105.         .         .    O    .         .         .         .         .         .         .         .         .       XX.
10845 106.         .         .   O     .         .         .         .         .         .         .         .         .       XX.
10850 107.         .         .  O      .         .         .         .         .         .         .         .         .       XX.
10855 108.         .         .  O      .         .         .         .         .         .         .         .         .       XX.
10900 109.         .         . O       .         .         .         .         .         .         .         .         .       XX.
10905 110.         .         . O       .         .         .         .         .         .         .         .         .       LX.
10910 111. . . . . . . . . . .O. . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .X.
10915 112.         .         .O        .         .         .         .         .         .         .         .         .       LX.
10920 113.         .         O         .         .         .         .         .         .         .         .         .       LX.
10925 114.         .        O.         .         .         .         .         .         .         .         .         .       LX.
10930 115.         .        O.         .         .         .         .         .         .         .         .         .       LX.
10935 116.         .       O .         .         .         .         .         .         .         .         .         .       LX.
10940 117.         .      O  .         .         .         .         .         .         .         .         .         .       LX.
10945 118.         .      O  .         .         .         .         .         .         .         .         .         .       LX.
10950 119.         .      O  .         .         .         .         .         .         .         .         .         .       LX.
10955 120.         .     O   .         .         .         .         .         .         .         .         .         .       LX.
11000 121. . . . . . . O . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .X.
11005 122.         .     O   .         .         .         .         .         .         .         .         .         .       XX.
11010 123.         .     O   .         .         .         .         .         .         .         .         .         .       XX.
11015 124.         .     O   .         .         .         .         .         .         .         .         .         .       XX.
11020 125.         .      O  .         .         .         .         .         .         .         .         .         .       XX.
11025 126.         .      O  .         .         .         .         .         .         .         .         .         .       XX.
11030 127.         .       O .         .         .         .         .         .         .         .         .         .       XX.
11035 128.         .        O.         .         .         .         .         .         .         .         .         .       XX.
11040 129.         .        O.         .         .         .         .         .         .         .         .         .       XX.
11045 130.         .         O         .         .         .         .         .         .         .         .         .       XX.
11050 131. . . . . . . . . O . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . XX.
11055 132.         .         .O        .         .         .         .         .         .         .         .         .       XX.
11100 133.         .         .O        .         .         .         .         .         .         .         .         .       XX.
11105 134.         .         .O        .         .         .         .         .         .         .         .         .      LXX.
11110 135.         .         .O        .         .         .         .         .         .         .         .         .      LXX.
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11115 136.         .         . O       .         .         .         .         .         .         .         .         .      LXX.
11120 137.         .         . O       .         .         .         .         .         .         .         .         .      LXX.
11125 138.         .         .  O      .         .         .         .         .         .         .         .         .      LXX.
11130 139.         .         .  O      .         .         .         .         .         .         .         .         .      LXX.
11135 140.         .         .   O     .         .         .         .         .         .         .         .         .      LXX.
11140 141. . . . . . . . . . . .O. . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . XX.
11145 142.         .         .    O    .         .         .         .         .         .         .         .         .      LXX.
11150 143.         .         .    O    .         .         .         .         .         .         .         .         .      LXX.
11155 144.         .         .     O   .         .         .         .         .         .         .         .         .      LXX.
11200 145.         .         .     O   .         .         .         .         .         .         .         .         .      LXX.
11205 146.         .         .     O   .         .         .         .         .         .         .         .         .       XX.
11210 147.         .         .     O   .         .         .         .         .         .         .         .         .       XX.
11215 148.         .         .    O    .         .         .         .         .         .         .         .         .       XX.
11220 149.         .         .    O    .         .         .         .         .         .         .         .         .       XX.
11225 150.         .         .   O     .         .         .         .         .         .         .         .         .       XX.
11230 151. . . . . . . . . . . .O. . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . XX.
11235 152.         .         .  O      .         .         .         .         .         .         .         .         .       XX.
11240 153.         .         . O       .         .         .         .         .         .         .         .         .       XX.
11245 154.         .         . O       .         .         .         .         .         .         .         .         .       XX.
11250 155.         .         .O        .         .         .         .         .         .         .         .         .       XX.
11255 156.         .         .O        .         .         .         .         .         .         .         .         .       XX.
11300 157.         .         .O        .         .         .         .         .         .         .         .         .       XX.
11305 158.         .         .O        .         .         .         .         .         .         .         .         .       XX.
11310 159.         .         O         .         .         .         .         .         .         .         .         .       XX.
11315 160.         .         O         .         .         .         .         .         .         .         .         .       XX.
11320 161. . . . . . . . . . O . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . XX.
11325 162.         .         O         .         .         .         .         .         .         .         .         .       XX.
11330 163.         .         O         .         .         .         .         .         .         .         .         .       XX.
11335 164.         .         O         .         .         .         .         .         .         .         .         .       XX.
11340 165.         .         O         .         .         .         .         .         .         .         .         .       XX.
11345 166.         .         O         .         .         .         .         .         .         .         .         .       XX.
11350 167.         .         .O        .         .         .         .         .         .         .         .         .       XX.
11355 168.         .         .O        .         .         .         .         .         .         .         .         .       XX.
11400 169.         .         .O        .         .         .         .         .         .         .         .         .       XX.
11405 170.         .         .O        .         .         .         .         .         .         .         .         .        X.
11410 171. . . . . . . . . . O . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .X.
11415 172.         .         O         .         .         .         .         .         .         .         .         .        X.
11420 173.         .         O         .         .         .         .         .         .         .         .         .        X.
11425 174.         .        O.         .         .         .         .         .         .         .         .         .        X.
11430 175.         .       O .         .         .         .         .         .         .         .         .         .        X.
11435 176.         .      O  .         .         .         .         .         .         .         .         .         .        X.
11440 177.         .      O  .         .         .         .         .         .         .         .         .         .        X.
11445 178.         .     O   .         .         .         .         .         .         .         .         .         .        X.
11450 179.         .     O   .         .         .         .         .         .         .         .         .         .        X.
11455 180.         .     O   .         .         .         .         .         .         .         .         .         .        X.
11500 181. . . . . . . O . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .X.
11505 182.         .    O    .         .         .         .         .         .         .         .         .         .       XX.
11510 183.         .    O    .         .         .         .         .         .         .         .         .         .       XX.
11515 184.         .    O    .         .         .         .         .         .         .         .         .         .       XX.
11520 185.         .    O    .         .         .         .         .         .         .         .         .         .       XX.
11525 186.         .    O    .         .         .         .         .         .         .         .         .         .       XX.
11530 187.         .     O   .         .         .         .         .         .         .         .         .         .       XX.
11535 188.         .     O   .         .         .         .         .         .         .         .         .         .       XX.
11540 189.         .     O   .         .         .         .         .         .         .         .         .         .       XX.
11545 190.         .     O   .         .         .         .         .         .         .         .         .         .       XX.
11550 191. . . . . . . O . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .X.
11555 192.         .      O  .         .         .         .         .         .         .         .         .         .       XX.
11600 193.         .     O   .         .         .         .         .         .         .         .         .         .       XX.
11605 194.         .     O   .         .         .         .         .         .         .         .         .         .        X.
11610 195.         .     O   .         .         .         .         .         .         .         .         .         .        X.
11615 196.         .     O   .         .         .         .         .         .         .         .         .         .        X.
11620 197.         .     O   .         .         .         .         .         .         .         .         .         .        X.
11625 198.         .     O   .         .         .         .         .         .         .         .         .         .        X.
11630 199.         .     O   .         .         .         .         .         .         .         .         .         .        X.
11635 200.         .     O   .         .         .         .         .         .         .         .         .         .        X.
11640 201. . . . . . .O. . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .X.
11645 202.         .    O    .         .         .         .         .         .         .         .         .         .        X.
11650 203.         .    O    .         .         .         .         .         .         .         .         .         .        X.
11655 204.         .    O    .         .         .         .         .         .         .         .         .         .        X.
11700 205.         .    O    .         .         .         .         .         .         .         .         .         .        X.
11705 206.         .    O    .         .         .         .         .         .         .         .         .         .        X.
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11710 207.         .    O    .         .         .         .         .         .         .         .         .         .         X.
11715 208.         .   O     .         .         .         .         .         .         .         .         .         .         X.
11720 209.         .   O     .         .         .         .         .         .         .         .         .         .         X.
11725 210.         .  O      .         .         .         .         .         .         .         .         .         .         X.
11730 211. . . . . . O . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . X.
11735 212.         .O        .         .         .         .         .         .         .         .         .         .         X.
11740 213.         .O        .         .         .         .         .         .         .         .         .         .         X.
11745 214.         O         .         .         .         .         .         .         .         .         .         .         X.
11750 215.         O         .         .         .         .         .         .         .         .         .         .         X.
11755 216.        O.         .         .         .         .         .         .         .         .         .         .         X.
11800 217.        O.         .         .         .         .         .         .         .         .         .         .         X.
11805 218.        O.         .         .         .         .         .         .         .         .         .         .         X.
11810 219.        O.         .         .         .         .         .         .         .         .         .         .         X.
11815 220.        O.         .         .         .         .         .         .         .         .         .         .         X.
11820 221. . . . .O. . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . X.
11825 222.        O.         .         .         .         .         .         .         .         .         .         .         X.
11830 223.        O.         .         .         .         .         .         .         .         .         .         .         X.
11835 224.         O         .         .         .         .         .         .         .         .         .         .         X.
11840 225.         O         .         .         .         .         .         .         .         .         .         .         X.
11845 226.         O         .         .         .         .         .         .         .         .         .         .         X.
11850 227.         O         .         .         .         .         .         .         .         .         .         .         X.
11855 228.         O         .         .         .         .         .         .         .         .         .         .         X.
11900 229.         O         .         .         .         .         .         .         .         .         .         .         X.
11905 230.         .O        .         .         .         .         .         .         .         .         .         .         X.
11910 231. . . . . .O. . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . X.
11915 232.         .O        .         .         .         .         .         .         .         .         .         .         X.
11920 233.         .O        .         .         .         .         .         .         .         .         .         .         X.
11925 234.         .O        .         .         .         .         .         .         .         .         .         .         X.
11930 235.         .O        .         .         .         .         .         .         .         .         .         .         X.
11935 236.         .O        .         .         .         .         .         .         .         .         .         .         X.
11940 237.         .O        .         .         .         .         .         .         .         .         .         .         X.
11945 238.         .O        .         .         .         .         .         .         .         .         .         .         X.
11950 239.         .O        .         .         .         .         .         .         .         .         .         .         X.
11955 240.         .O        .         .         .         .         .         .         .         .         .         .         X.
12000 241. . . . . .O. . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . X.
12005 242.         .O        .         .         .         .         .         .         .         .         .         .         X.
12010 243.         .O        .         .         .         .         .         .         .         .         .         .         X.
12015 244.         .O        .         .         .         .         .         .         .         .         .         .         X.
12020 245.         .O        .         .         .         .         .         .         .         .         .         .         X.
12025 246.         O         .         .         .         .         .         .         .         .         .         .         X.
12030 247.         O         .         .         .         .         .         .         .         .         .         .         X.
12035 248.         O         .         .         .         .         .         .         .         .         .         .         X.
12040 249.         O         .         .         .         .         .         .         .         .         .         .         X.
12045 250.         O         .         .         .         .         .         .         .         .         .         .         X.
12050 251. . . . . O . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . X.
12055 252.         O         .         .         .         .         .         .         .         .         .         .         X.
12100 253.         O         .         .         .         .         .         .         .         .         .         .         X.
12105 254.         O         .         .         .         .         .         .         .         .         .         .        XX.
12110 255.         O         .         .         .         .         .         .         .         .         .         .        XX.
12115 256.         .O        .         .         .         .         .         .         .         .         .         .        XX.
12120 257.         . O       .         .         .         .         .         .         .         .         .         .        XX.
12125 258.         .   O     .         .         .         .         .         .         .         .         .         .        XX.
12130 259.         .     O   .         .         .         .         .         .         .         .         .         .        XX.
12135 260.         .       O .         .         .         .         .         .         .         .         .         .        XX.
12140 261. . . . . . . . . .O. . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .XX.
12145 262.         .         O         .         .         .         .         .         .         .         .         .        XX.
12150 263.         .         .O        .         .         .         .         .         .         .         .         .        XX.
12155 264.         .         . O       .         .         .         .         .         .         .         .         .        XX.
12200 265.         .         . O       .         .         .         .         .         .         .         .         .        XX.
12205 266.         .         . O       .         .         .         .         .         .         .         .         .        XX.
12210 267.         .         .  O      .         .         .         .         .         .         .         .         .        XX.
12215 268.         .         .  O      .         .         .         .         .         .         .         .         .        XX.
12220 269.         .         .  O      .         .         .         .         .         .         .         .         .        XX.
12225 270.         .         . O       .         .         .         .         .         .         .         .         .        XX.
12230 271. . . . . . . . . . . O . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .XX.
12235 272.         .         .O        .         .         .         .         .         .         .         .         .        XX.
12240 273.         .         .O        .         .         .         .         .         .         .         .         .        XX.
12245 274.         .         .O        .         .         .         .         .         .         .         .         .        XX.
12250 275.         .         .O        .         .         .         .         .         .         .         .         .        XX.
12255 276.         .         O         .         .         .         .         .         .         .         .         .        XX.
12300 277.         .         O         .         .         .         .         .         .         .         .         .        XX.
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12305 278.         .         O         .         .         .         .         .         .         .         .         .        X.
12310 279.         .         O         .         .         .         .         .         .         .         .         .        X.
12315 280.         .        O.         .         .         .         .         .         .         .         .         .        X.
12320 281. . . . . . . . O . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .X.
12325 282.         .      O  .         .         .         .         .         .         .         .         .         .        X.
12330 283.         .    O    .         .         .         .         .         .         .         .         .         .        X.
12335 284.         .   O     .         .         .         .         .         .         .         .         .         .        X.
12340 285.         .  O      .         .         .         .         .         .         .         .         .         .        X.
12345 286.         . O       .         .         .         .         .         .         .         .         .         .        X.
12350 287.         . O       .         .         .         .         .         .         .         .         .         .        X.
12355 288.         .O        .         .         .         .         .         .         .         .         .         .        X.
20000 289.         .O        .         .         .         .         .         .         .         .         .         .        X.
20005 290.         O         .         .         .         .         .         .         .         .         .         .         .
20010 291. . . . . O . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .
20015 292.        O.         .         .         .         .         .         .         .         .         .         .         .
20020 293.       O .         .         .         .         .         .         .         .         .         .         .         .
20025 294.      O  .         .         .         .         .         .         .         .         .         .         .         .
20030 295.     O   .         .         .         .         .         .         .         .         .         .         .         .
20035 296.    O    .         .         .         .         .         .         .         .         .         .         .         .
20040 297.   O     .         .         .         .         .         .         .         .         .         .         .         .
20045 298.  O      .         .         .         .         .         .         .         .         .         .         .         .
20050 299. O       .         .         .         .         .         .         .         .         .         .         .         .
20055 300.-O-------.---------.---------.---------.---------.---------.---------.---------.---------.---------.---------.---------.
```

RUNOFF SUMMARY
FLOW IN CUBIC FEET PER SECOND
TIME IN HOURS, AREA IN SQUARE MILES

	OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA	MAXIMUM STAGE	TIME OF MAX STAGE
+	HYDROGRAPH AT	BASIN	320.	6.67	138.	76.	73.	.56		

*** NORMAL END OF HEC-1 ***

```
*****************************************                          ***************************************
*                                       *                          *                                     *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *                          *   U.S. ARMY CORPS OF ENGINEERS      *
*              JUN   1998               *                          *   HYDROLOGIC ENGINEERING CENTER     *
*           VERSION 4.1                 *                          *         609 SECOND STREET           *
*                                       *                          *      DAVIS, CALIFORNIA 95616        *
*  RUN DATE   08MAY23  TIME  20:23:51   *                          *           (916) 756-1104            *
*                                       *                          *                                     *
*****************************************                          ***************************************
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```
X     X  XXXXXXX   XXXXX           X
X     X  X        X     X         XX
X     X  X        X                X
XXXXXXX  XXXX     X        XXXXX   X
X     X  X        X                X
X     X  X        X     X          X
X     X  XXXXXXX   XXXXX          XXX
```

THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.
THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION
NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,
DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL   LOSS RATE:GREEN AND AMPT INFILTRATION
KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM

```
LINE        ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

            *DIAGRAM
*** FREE ***
            ID   PERMANENTE QUARRY
            ID   EXISTING CONDITIONS - NORTH QUARRY/WMSA
            ID   100-YEAR FLOW RATE
            ID   COUNTY OF SANTA CLARA HYDROGRAPH METHOD
            IT       5       0       0     300
            IO       5       2

            KK   BASIN
            IN       5
            PB    7.63
            PI  0.0015  0.0015  0.0015  0.0015  0.0015  0.0015  0.0015  0.0015  0.0015   0.001
            PI  0.0015  0.0015  0.0014  0.0014  0.0014  0.0014  0.0014  0.0014  0.0014   0.001
            PI  0.0014  0.0014  0.0014  0.0014  0.0030  0.0030  0.0030  0.0030  0.0030   0.003
            PI  0.0030  0.0030  0.0030  0.0030  0.0030  0.0030  0.0062  0.0062  0.0062   0.006
            PI  0.0062  0.0062  0.0062  0.0062  0.0062  0.0062  0.0062  0.0062  0.0055   0.005
            PI  0.0055  0.0055  0.0055  0.0055  0.0055  0.0055  0.0055  0.0055  0.0055   0.005
            PI  0.0053  0.0053  0.0053  0.0053  0.0053  0.0053  0.0053  0.0053  0.0053   0.005
            PI  0.0053  0.0053  0.0345  0.0345  0.0103  0.0103  0.0103  0.0103  0.0094   0.009
            PI  0.0094  0.0094  0.0094  0.0094  0.0053  0.0053  0.0053  0.0053  0.0053   0.005
            PI  0.0053  0.0053  0.0053  0.0053  0.0053  0.0053  0.0033  0.0033  0.0033   0.003
            PI  0.0033  0.0033  0.0033  0.0033  0.0033  0.0033  0.0033  0.0033  0.0025   0.002
            PI  0.0025  0.0025  0.0025  0.0025  0.0025  0.0025  0.0025  0.0025  0.0025   0.002
            PI  0.0034  0.0034  0.0034  0.0034  0.0034  0.0034  0.0034  0.0034  0.0034   0.003
            PI  0.0034  0.0034  0.0041  0.0041  0.0041  0.0041  0.0041  0.0041  0.0041   0.004
            PI  0.0041  0.0041  0.0041  0.0041  0.0031  0.0031  0.0031  0.0031  0.0031   0.003
            PI  0.0031  0.0031  0.0031  0.0031  0.0031  0.0031  0.0032  0.0032  0.0032   0.003
            PI  0.0032  0.0032  0.0032  0.0032  0.0032  0.0032  0.0032  0.0032  0.0023   0.002
            PI  0.0023  0.0023  0.0023  0.0023  0.0023  0.0023  0.0023  0.0023  0.0023   0.002
            PI  0.0026  0.0026  0.0026  0.0026  0.0026  0.0026  0.0026  0.0026  0.0026   0.002
            PI  0.0026  0.0026  0.0023  0.0023  0.0023  0.0023  0.0023  0.0023  0.0023   0.002
            PI  0.0023  0.0023  0.0023  0.0023  0.0013  0.0013  0.0013  0.0013  0.0013   0.001
            PI  0.0013  0.0013  0.0013  0.0013  0.0013  0.0013  0.0017  0.0017  0.0017   0.001
            PI  0.0017  0.0017  0.0017  0.0017  0.0017  0.0017  0.0017  0.0017  0.0018   0.001
            PI  0.0018  0.0018  0.0018  0.0018  0.0018  0.0018  0.0018  0.0018  0.0018   0.001
            PI  0.0015  0.0015  0.0015  0.0015  0.0015  0.0015  0.0015  0.0015  0.0015   0.001
            PI  0.0015  0.0015  0.0037  0.0037  0.0037  0.0037  0.0037  0.0037  0.0037   0.003
            PI  0.0037  0.0037  0.0037  0.0037  0.0030  0.0030  0.0030  0.0030  0.0030   0.003
            PI  0.0030  0.0030  0.0030  0.0030  0.0030  0.0030  0.0015  0.0015  0.0015   0.001
            PI  0.0015  0.0015  0.0015  0.0015  0.0015  0.0015  0.0015  0.0015
            BA  0.5641
            LS    0.22      90
            UD    0.46
            ZZ
```

```
               SCHEMATIC DIAGRAM OF STREAM NETWORK
INPUT
 LINE     (V) ROUTING         (--->) DIVERSION OR PUMP FLOW

  NO.     (.) CONNECTOR       (<---) RETURN OF DIVERTED OR PUMPED FLOW

   7       BASIN

(***) RUNOFF ALSO COMPUTED AT THIS LOCATION
****************************************                                                  ****************************************
*                                      *                                                  *                                      *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *                                                  *   U.S. ARMY CORPS OF ENGINEERS       *
*              JUN  1998               *                                                  *   HYDROLOGIC ENGINEERING CENTER      *
*            VERSION 4.1               *                                                  *         609 SECOND STREET            *
*                                      *                                                  *      DAVIS, CALIFORNIA 95616         *
* RUN DATE  08MAY23  TIME  20:23:51    *                                                  *          (916) 756-1104              *
*                                      *                                                  *                                      *
****************************************                                                  ****************************************



                          PERMANENTE QUARRY
                          EXISTING CONDITIONS - NORTH QUARRY/WMSA
                          100-YEAR FLOW RATE
                          COUNTY OF SANTA CLARA HYDROGRAPH METHOD

  6 IO         OUTPUT CONTROL VARIABLES
                     IPRNT          5  PRINT CONTROL
                     IPLOT          2  PLOT CONTROL
                     QSCAL         0.  HYDROGRAPH PLOT SCALE

    IT         HYDROGRAPH TIME DATA
                      NMIN          5  MINUTES IN COMPUTATION INTERVAL
                     IDATE     1    0  STARTING DATE
                     ITIME       0000  STARTING TIME
                        NQ        300  NUMBER OF HYDROGRAPH ORDINATES
                    NDDATE     2    0  ENDING DATE
                    NDTIME       0055  ENDING TIME
                     ICENT         19  CENTURY MARK

                 COMPUTATION INTERVAL    .08 HOURS
                      TOTAL TIME BASE  24.92 HOURS

       ENGLISH UNITS
            DRAINAGE AREA         SQUARE MILES
            PRECIPITATION DEPTH   INCHES
            LENGTH, ELEVATION     FEET
            FLOW                  CUBIC FEET PER SECOND
            STORAGE VOLUME        ACRE-FEET
            SURFACE AREA          ACRES
            TEMPERATURE           DEGREES FAHRENHEIT
```

```
                                                         STATION    BASIN

                         (O) OUTFLOW
         0.       50.      100.      150.      200.      250.      300.      350.      400.      450.        0.        0.        0.
                                                                                                       (L) PRECIP,   (X) EXCESS
         .0        .0        .0        .0        .0        .0        .0        .0        .0        .3        .2        .1        .0
DAHRMN PER
 10000   1O---------.---------.---------.---------.---------.---------.---------.---------.---------.---------.---------.---------.
 10005   2O         .         .         .         .         .         .         .         .         .         .         .        L.
 10010   3O         .         .         .         .         .         .         .         .         .         .         .        L.
 10015   4O         .         .         .         .         .         .         .         .         .         .         .        L.
 10020   5O         .         .         .         .         .         .         .         .         .         .         .        L.
 10025   6O         .         .         .         .         .         .         .         .         .         .         .        L.
 10030   7O         .         .         .         .         .         .         .         .         .         .         .        L.
 10035   8O         .         .         .         .         .         .         .         .         .         .         .        L.
 10040   9O         .         .         .         .         .         .         .         .         .         .         .        L.
 10045  10O         .         .         .         .         .         .         .         .         .         .         .        L.
 10050  11O . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .L.
 10055  12O         .         .         .         .         .         .         .         .         .         .         .        L.
 10100  13O         .         .         .         .         .         .         .         .         .         .         .        L.
 10105  14O         .         .         .         .         .         .         .         .         .         .         .        L.
 10110  15O         .         .         .         .         .         .         .         .         .         .         .        L.
 10115  16O         .         .         .         .         .         .         .         .         .         .         .        L.
 10120  17O         .         .         .         .         .         .         .         .         .         .         .        L.
 10125  18O         .         .         .         .         .         .         .         .         .         .         .        L.
 10130  19O         .         .         .         .         .         .         .         .         .         .         .        L.
 10135  20O         .         .         .         .         .         .         .         .         .         .         .        L.
 10140  21O . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .L.
 10145  22O         .         .         .         .         .         .         .         .         .         .         .        L.
 10150  23O         .         .         .         .         .         .         .         .         .         .         .        L.
 10155  24O         .         .         .         .         .         .         .         .         .         .         .        L.
 10200  25O         .         .         .         .         .         .         .         .         .         .         .        L.
 10205  26O         .         .         .         .         .         .         .         .         .         .         .       LL.
 10210  27O         .         .         .         .         .         .         .         .         .         .         .       LL.
 10215  28O         .         .         .         .         .         .         .         .         .         .         .       LL.
 10220  29.O        .         .         .         .         .         .         .         .         .         .         .       LL.
 10225  30.O        .         .         .         .         .         .         .         .         .         .         .       LX.
 10230  31.O. . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . LX.
 10235  32. O       .         .         .         .         .         .         .         .         .         .         .       LX.
 10240  33. O       .         .         .         .         .         .         .         .         .         .         .       LX.
 10245  34.  O      .         .         .         .         .         .         .         .         .         .         .       LX.
 10250  35.  O      .         .         .         .         .         .         .         .         .         .         .       LX.
 10255  36.   O     .         .         .         .         .         .         .         .         .         .         .       LX.
 10300  37.   O     .         .         .         .         .         .         .         .         .         .         .       LX.
 10305  38.    O    .         .         .         .         .         .         .         .         .         .         .    LLLXX.
 10310  39.     O   .         .         .         .         .         .         .         .         .         .         .    LLLXX.
 10315  40.      O  .         .         .         .         .         .         .         .         .         .         .    LLLXX.
 10320  41. . . . O . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .LLLXX.
 10325  42.         O         .         .         .         .         .         .         .         .         .         .    LLXXX.
 10330  43.         . O       .         .         .         .         .         .         .         .         .         .    LLXXX.
 10335  44.         .   O     .         .         .         .         .         .         .         .         .         .    LLXXX.
 10340  45.         .     O   .         .         .         .         .         .         .         .         .         .    LLXXX.
 10345  46.         .      O  .         .         .         .         .         .         .         .         .         .    LLXXX.
 10350  47.         .        O.         .         .         .         .         .         .         .         .         .    LLXXX.
 10355  48.         .         O         .         .         .         .         .         .         .         .         .    LLXXX.
 10400  49.         .         . O       .         .         .         .         .         .         .         .         .    LLXXX.
 10405  50.         .         .  O      .         .         .         .         .         .         .         .         .     LXXX.
 10410  51. . . . . . . . . . . . O . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . LXXX.
 10415  52.         .         .    O    .         .         .         .         .         .         .         .         .     LXXX.
 10420  53.         .         .    O    .         .         .         .         .         .         .         .         .     LXXX.
 10425  54.         .         .    O    .         .         .         .         .         .         .         .         .     LXXX.
 10430  55.         .         .     O   .         .         .         .         .         .         .         .         .     LXXX.
 10435  56.         .         .     O   .         .         .         .         .         .         .         .         .     LXXX.
 10440  57.         .         .     O   .         .         .         .         .         .         .         .         .     LXXX.
 10445  58.         .         .      O  .         .         .         .         .         .         .         .         .     LXXX.
 10450  59.         .         .      O  .         .         .         .         .         .         .         .         .     LXXX.
 10455  60.         .         .      O  .         .         .         .         .         .         .         .         .     LXXX.
 10500  61. . . . . . . . . . . . . . O . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . LXXX.
 10505  62.         .         .       O .         .         .         .         .         .         .         .         .     LXXX.
 10510  63.         .         .       O .         .         .         .         .         .         .         .         .     LXXX.
 10515  64.         .         .       O .         .         .         .         .         .         .         .         .     LXXX.
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10520  65.         .         .       O .         .         .         .         .         .         .         .         .     LXXX.
10525  66.         .         .       O .         .         .         .         .         .         .         .         .     LXXX.
10530  67.         .         .        O.         .         .         .         .         .         .         .         .     LXXX.
10535  68.         .         .        O.         .         .         .         .         .         .         .         .     LXXX.
10540  69.         .         .        O.         .         .         .         .         .         .         .         .     LXXX.
10545  70.         .         .        O.         .         .         .         .         .         .         .         .     LXXX.
10550  71. . . . . . . . . . . . . . .O. . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . LXXX.
10555  72.         .         .        O.         .         .         .         .         .         .         .         .     LXXX.
10600  73.         .         .         O         .         .         .         .         .         .         .         .     XXXX.
10605  74.         .         .         .O        .         .         .         .         .         .  LLLLXXXXXXXXXXXXXXXXXXXXXXX.
10610  75.         .         .         .     O   .         .         .         .         .         .  LLLXXXXXXXXXXXXXXXXXXXXXXXX.
10615  76.         .         .         .         .    O    .         .         .         .         .         .         . LXXXXXXX.
10620  77.         .         .         .         .         .       O .         .         .         .         .         . LXXXXXXX.
10625  78.         .         .         .         .         .         .         O         .         .         .         . LXXXXXXX.
10630  79.         .         .         .         .         .         .         .        O.         .         .         . LXXXXXXX.
10635  80.         .         .         .         .         .         .         .         .  O      .         .         .  XXXXXXX.
10640  81. . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .O. . . . . . . . . . . . . .LXXXXXX.
10645  82.         .         .         .         .         .         .         .         .O        .         .         .  XXXXXXX.
10650  83.         .         .         .         .         .         .         .     O   .         .         .         .  XXXXXXX.
10655  84.         .         .         .         .         .         .         . O       .         .         .         .  XXXXXXX.
10700  85.         .         .         .         .         .         .        O.         .         .         .         .  XXXXXXX.
10705  86.         .         .         .         .         .         .     O   .         .         .         .         .     XXXX.
10710  87.         .         .         .         .         .         .   O     .         .         .         .         .     XXXX.
10715  88.         .         .         .         .         .         .O        .         .         .         .         .     XXXX.
10720  89.         .         .         .         .         .      O  .         .         .         .         .         .     XXXX.
10725  90.         .         .         .         .         .  O      .         .         .         .         .         .     XXXX.
10730  91. . . . . . . . . . . . . . . . . . . . . . . . O . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . XXXX.
10735  92.         .         .         .         .     O   .         .         .         .         .         .         .     XXXX.
10740  93.         .         .         .         .  O      .         .         .         .         .         .         .     XXXX.
10745  94.         .         .         .         .O        .         .         .         .         .         .         .     XXXX.
10750  95.         .         .         .        O.         .         .         .         .         .         .         .     XXXX.
10755  96.         .         .         .       O .         .         .         .         .         .         .         .     XXXX.
10800  97.         .         .         .      O  .         .         .         .         .         .         .         .     XXXX.
10805  98.         .         .         .     O   .         .         .         .         .         .         .         .      LXX.
10810  99.         .         .         .    O    .         .         .         .         .         .         .         .      LXX.
10815 100.         .         .         .   O     .         .         .         .         .         .         .         .      LXX.
10820 101. . . . . . . . . . . . . . . . O . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . XX.
10825 102.         .         .         O         .         .         .         .         .         .         .         .      LXX.
10830 103.         .         .        O.         .         .         .         .         .         .         .         .      LXX.
10835 104.         .         .      O  .         .         .         .         .         .         .         .         .      LXX.
10840 105.         .         .    O    .         .         .         .         .         .         .         .         .      LXX.
10845 106.         .         .   O     .         .         .         .         .         .         .         .         .      LXX.
10850 107.         .         .  O      .         .         .         .         .         .         .         .         .      LXX.
10855 108.         .         .  O      .         .         .         .         .         .         .         .         .      LXX.
10900 109.         .         . O       .         .         .         .         .         .         .         .         .      LXX.
10905 110.         .         . O       .         .         .         .         .         .         .         .         .       XX.
10910 111. . . . . . . . . . . O . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . LX.
10915 112.         .         .O        .         .         .         .         .         .         .         .         .       XX.
10920 113.         .         O         .         .         .         .         .         .         .         .         .       XX.
10925 114.         .         O         .         .         .         .         .         .         .         .         .       XX.
10930 115.         .        O.         .         .         .         .         .         .         .         .         .       XX.
10935 116.         .       O .         .         .         .         .         .         .         .         .         .       XX.
10940 117.         .       O .         .         .         .         .         .         .         .         .         .       XX.
10945 118.         .      O  .         .         .         .         .         .         .         .         .         .       XX.
10950 119.         .      O  .         .         .         .         .         .         .         .         .         .       XX.
10955 120.         .      O  .         .         .         .         .         .         .         .         .         .       XX.
11000 121. . . . . . . . .O. . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . LX.
11005 122.         .     O   .         .         .         .         .         .         .         .         .         .      XXX.
11010 123.         .     O   .         .         .         .         .         .         .         .         .         .      XXX.
11015 124.         .      O  .         .         .         .         .         .         .         .         .         .      XXX.
11020 125.         .      O  .         .         .         .         .         .         .         .         .         .      XXX.
11025 126.         .       O .         .         .         .         .         .         .         .         .         .      XXX.
11030 127.         .       O .         .         .         .         .         .         .         .         .         .      XXX.
11035 128.         .        O.         .         .         .         .         .         .         .         .         .      XXX.
11040 129.         .         O         .         .         .         .         .         .         .         .         .      XXX.
11045 130.         .         O         .         .         .         .         .         .         .         .         .      XXX.
11050 131. . . . . . . . . . .O. . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . XX.
11055 132.         .         .O        .         .         .         .         .         .         .         .         .      XXX.
11100 133.         .         .O        .         .         .         .         .         .         .         .         .      XXX.
11105 134.         .         .O        .         .         .         .         .         .         .         .         .      XXX.
11110 135.         .         .O        .         .         .         .         .         .         .         .         .      XXX.
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11115 136.         .         . O       .         .         .         .         .         .         .         .         .      XXX.
11120 137.         .         . O       .         .         .         .         .         .         .         .         .      XXX.
11125 138.         .         .  O      .         .         .         .         .         .         .         .         .      XXX.
11130 139.         .         .   O     .         .         .         .         .         .         .         .         .      XXX.
11135 140.         .         .   O     .         .         .         .         .         .         .         .         .      XXX.
11140 141. . . . . . . . . . . . .O. . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .XXX.
11145 142.         .         .    O    .         .         .         .         .         .         .         .         .      XXX.
11150 143.         .         .     O   .         .         .         .         .         .         .         .         .      XXX.
11155 144.         .         .     O   .         .         .         .         .         .         .         .         .      XXX.
11200 145.         .         .     O   .         .         .         .         .         .         .         .         .      XXX.
11205 146.         .         .     O   .         .         .         .         .         .         .         .         .       XX.
11210 147.         .         .     O   .         .         .         .         .         .         .         .         .       XX.
11215 148.         .         .     O   .         .         .         .         .         .         .         .         .       XX.
11220 149.         .         .    O    .         .         .         .         .         .         .         .         .       XX.
11225 150.         .         .   O     .         .         .         .         .         .         .         .         .       XX.
11230 151. . . . . . . . . . . . O . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . XX.
11235 152.         .         .  O      .         .         .         .         .         .         .         .         .       XX.
11240 153.         .         . O       .         .         .         .         .         .         .         .         .       XX.
11245 154.         .         . O       .         .         .         .         .         .         .         .         .       XX.
11250 155.         .         .O        .         .         .         .         .         .         .         .         .       XX.
11255 156.         .         .O        .         .         .         .         .         .         .         .         .       XX.
11300 157.         .         .O        .         .         .         .         .         .         .         .         .       XX.
11305 158.         .         .O        .         .         .         .         .         .         .         .         .       XX.
11310 159.         .         .O        .         .         .         .         .         .         .         .         .       XX.
11315 160.         .         .O        .         .         .         .         .         .         .         .         .       XX.
11320 161. . . . . . . . . . .O. . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . XX.
11325 162.         .         .O        .         .         .         .         .         .         .         .         .       XX.
11330 163.         .         .O        .         .         .         .         .         .         .         .         .       XX.
11335 164.         .         .O        .         .         .         .         .         .         .         .         .       XX.
11340 165.         .         .O        .         .         .         .         .         .         .         .         .       XX.
11345 166.         .         .O        .         .         .         .         .         .         .         .         .       XX.
11350 167.         .         .O        .         .         .         .         .         .         .         .         .       XX.
11355 168.         .         .O        .         .         .         .         .         .         .         .         .       XX.
11400 169.         .         .O        .         .         .         .         .         .         .         .         .       XX.
11405 170.         .         .O        .         .         .         .         .         .         .         .         .       XX.
11410 171. . . . . . . . . . .O. . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . LX.
11415 172.         .         O         .         .         .         .         .         .         .         .         .       XX.
11420 173.         .         O         .         .         .         .         .         .         .         .         .       XX.
11425 174.         .        O.         .         .         .         .         .         .         .         .         .       XX.
11430 175.         .       O .         .         .         .         .         .         .         .         .         .       XX.
11435 176.         .      O  .         .         .         .         .         .         .         .         .         .       XX.
11440 177.         .      O  .         .         .         .         .         .         .         .         .         .       XX.
11445 178.         .     O   .         .         .         .         .         .         .         .         .         .       XX.
11450 179.         .     O   .         .         .         .         .         .         .         .         .         .       XX.
11455 180.         .     O   .         .         .         .         .         .         .         .         .         .       XX.
11500 181. . . . . . . . O . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . XX.
11505 182.         .    O    .         .         .         .         .         .         .         .         .         .       XX.
11510 183.         .    O    .         .         .         .         .         .         .         .         .         .       XX.
11515 184.         .    O    .         .         .         .         .         .         .         .         .         .       XX.
11520 185.         .    O    .         .         .         .         .         .         .         .         .         .       XX.
11525 186.         .     O   .         .         .         .         .         .         .         .         .         .       XX.
11530 187.         .     O   .         .         .         .         .         .         .         .         .         .       XX.
11535 188.         .     O   .         .         .         .         .         .         .         .         .         .       XX.
11540 189.         .     O   .         .         .         .         .         .         .         .         .         .       XX.
11545 190.         .     O   .         .         .         .         .         .         .         .         .         .       XX.
11550 191. . . . . . . . .O. . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . XX.
11555 192.         .      O  .         .         .         .         .         .         .         .         .         .       XX.
11600 193.         .      O  .         .         .         .         .         .         .         .         .         .       XX.
11605 194.         .     O   .         .         .         .         .         .         .         .         .         .       XX.
11610 195.         .     O   .         .         .         .         .         .         .         .         .         .       XX.
11615 196.         .     O   .         .         .         .         .         .         .         .         .         .       XX.
11620 197.         .     O   .         .         .         .         .         .         .         .         .         .       XX.
11625 198.         .     O   .         .         .         .         .         .         .         .         .         .       XX.
11630 199.         .     O   .         .         .         .         .         .         .         .         .         .       XX.
11635 200.         .     O   .         .         .         .         .         .         .         .         .         .       XX.
11640 201. . . . . . . . O . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . XX.
11645 202.         .    O    .         .         .         .         .         .         .         .         .         .       XX.
11650 203.         .    O    .         .         .         .         .         .         .         .         .         .       XX.
11655 204.         .    O    .         .         .         .         .         .         .         .         .         .       XX.
11700 205.         .    O    .         .         .         .         .         .         .         .         .         .       XX.
11705 206.         .    O    .         .         .         .         .         .         .         .         .         .        X.
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11710 207.         .    O    .         .         .         .         .         .         .         .         .         .        X.
11715 208.         .   O     .         .         .         .         .         .         .         .         .         .        X.
11720 209.         .   O     .         .         .         .         .         .         .         .         .         .        X.
11725 210.         .  O      .         .         .         .         .         .         .         .         .         .        X.
11730 211. . . . . . O . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .X.
11735 212.         .O        .         .         .         .         .         .         .         .         .         .        X.
11740 213.         .O        .         .         .         .         .         .         .         .         .         .        X.
11745 214.         O         .         .         .         .         .         .         .         .         .         .        X.
11750 215.         O         .         .         .         .         .         .         .         .         .         .        X.
11755 216.        O.         .         .         .         .         .         .         .         .         .         .        X.
11800 217.        O.         .         .         .         .         .         .         .         .         .         .        X.
11805 218.        O.         .         .         .         .         .         .         .         .         .         .        X.
11810 219.        O.         .         .         .         .         .         .         .         .         .         .        X.
11815 220.        O.         .         .         .         .         .         .         .         .         .         .        X.
11820 221. . . . .O. . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .X.
11825 222.        O.         .         .         .         .         .         .         .         .         .         .        X.
11830 223.         O         .         .         .         .         .         .         .         .         .         .        X.
11835 224.         O         .         .         .         .         .         .         .         .         .         .        X.
11840 225.         O         .         .         .         .         .         .         .         .         .         .        X.
11845 226.         O         .         .         .         .         .         .         .         .         .         .        X.
11850 227.         O         .         .         .         .         .         .         .         .         .         .        X.
11855 228.         O         .         .         .         .         .         .         .         .         .         .        X.
11900 229.         .O        .         .         .         .         .         .         .         .         .         .        X.
11905 230.         .O        .         .         .         .         .         .         .         .         .         .        X.
11910 231. . . . . .O. . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .X.
11915 232.         .O        .         .         .         .         .         .         .         .         .         .        X.
11920 233.         .O        .         .         .         .         .         .         .         .         .         .        X.
11925 234.         .O        .         .         .         .         .         .         .         .         .         .        X.
11930 235.         .O        .         .         .         .         .         .         .         .         .         .        X.
11935 236.         .O        .         .         .         .         .         .         .         .         .         .        X.
11940 237.         .O        .         .         .         .         .         .         .         .         .         .        X.
11945 238.         .O        .         .         .         .         .         .         .         .         .         .        X.
11950 239.         .O        .         .         .         .         .         .         .         .         .         .        X.
11955 240.         .O        .         .         .         .         .         .         .         .         .         .        X.
12000 241. . . . . .O. . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .X.
12005 242.         .O        .         .         .         .         .         .         .         .         .         .        X.
12010 243.         .O        .         .         .         .         .         .         .         .         .         .        X.
12015 244.         .O        .         .         .         .         .         .         .         .         .         .        X.
12020 245.         .O        .         .         .         .         .         .         .         .         .         .        X.
12025 246.         .O        .         .         .         .         .         .         .         .         .         .        X.
12030 247.         O         .         .         .         .         .         .         .         .         .         .        X.
12035 248.         O         .         .         .         .         .         .         .         .         .         .        X.
12040 249.         O         .         .         .         .         .         .         .         .         .         .        X.
12045 250.         O         .         .         .         .         .         .         .         .         .         .        X.
12050 251. . . . . O . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .X.
12055 252.         O         .         .         .         .         .         .         .         .         .         .        X.
12100 253.         O         .         .         .         .         .         .         .         .         .         .        X.
12105 254.         O         .         .         .         .         .         .         .         .         .         .      XXX.
12110 255.         O         .         .         .         .         .         .         .         .         .         .      XXX.
12115 256.         .O        .         .         .         .         .         .         .         .         .         .      XXX.
12120 257.         . O       .         .         .         .         .         .         .         .         .         .      XXX.
12125 258.         .   O     .         .         .         .         .         .         .         .         .         .      XXX.
12130 259.         .     O   .         .         .         .         .         .         .         .         .         .      XXX.
12135 260.         .       O .         .         .         .         .         .         .         .         .         .      XXX.
12140 261. . . . . . . . . .O. . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . XX.
12145 262.         .         O         .         .         .         .         .         .         .         .         .      XXX.
12150 263.         .         .O        .         .         .         .         .         .         .         .         .      XXX.
12155 264.         .         . O       .         .         .         .         .         .         .         .         .      XXX.
12200 265.         .         . O       .         .         .         .         .         .         .         .         .      XXX.
12205 266.         .         .  O      .         .         .         .         .         .         .         .         .       XX.
12210 267.         .         .  O      .         .         .         .         .         .         .         .         .       XX.
12215 268.         .         .  O      .         .         .         .         .         .         .         .         .       XX.
12220 269.         .         .  O      .         .         .         .         .         .         .         .         .       XX.
12225 270.         .         . O       .         .         .         .         .         .         .         .         .       XX.
12230 271. . . . . . . . . . . O . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . XX.
12235 272.         .         .O        .         .         .         .         .         .         .         .         .       XX.
12240 273.         .         .O        .         .         .         .         .         .         .         .         .       XX.
12245 274.         .         .O        .         .         .         .         .         .         .         .         .       XX.
12250 275.         .         .O        .         .         .         .         .         .         .         .         .       XX.
12255 276.         .         O         .         .         .         .         .         .         .         .         .       XX.
12300 277.         .         O         .         .         .         .         .         .         .         .         .       XX.
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12305 278.         .         O         .         .         .         .         .         .         .         .         .        X.
12310 279.         .         O         .         .         .         .         .         .         .         .         .        X.
12315 280.         .        O.         .         .         .         .         .         .         .         .         .        X.
12320 281. . . . . . . . . O . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .X.
12325 282.         .      O  .         .         .         .         .         .         .         .         .         .        X.
12330 283.         .    O    .         .         .         .         .         .         .         .         .         .        X.
12335 284.         .   O     .         .         .         .         .         .         .         .         .         .        X.
12340 285.         .  O      .         .         .         .         .         .         .         .         .         .        X.
12345 286.         . O       .         .         .         .         .         .         .         .         .         .        X.
12350 287.         . O       .         .         .         .         .         .         .         .         .         .        X.
12355 288.         .O        .         .         .         .         .         .         .         .         .         .        X.
20000 289.         .O        .         .         .         .         .         .         .         .         .         .        X.
20005 290.         .O        .         .         .         .         .         .         .         .         .         .         .
20010 291. . . . . O . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .
20015 292.        O.         .         .         .         .         .         .         .         .         .         .         .
20020 293.       O .         .         .         .         .         .         .         .         .         .         .         .
20025 294.      O  .         .         .         .         .         .         .         .         .         .         .         .
20030 295.     O   .         .         .         .         .         .         .         .         .         .         .         .
20035 296.    O    .         .         .         .         .         .         .         .         .         .         .         .
20040 297.   O     .         .         .         .         .         .         .         .         .         .         .         .
20045 298.  O      .         .         .         .         .         .         .         .         .         .         .         .
20050 299. O       .         .         .         .         .         .         .         .         .         .         .         .
20055 300.-O-------.---------.---------.---------.---------.---------.---------.---------.---------.---------.---------.---------.
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RUNOFF SUMMARY
FLOW IN CUBIC FEET PER SECOND
TIME IN HOURS, AREA IN SQUARE MILES

	OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD			BASIN AREA	MAXIMUM STAGE	TIME OF MAX STAGE
+					6-HOUR	24-HOUR	72-HOUR			
	HYDROGRAPH AT									
+		BASIN	416.	6.67	181.	98.	94.	.56		

*** NORMAL END OF HEC-1 ***

APPENDIX C

DESILTATION BASIN ANALYSES

DESILTATION BASIN SIZING

Proposed Desiltation Basin Sizing using SCVURPPP Method

Region	Hydrology Study Node Number	Drainage Area, ac	Rain Gage Correction Factor	Unit Basin Storage Volume, in	BMP Volume, ac-ft	BMP Volume, cf
WMSA	106	65.45	2.0	0.01	0.1091	4,752
WMSA/NQ	212	106.73	2.0	0.01	0.1779	7,749
NQ	314	143.43	2.0	0.01	0.2391	10,413
Shop/Office	410	92.13	2.0	0.01	0.1536	6,689
Rock Preserve	606	91.43	2.0	0.01	0.1524	6,638

Notes:
BMP Volume = Rain Gage Correction Factor x Unit Basin Storage Volume x Drainage Area
Rain gage correction factor = Site M.A.P. / Gage M.A.P. = Site M.A.P. / 13.7   (Site M.A.P. given in Appendix A)

Proposed Desiltation Basin Sizing using SWRCB Equation

Region	Hydrology Study Node Number	Drainage Area, ac	Q25, cfs	As, sf	Minimum Basin Length, ft	Minimum Basin Width, ft
WMSA	106	65.45	96.0	18,581	193	96
WMSA/NQ	212	106.73	182.0	35,226	265	133
NQ	314	143.43	222.0	42,968	293	147
Shop/Office	410	92.13	103.0	19,935	200	100
Rock Preserve	606	91.43	155.0	30,000	245	122

B.1 SCVURPPP Sizing Criteria Worksheets

These worksheets are designed to assist municipal staff and development project proponents in sizing stormwater treatment measures. Figures referenced in the computations can be found at the end of this Appendix B.

Section I. Selecting Sizing Approach Based on Type of Treatment Measure

1. Does the treatment measure operate by detaining a volume of runoff for a certain amount of time for pollutant removal (i.e., is it a volume-based treatment measure)? See Table B-1 for examples.

x Yes ____ No

If Yes, continue to Section II. Sizing for Volume-Based Treatment Measures.
If No, continue to next question.

2. Does the treatment measure operate based on the flow of runoff through the device (i.e, is it a flow-based treatment measure)? See Table B-1 for examples.

___ Yes x No

If Yes, continue to Section III. Sizing for Flow-Based Treatment Measures.

Table B-1. Flow and Volume Based Treatment Measure Sizing Criteria

Type of Treatment Measure	LID?	Hydraulic Sizing Criteria
Bioretention area	Yes	Flow- or volume-based or combination
Flow-through planter box	Yes	Flow- or volume-based or combination
Tree well filter	Yes[1]	Flow-based
Infiltration trench	Yes	Volume-based
Subsurface infiltration system	Yes	Volume-based
Rainwater harvesting and reuse	Yes	Volume-based
Media filter	No	Flow-based
Extended detention basin	No	Volume-based

[1] A tree well filter is considered LID treatment if biotreatment soil is used as the filter media and the unit is sized based on a 5 in/hr surface loading rate.

Section II. Sizing for Volume-Based Treatment Measures, continued

Section II.B — Sizing Volume-Based Treatment Measures based on the Adapted CASQA Stormwater BMP Handbook Approach

The equation that will be used to size the BMP is:

Design Volume = (Rain Gage Correction Factor) × (Unit Basin Storage Volume) × (Drainage Area)

Step 1. Determine the drainage area for the BMP, A = varies acres

See spreadsheet for area tributary to each desiltation basin.

Step 2. Determine percent imperviousness of the drainage area:

a. Estimate the amount of impervious surface (rooftops, hardscape, streets, and sidewalks, etc.) in the area draining to the BMP: 0 acres

b. % impervious area = (amount of impervious area/drainage area for the BMP) × 100
% impervious area = **(Step 2.a/Step 1)** × 100
% impervious area = 0 %

Step 3. Find the mean annual precipitation at the site (MAP_{site}). To do so, estimate where the site is on Figure B-1 and estimate the mean annual precipitation in inches from the rain line (isopleth) nearest to the project site.[6] Interpolate between isopleths if necessary.

MAP_{site} = 28 inches

Step 4. Identify the reference rain gage closest to the project site from Table B-2b and record the MAP_{gage}:

MAP_{gage} = 13.7 inches

Table B-2b: Precipitation Data for Three Reference Gages

Reference Rain Gages	Mean Annual Precipitation (MAP_{gage}) (in)
San Jose Airport	13.9
Palo Alto	13.7 ←
Morgan Hill	19.5

[6] Check with the local municipality to determine if more detailed maps are available for locating the site and estimating MAP.

Section II. Sizing for Volume-Based Treatment Measures, continued

Section II.B —Adapted CASQA Stormwater BMP Handbook Approach (continued)

Step 5 Determine the rain gage correction factor for the precipitation at the site using the information from **Step 3** and **Step 4**.

Correction Factor = MAP_{site} (**Step 3**)/MAP_{gage} (**Step 4**)

Correction Factor = see spreadsheet

Step 6. Identify the representative soil type for the BMP drainage area.

a) Identify from Figure B-1 or from site soils data, the soil type that is representative of the pervious portion of the project shown here in order of increasing infiltration capability:

____ Clay (D) ____ Sandy Clay (D) ____ Clay Loam (D)

_x_ Silt Loam/Loam (B) ____ Not Applicable (100% Impervious) See Figure B-1 in Appendix A.

b) Does the site planning allow for protection of natural areas and associated vegetation and soils so that the soils outside the building footprint are not graded/compacted? Y (Y/N)

If your answer is no, and the soil will be compacted during site preparation and grading, the soil's infiltration ability will be decreased. Modify your answer to a soil with a lower infiltration rate (e.g., Silt Loam to Clay Loam or Clay).

Modified soil type: N/A

Step 7. Determine the average slope for the drainage area for the BMP: >15 %

Step 8. Determine the unit basin storage volume from sizing curves.

a) Slope ≤ 1%

Use the figure at the end of this Appendix entitled "Unit Basin Volume for 80% Capture, 1% Slope" corresponding to the nearest rain gage: Figure B-2, B-3, or B-4 for San Jose, Palo Alto, or Morgan Hill, respectively. Find the percent imperviousness of the drainage area (from **Step 2**) on the x-axis. From there, find the line corresponding to the soil type (from **Step 6**), and obtain the unit basin storage volume on the y-axis.

Unit Basin Storage for 1% slope ($UBS_{1\%}$) = ______ (inches)

b) Slope ≥ 15%

Use the figure at the end of this Appendix entitled "Unit Basin Volume for 80% Capture, 15% Slope" corresponding to the nearest rain gage: Figure B-5, B-6, or B-7 for San Jose, Palo Alto, or Morgan Hill, respectively. Find the percent imperviousness of the drainage area (from **Step 2**) on the x-axis. From there, find the line corresponding to the soil type (from **Step 6**), and obtain the unit basin storage volume on the y-axis.

Unit Basin Storage for 15% slope ($UBS_{15\%}$) = ______ (inches)

Section II. Sizing for Volume-Based Treatment Measures, continued

Section II.B. —Adapted CASQA Stormwater BMP Handbook Approach (continued)

c) Slope > 1% and < 15%

Find the unit basin volumes for 1% and 15% using the techniques in **Steps 8.a** and **8.b** and interpolate by applying a slope correction factor per the following formula:

UBS_x = $UBS_{1\%}$ + ($UBS_{15\%}$ - $UBS_{1\%}$) × (X%-1%) / (15% -1%)
= (**Step 8a**) + (**Step 8b**- **Step 8a**) × (X%-1%)/(15%-1%)

Where UBS_x = Unit Basin Storage volume for drainage area of intermediate slope, X %

Unit Basin Storage volume (UBS_x) = ____________(inches)
(corrected for slope of site)

Step 9. Determine the Adjusted Unit Basin Storage Volume for the site, using the following equation:

Adjusted UBS = Rain Gage Correction Factor × Unit Basin Storage Volume

Adjusted UBS = (**Step 5**) × (**Step 8**)

Adjusted UBS = _______inches

Step 10. Determine the BMP Design Volume, using the following equation:

Design Volume = Adjusted Unit Basin Storage Volume × Drainage Area

Design Volume = (**Step 9**) × (**Step 1**) × 1 foot/12 inch

Design Volume = _______acre-feet × 43,560 square feet/acre = _______cubic feet

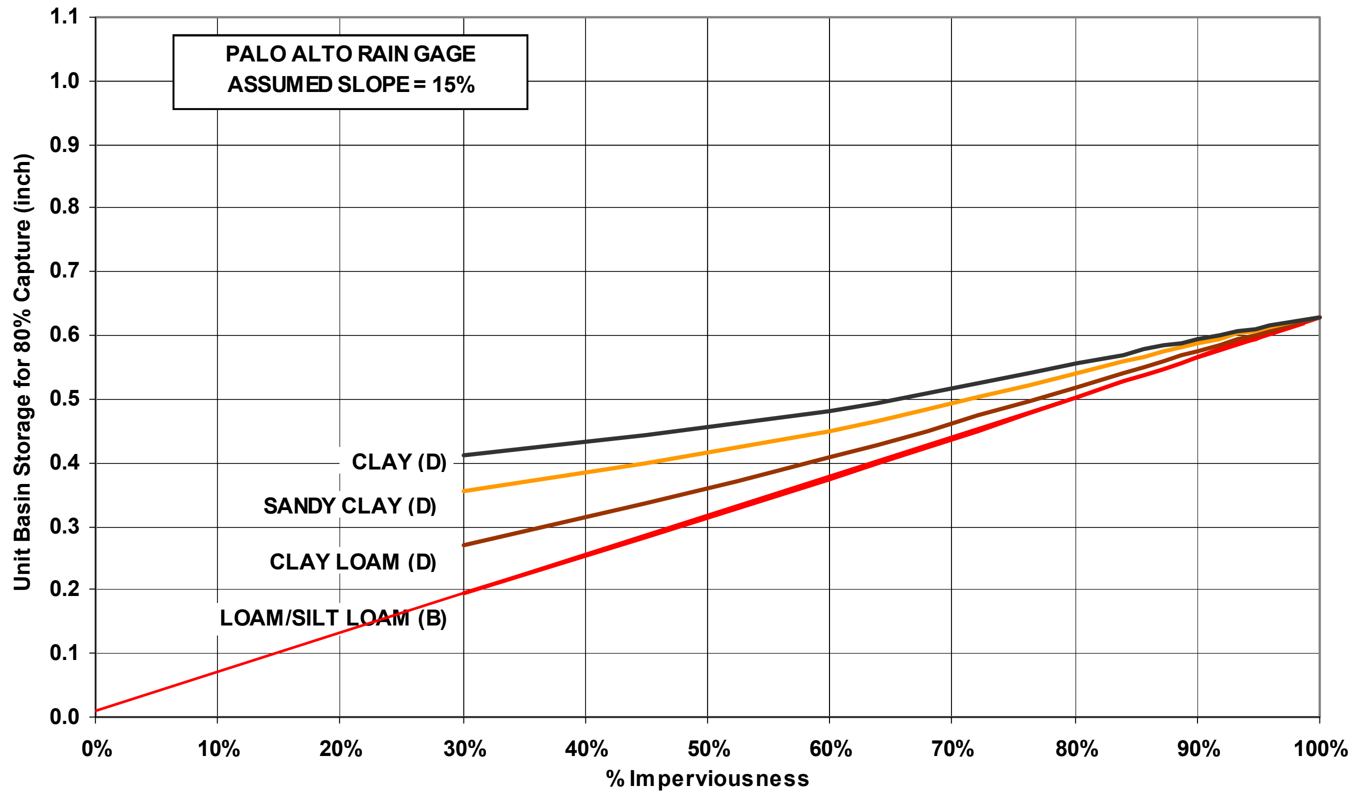
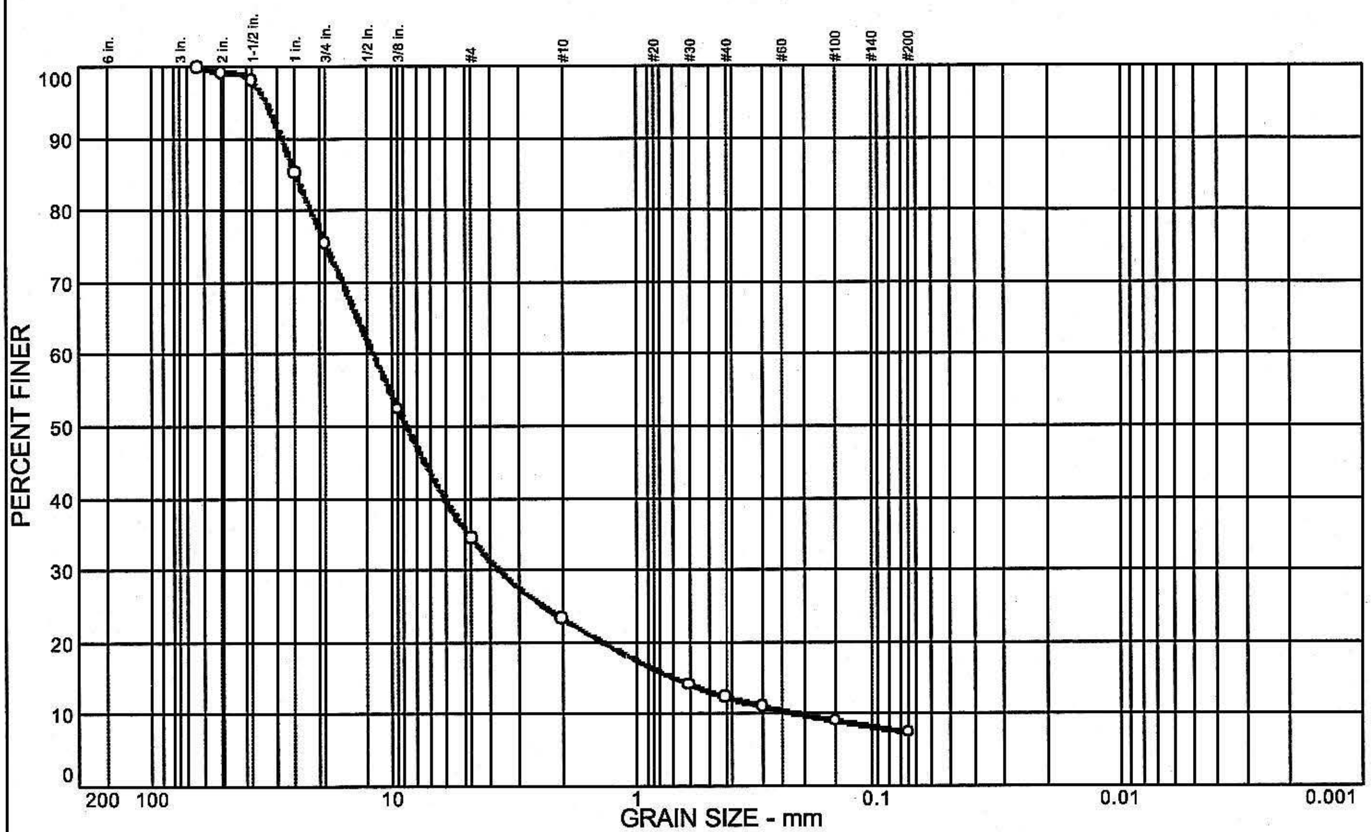


Figure 3-B Unit Basin Volume for 80% Capture - <u>Palo Alto Rain Gage</u>

Particle Size Distribution Report



	% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY	USCS	AASHTO	PL	LL
o		65.6	27.0	7.4					

SIEVE inches size	PERCENT FINER o		
2.5	100.0		
2	99.2		
1.5	98.0		
1	85.3		
3/4	75.5		
3/8	52.4		
	GRAIN SIZE		
D_{60}	12.0		
D_{30}	3.65		
D_{10}	0.220		
	COEFFICIENTS		
C_c	5.05		
C_u	54.84		

SIEVE number size	PERCENT FINER o		
#4	34.4		
#10	23.3		
#30	14.1		
#40	12.4		
#50	11.0		
#100	9.0		
#200	7.4		

SOIL DESCRIPTION

o Gray Poorly Graded GRAVEL w/ Silt & Sand

REMARKS:

o

o Source: TC-1

WASTE ROCK - EMSA

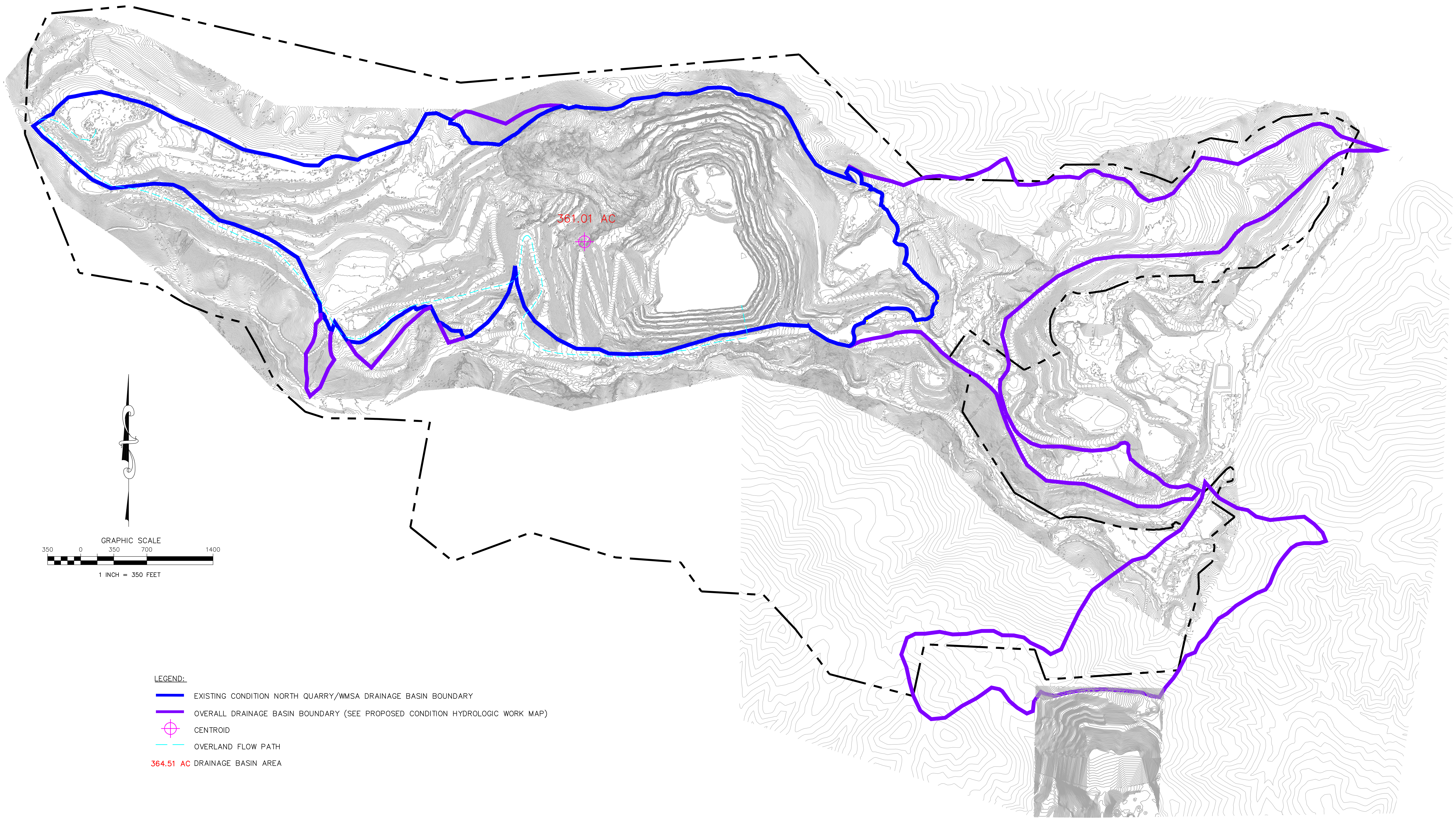
COOPER TESTING LABORATORY

Client: Golder Associates

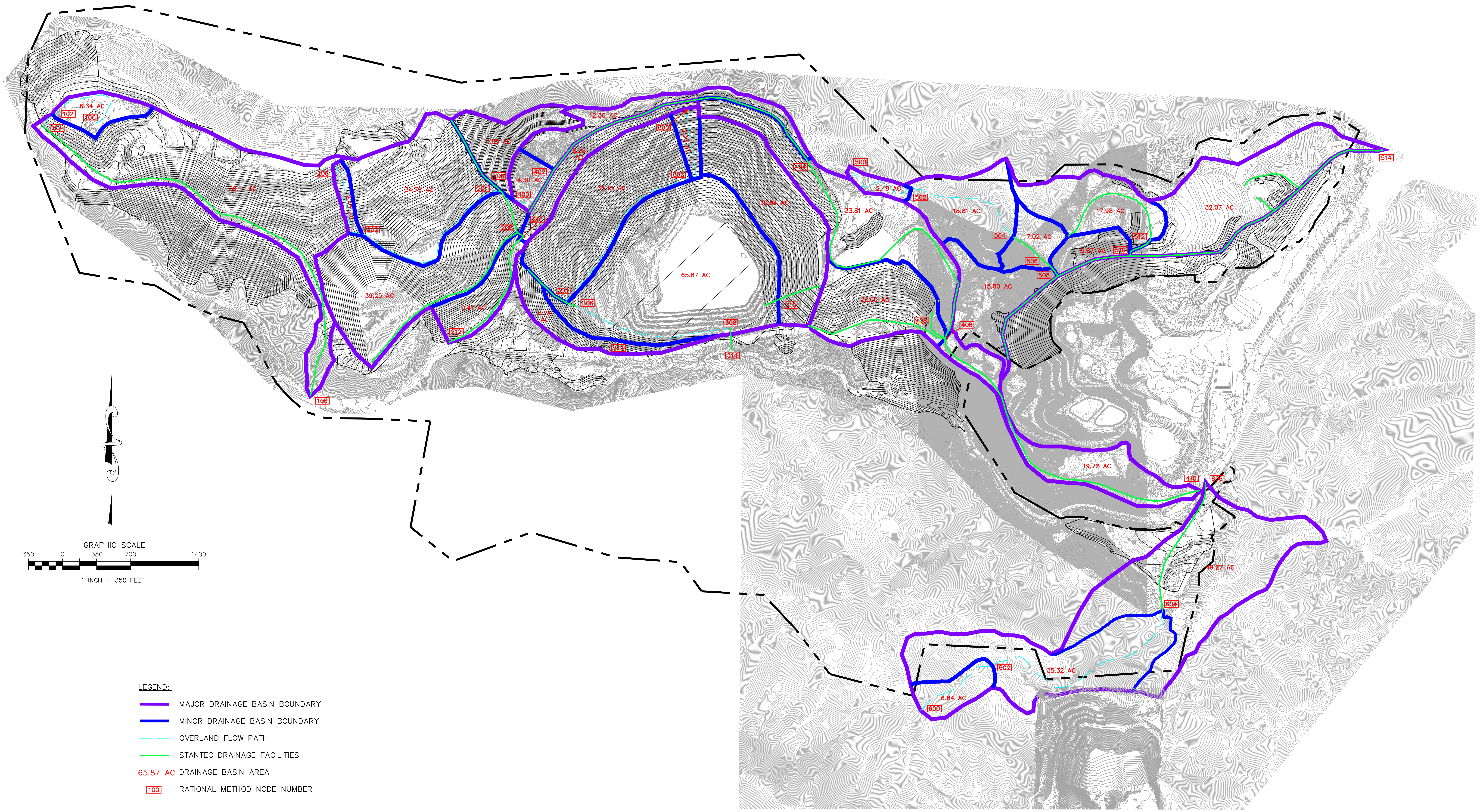
Project: Hanson - 063-7109

Project No.: 287-036

Figure



EXISTING CONDITION
HYDROLOGIC WORK MAP



PROPOSED CONDITION
HYDROLOGIC WORK MAP

APPENDIX I-2
EXAMPLE OF SURFACE WATER DRAINAGE CONTROLS

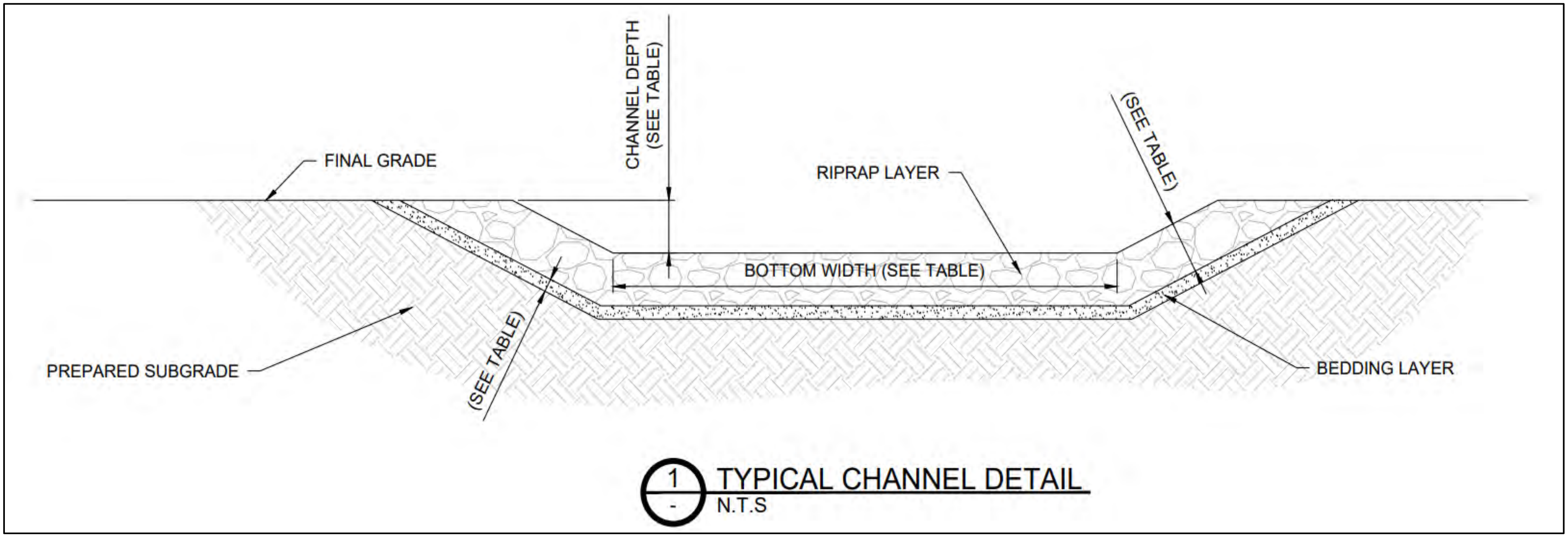


Figure 1: Typical Trapezoidal Channel with riprap lining. The figure shows callouts for bottom width and channel depths. Sideslopes on the channel can vary along with the amount of bedding and layers required, based on the lining system and subsurface conditions. A trapezoidal shape can be applied to both subcritical and supercritical channels with linings and subgrade layers varying per designed channel section.

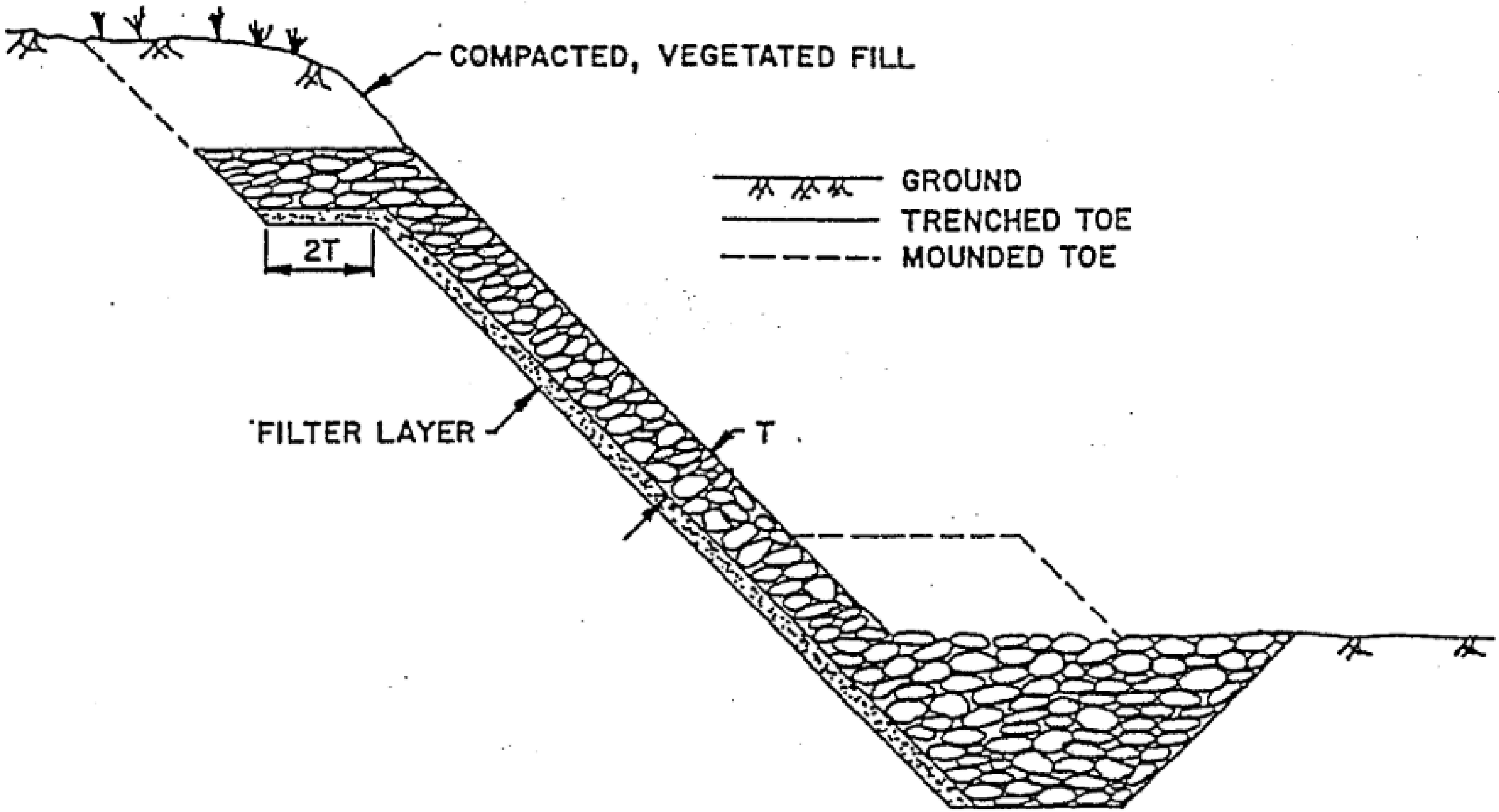


Figure 2: Example of armored sideslope with riprap showing riprap thickness and underlying filter layer – can be applied to channels, armored berms, and plunge pools (from Williams and Doeing, 2003)

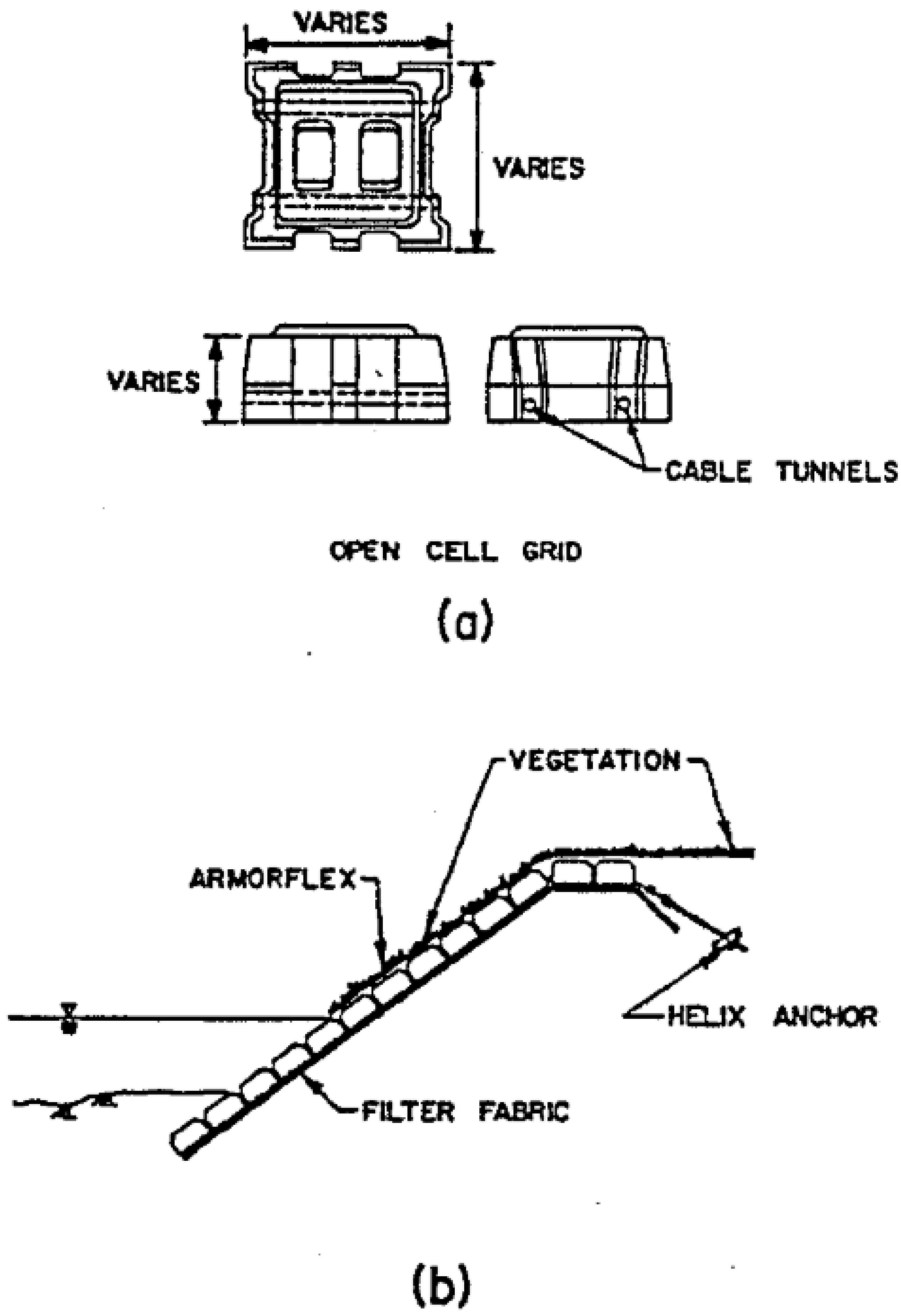


Figure 3: Example of armored sideslope with articulated concrete block showing the block and underlying filter layer – can be applied to channels, armored berms, and plunge pools (from Williams and Doeing, 2003)

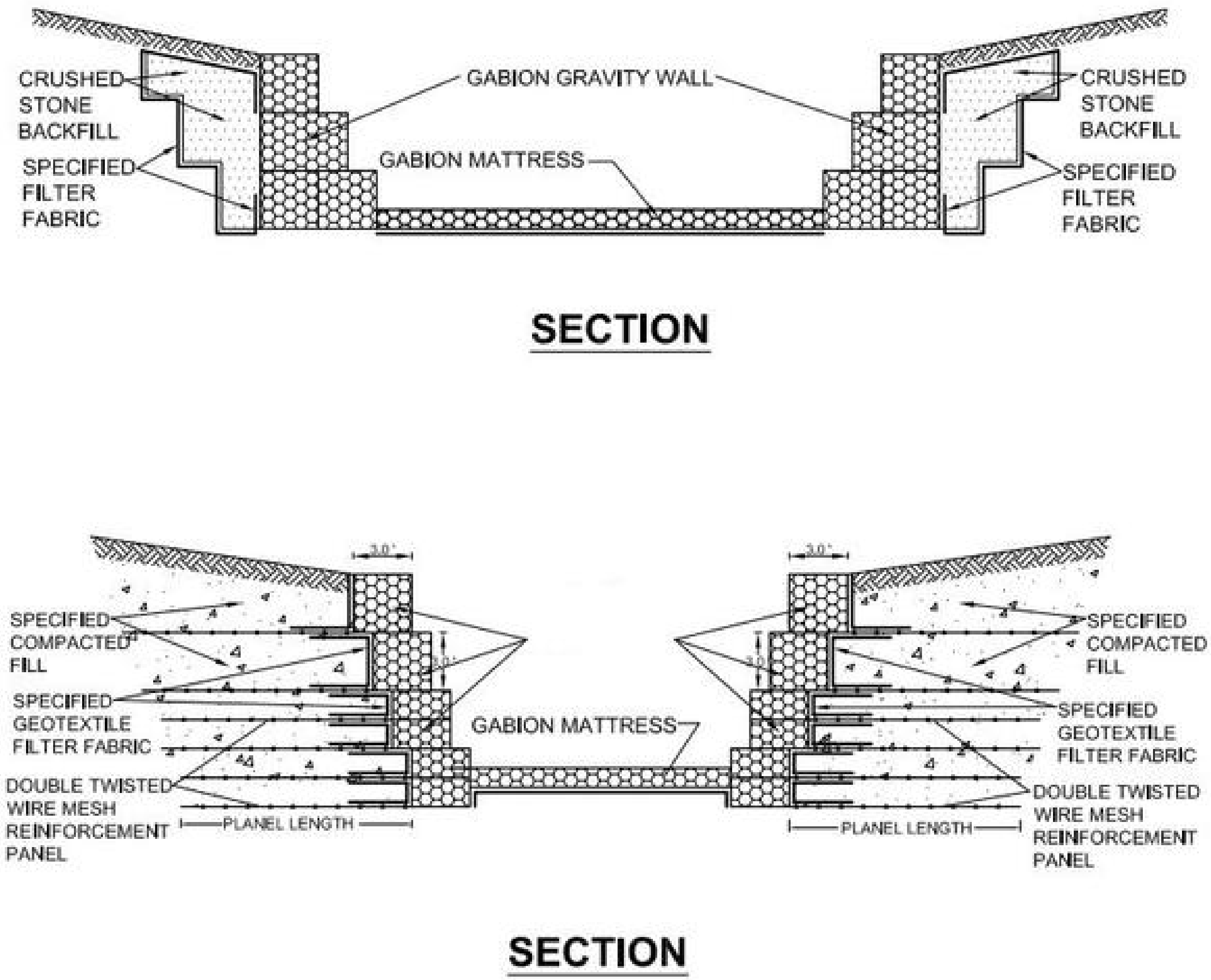


Figure 4: Example cross sections using gabion baskets to provide erosion protection. As shown, the baskets allow for developing more precise, near vertical structures compared to matts or riprap lining. Therefore, gabions can be used to develop stepped structures and be used in more precise applications. The downside of these structures is the potential longevity of the baskets, which are typically made of wire mesh (Gabion Supply, 2023). Other rigid lining types like roller compacted concrete and traditional concrete can also be used when designing structures requiring vertical walls.

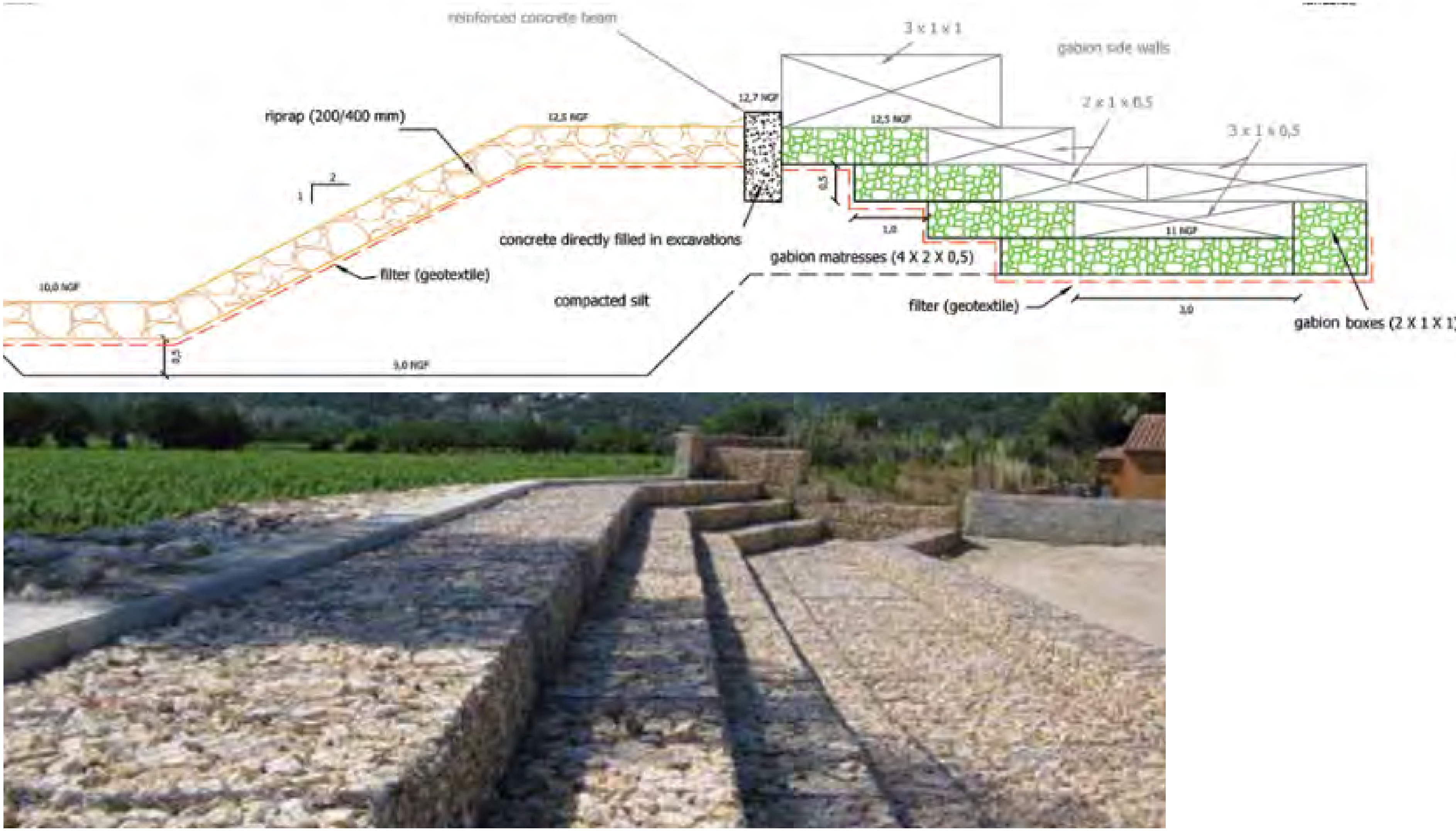


Figure 5: Example of a Stepped Structure using gabions (from CIRIA et al., 2013; The International Levee Handbook). Stepped structures like this are also commonly formed with traditional concrete or roller compacted concrete for different applications where space is limited, and steeper slopes are required for water management.

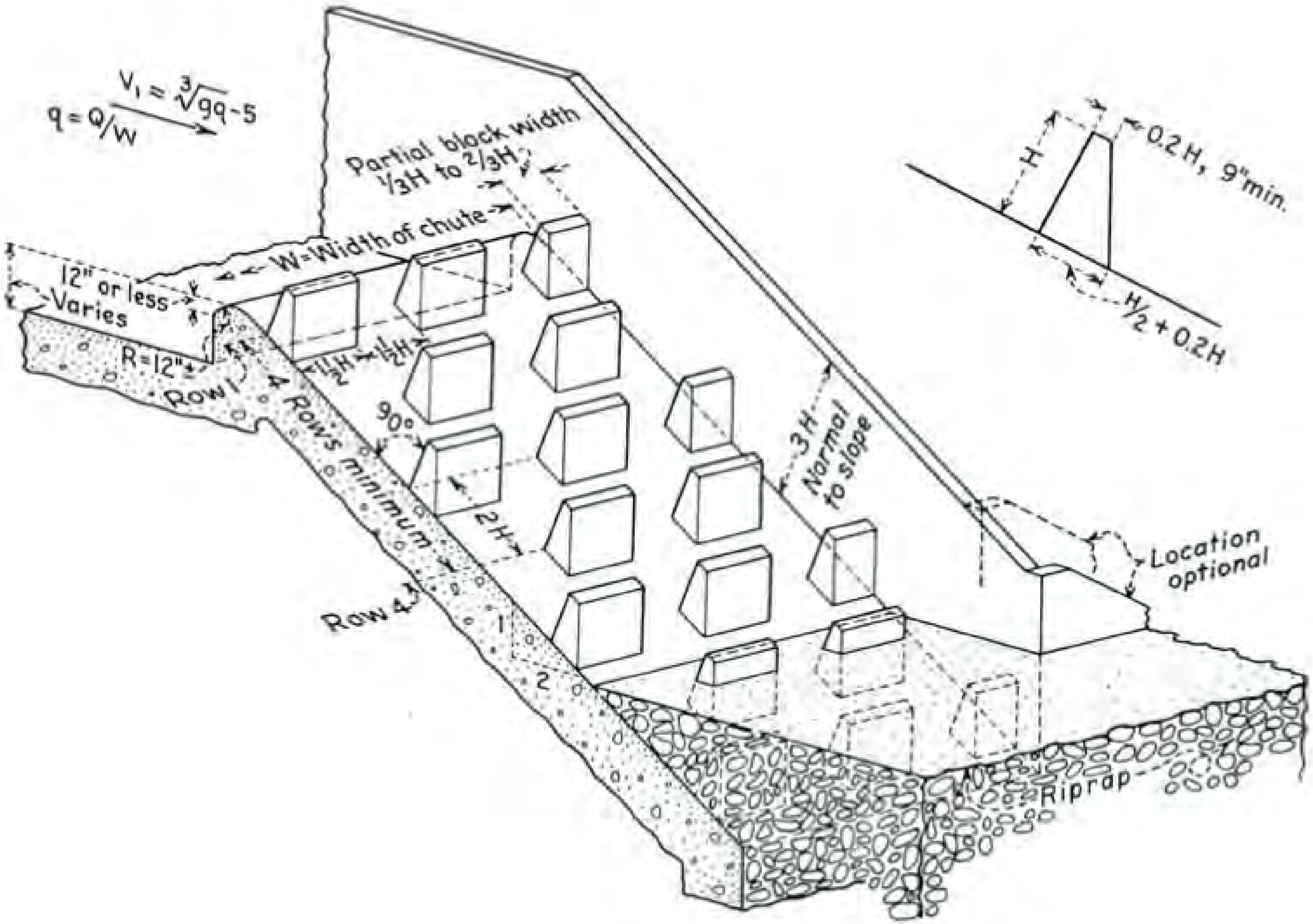


Figure 6: Example of a typical sloped baffle structure (from Thompson & Kilgore, 2012; i.e. HEC-14). The structure is concrete lined with vertical side walls to contain flow from the water body. The baffle height and spacing is designed as a function of the overall flow to be managed through the structure. These types of structure may also flow into downstream plunge pools or stilling basins.

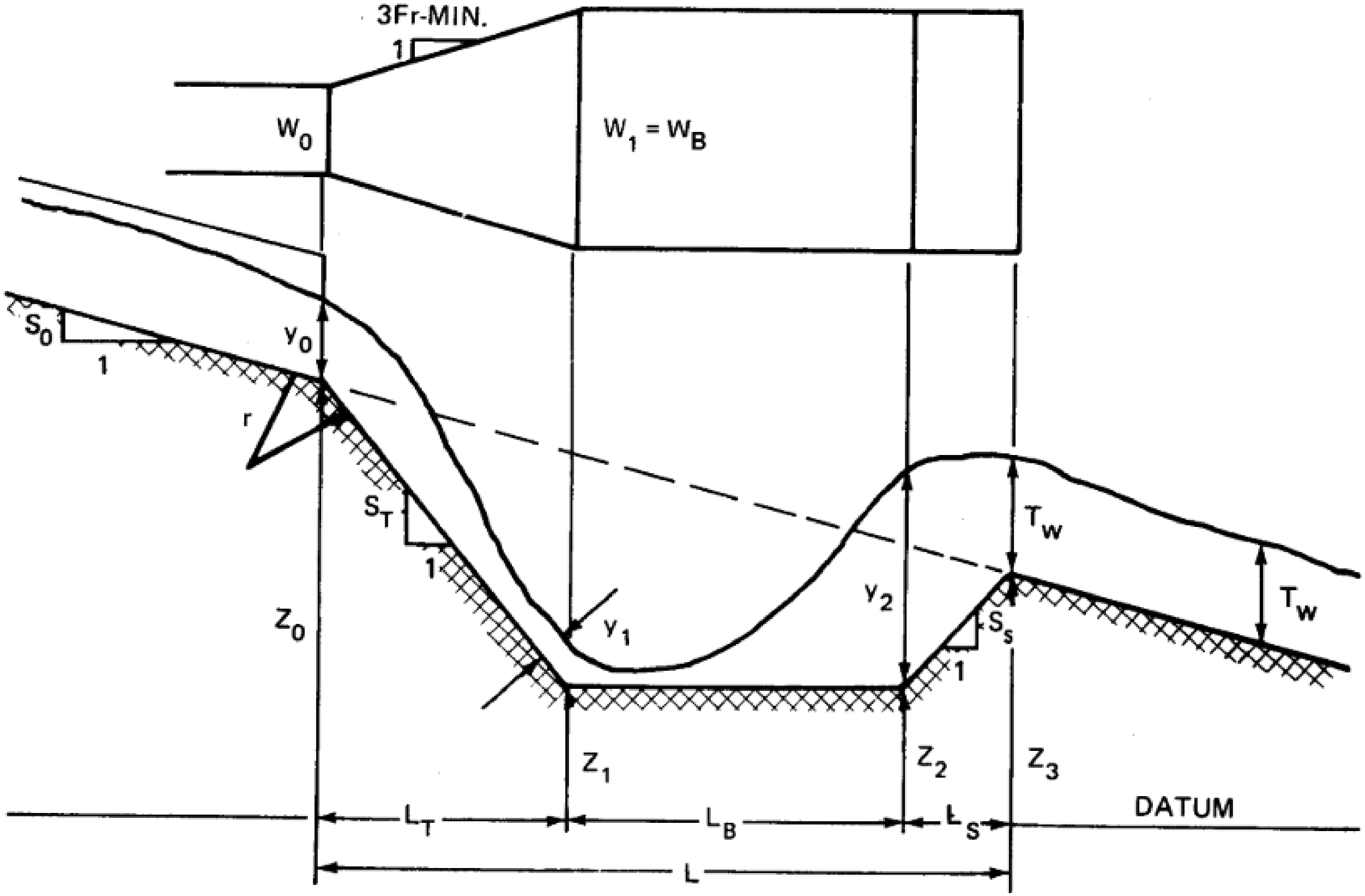


Figure 7: Example cross section view of a Plunge Pool where water flows from left to right – also called a free hydraulic jump basin (from Thompson & Kilgore, 2012; i.e. HEC-14). The basin can be made from many different lining types, like riprap, gabions, cut into native rock, concrete, etc. The basin size is bigger than other specialized stilling basins because a free hydraulic jump is allowed to occur as it normally would, without enhancements to reduce the jump length.

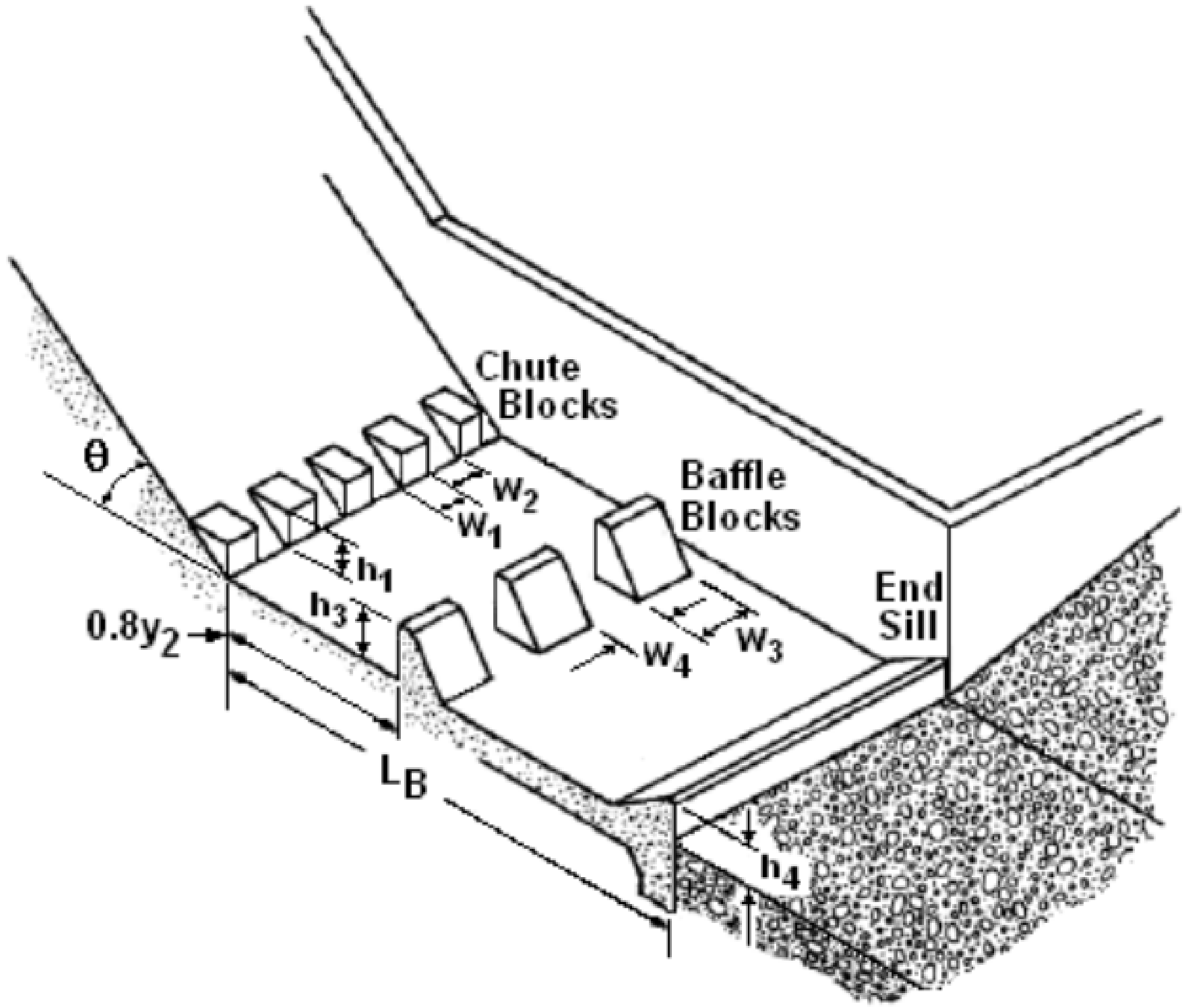


Figure 8: Example of a Specialized Stilling Basin - USBR Type III Basin (from Thompson & Kilgore, 2012; i.e. HEC-14). This type of structure requires concrete lining to obtain the precise dimensions needed for energy dissipation.

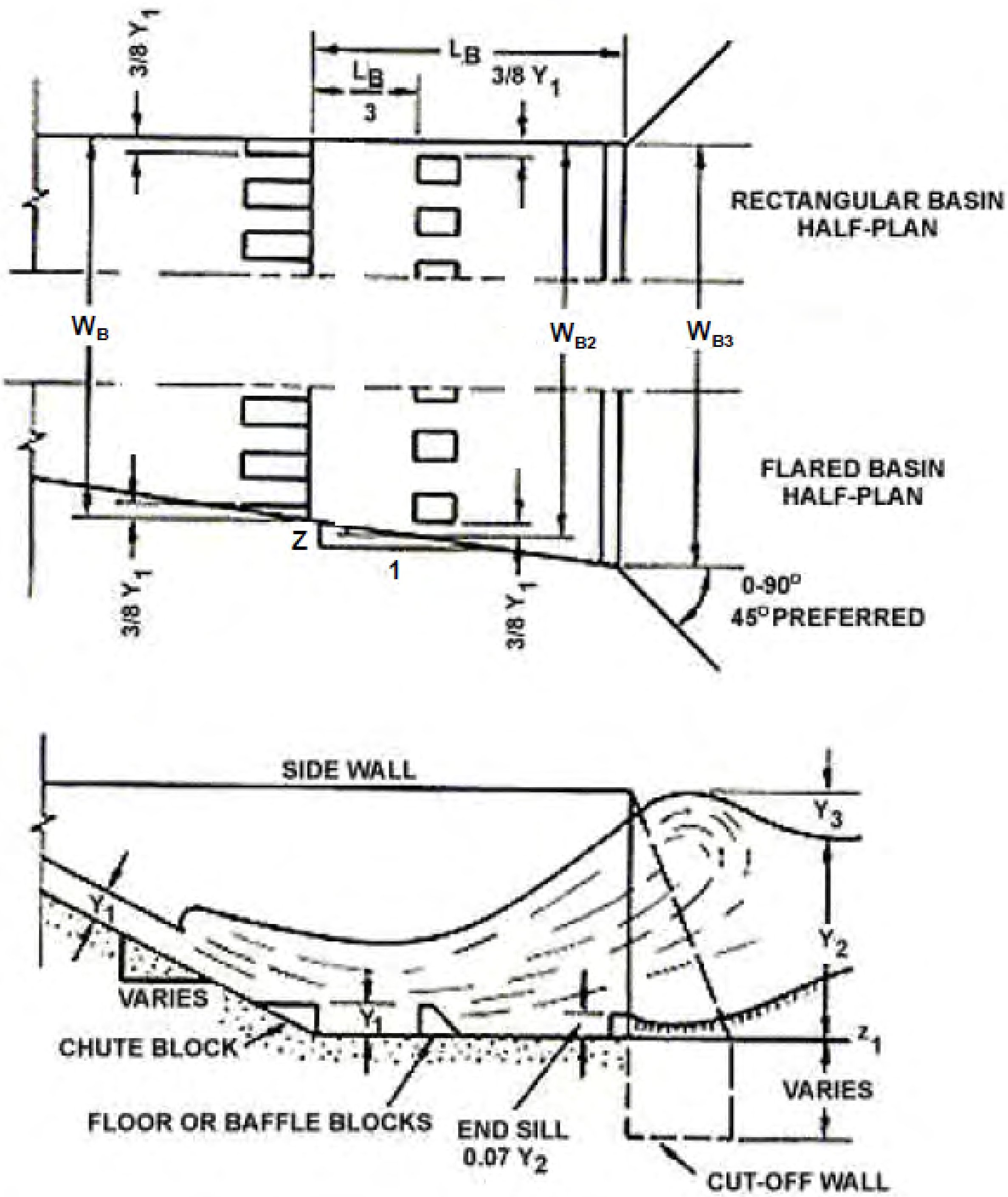


Figure 9: Example of a Specialized Stilling Basin – the St. Anthony Falls (SAF) structure. The figure is included to show the similarities to the USBR Type III basin.

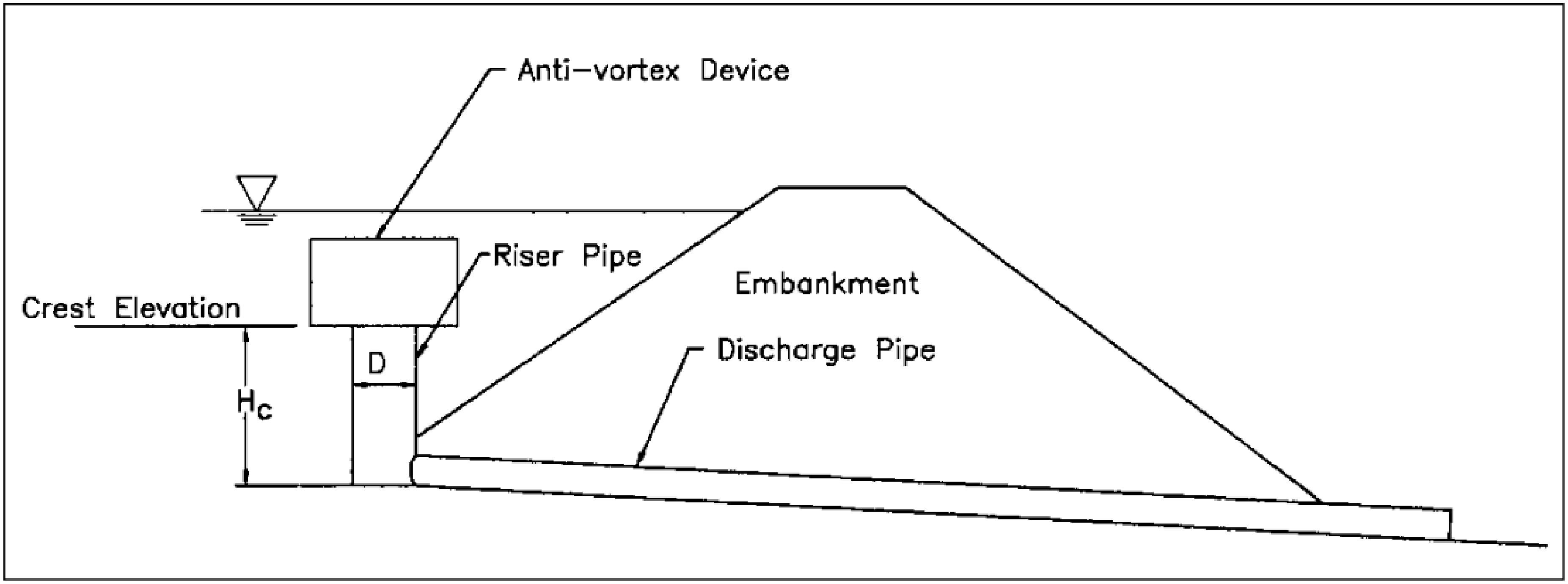


Figure 10:An illustration of a typical attenuation structure with an upstream riser pipe discharging into culvert that passes through the embankment (From Brown et al., 2009; i.e., HEC-22). The structure does not label a typical spillway that would be cut into the embankment, just below the embankment crest elevation. As shown, the intent of the design is to temporarily store water upstream of the embankment to reduce observed downstream discharge.

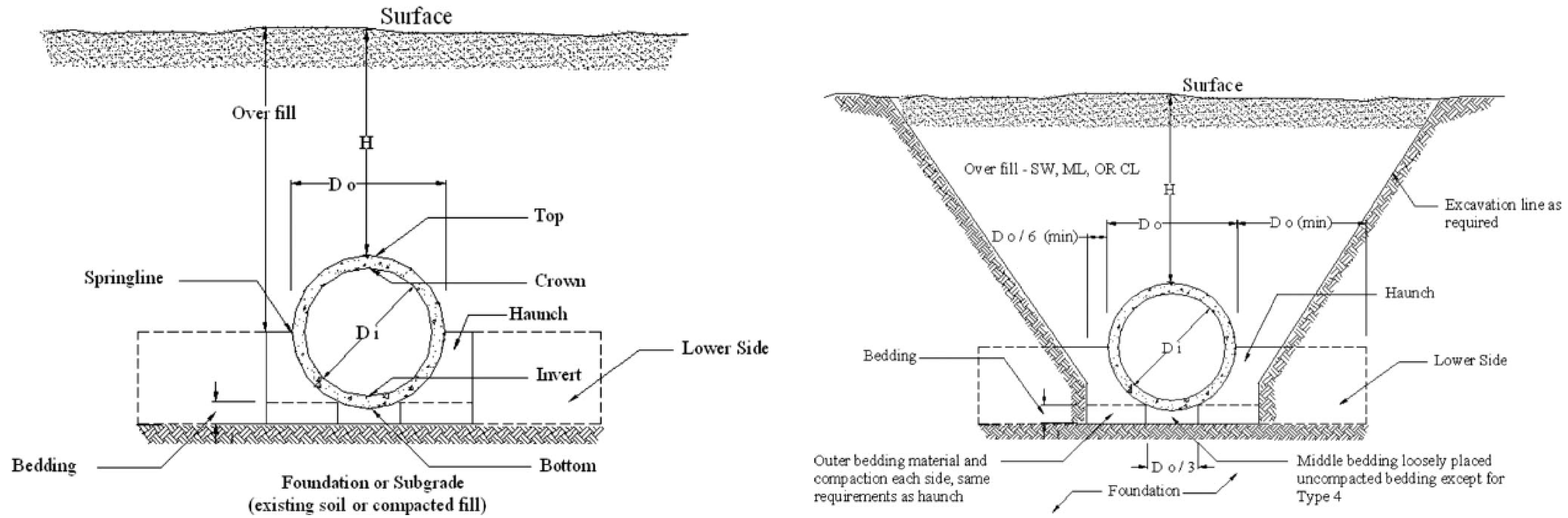


Figure 11. Typical installation details for concrete circular culverts for typical installation and for trench installation (from Erdogmus etal., 2010). Culverts come in a wide array for shapes and materials that result in unique considerations for proper installation, but all culverts should be installed with engineered bedding and overfill / backfill layers to prevent pipes from puncturing and to reduce the likelihood of piping failures caused from seepage during storm events.

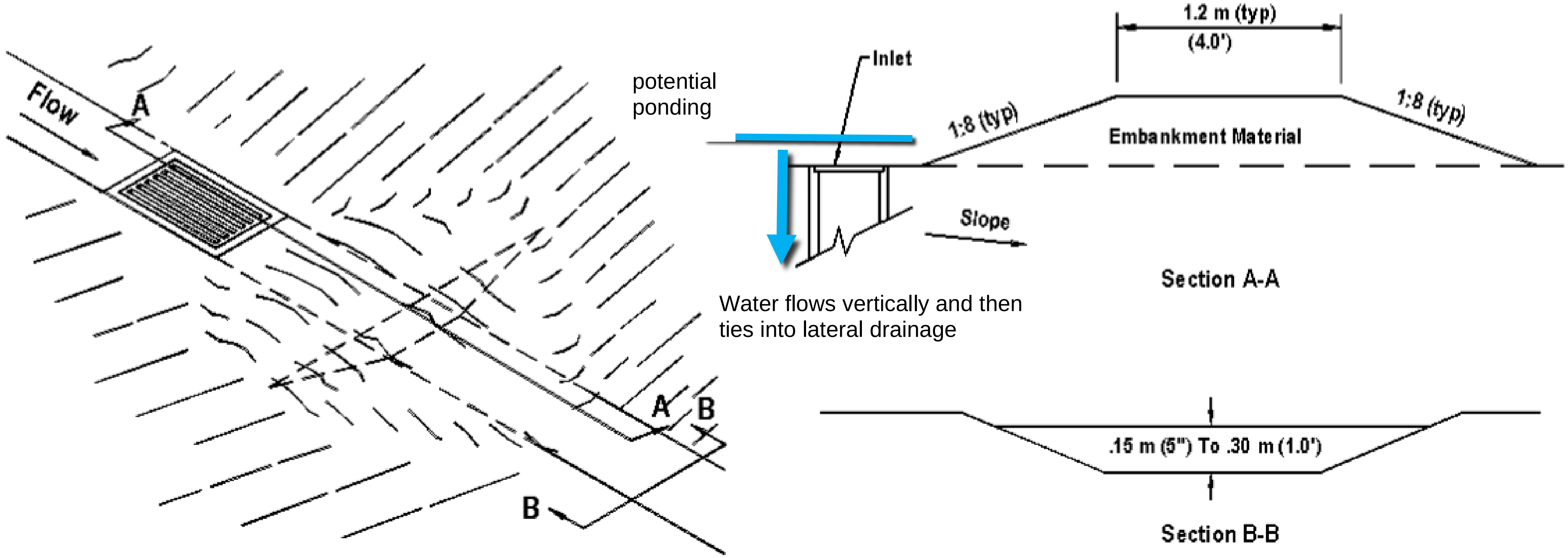


Figure 12: Plan and profile sections for a type of inlet drop structure with a downstream embankment to allow water to pool and drain into the inlet and then be relayed by vertical and lateral culverts (from Brown et al., 2009).

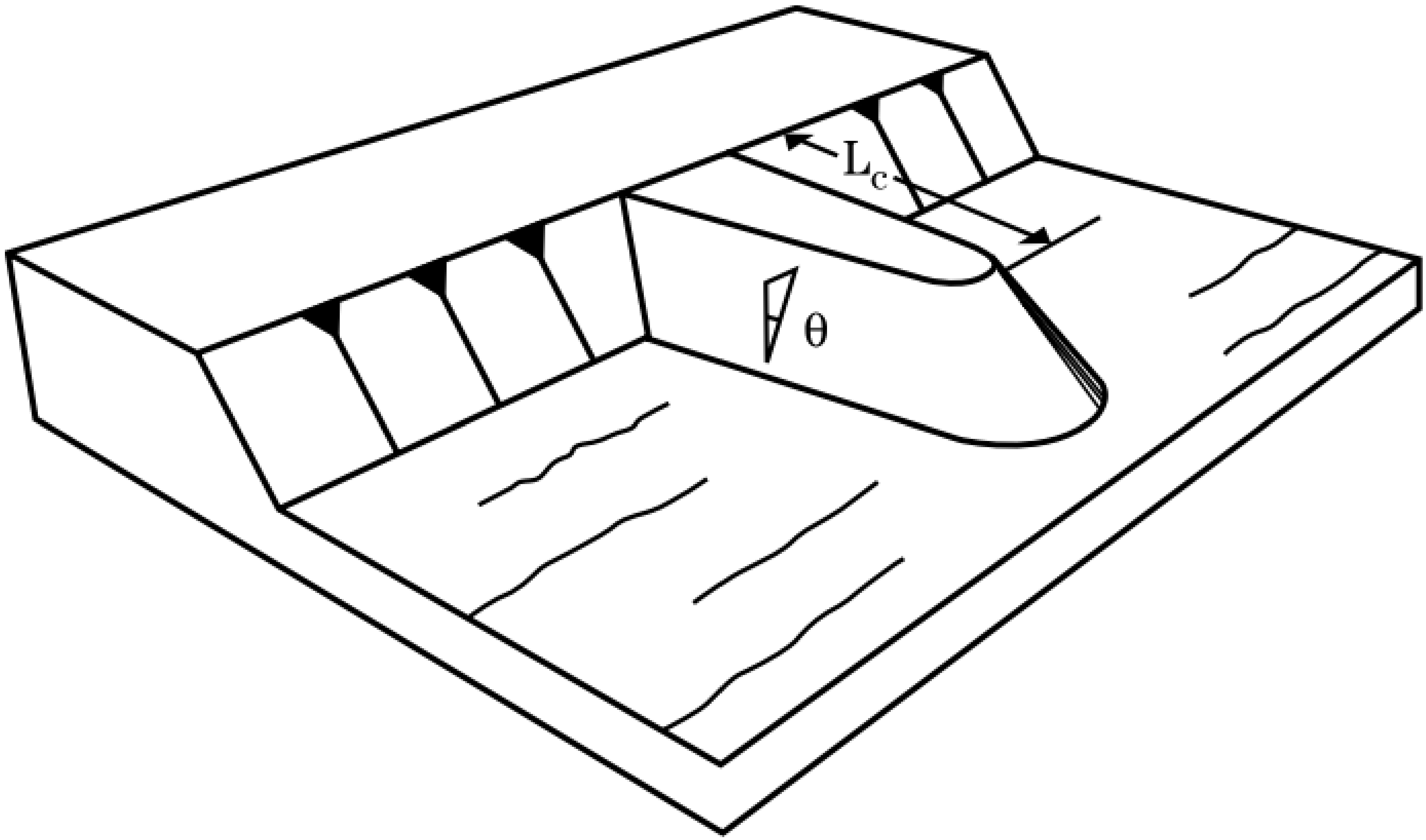


Figure 13: Definition sketch showing crest length, Lc, and side slope angle, θ, for spur dikes (from NRCS, 2007). Spur dikes, and other structures, extend from one bank into the channel. The structure reduces the velocity of streamflow on the downstream end of the spur dike structure.

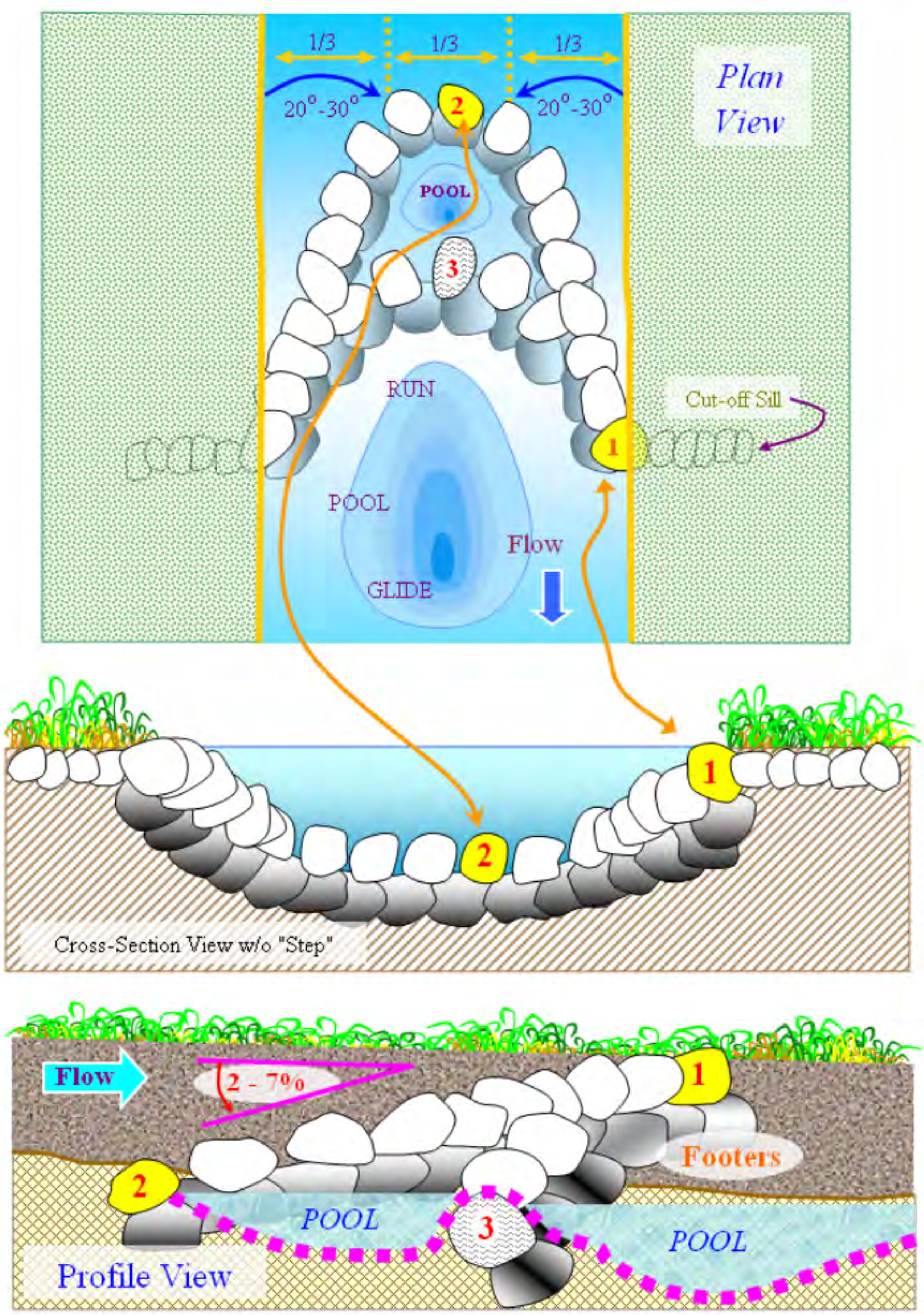


Figure 14: Example of a Cross Vane stream modification with multiple pools used to create in-stream eddies, leading to reduced embankment disruption (from NRCS, 2007).

References

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APPENDIX J
NOTIFICATION OF LANDOWNER

NOTIFICATION OF LANDOWNER

SMARA (Public Resources Code Section 2772[c][7]) requires that a reclamation plan provide evidence that all owners of a possessory interest in the land have been notified of the proposed use or potential uses after reclamation. Reclamation of Permanente Quarry will return the site to an undeveloped condition suitable for subsequent uses allowed under the Santa Clara County Zoning Ordinance for the applicable Agricultural and Hillside zones.

I (We) hereby acknowledge the planned mine reclamation for parcels listed below. Further, consent is given the operator, the State of California, and Santa Clara County or its authorized agents, to access the property for annual inspections and evaluation to achieve the satisfactory completion of the provisions of the reclamation plan approved pursuant to the California Surface Mining and Reclamation Act of 1975, as amended.

Parcel(s): 351-09-013, 351-09-020, 351-09-022, 351-09-023, 351-09-025, 351-10-005, 351-10-008, 351-10-033, 351-10-037, 351-10-038, 351-11-001, 351-11-081

Landowner(s):

Gregory A Roncyka

Hanson Permanente Cement, Inc.

May 31, 2023

Date

APPENDIX K
STATEMENT OF RESPONSIBILITY

Name and Address of Operator

Lehigh Southwest Cement Company
Gregory J Ronczka, MPH, P.G.
Vice President–Environment & Sustainability
Heidelberg Materials US, Inc.
300 E. John Carpenter Frwy
Irving, Texas 75062
Direct: (972) 657-4301
e-mail: gregory.ronczka@heidelbergmaterials.com

Name and Address of Agent

Lehigh Southwest Cement Company
Gregory J Ronczka, MPH, P.G.
Vice President–Environment & Sustainability
Heidelberg Materials US, Inc.
300 E. John Carpenter Frwy
Irving, Texas 75062
Direct: (972) 657-4301
e-mail: gregory.ronczka@heidelbergmaterials.com

STATEMENT OF RECLAMATION RESPONSIBILITY

I certify that the information in this reclamation plan is correct, to the best of my knowledge, and that all of the owners of possessory interest in the property in question have been notified of the planned operation and potential uses of the land after reclamation. I also certify that I am authorized on behalf of Lehigh Southwest Cement Company to accept responsibility for reclaiming the mined lands described and submitted herein, with any modification required by Santa Clara County and agreed to as conditions of approval.

Signed this 31 day of May, 2023.

Gregory J Ronczka

Gregory J Ronczka, MPH, P.G.
for Lehigh Southwest Cement Company (Owner/Operator)

Heidelberg Materials

Heidelberg
Materials