



**Water Supply Alternatives, Fish Passage  
and Use, and Streambed Conditions at  
Memorial County Park, San Mateo  
County, California.**

Prepared for:

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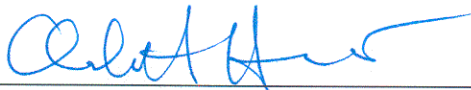
Balance Hydrologics, Inc.

September 2003

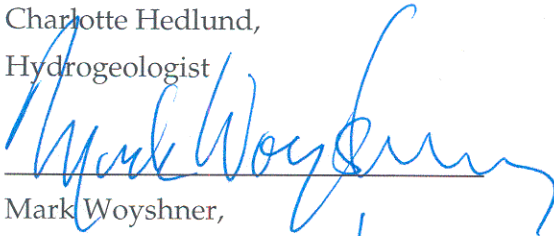
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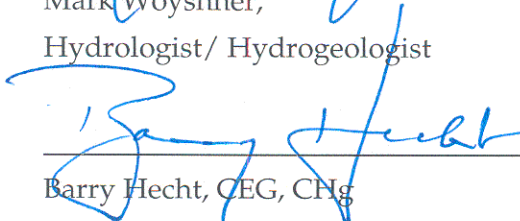
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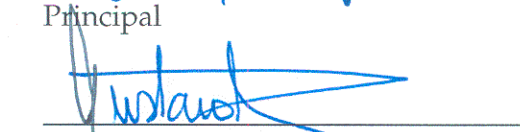
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## 1. INTRODUCTION

Memorial County Park is located about 4 miles east of Pescadero near Loma Mar, California. It was dedicated in 1924 and since 1938 has diverted surface water from Pescadero Creek per water rights granted by the State Water Resources Control Board. Diversions during the summer months average 4,125,000 gallons and account for nearly 75% of the Park's annual 5.5 million gallons of diversion. These supplies provide potable water for campers in Sam McDonald, Pescadero, and Memorial County Parks, as well as some adjacent residents. During the peak seasonal diversion, the Park diverts approximately 30 gallons per minute, equivalent to about 43,000 gallons per day if sustained for 24 hours.

Pescadero Creek has one of the largest watersheds of coastal San Mateo County (45.9 square miles as measured at the USGS gaging station about two miles downstream from the Park.), and has nearly 95 miles of stream potentially supporting federally listed salmonid species. The County of San Mateo Parks and Recreation Division desires to identify alternatives to the existing summer in-stream water diversion and seasonal dam in Pescadero Creek at Memorial County Park in an effort to enhance threatened steelhead (*Onchorhynchus mykiss*) and potentially restore endangered coho (*Oncorhynchus kisutch*) habitat and migration along reaches of the creek. Alternatives such as installation of infiltration galleries in or adjacent to the stream bed, development of ground-water wells, and dam removal are potential options to ensure that County Parks has a functioning water supply during peak summer use while enhancing salmonid migration and habitat.

### 1.1 Objectives of Study

This report is a preliminary analysis of water supply alternatives, salmonid habitat and migration, and streambed characterization for parts of Pescadero Creek at Memorial County Park. Its primary objective is to preserve the capability of County Parks to continue to use water per existing water rights, but modify how water is diverted from the Creek in order to enhance the migration and habitat of federally listed threatened steelhead trout and abet restoration of endangered coho salmon. The specific tasks detailed in the proposal letter to San Mateo County Parks and Recreation Division included the following:

1. Assessment of the existing water diversion system and identification of incongruities with regulations of the National Marine Fisheries Service, California Department of Fish

and Game, State Water Resources Control Board, and Regional Water Quality Control Board.

2. Assessment of current and future water uses with potential water saving measure recommendations.
3. Assess potential modifications to the existing dam for swimming and salmonid passage.
4. Water quality assessment and monitoring recommendations.
5. An evaluation of water supply alternatives.

## **1.2 Acknowledgments**

We would like to acknowledge the Parks and Recreation Division of San Mateo County for providing us the opportunity to perform the project, recommending contacts at Department of Fish and Game, in addition to insightful background information.

John Kenney and Don Curran of Memorial County Park showed us the parks facilities and the locations of key features as well as provided us with invaluable background information on water rights, diversion quantities, surface water quality, and cost estimates for previous dam removals.

Jeff Hagar of Hagar Environmental provided a very useful evaluation of the instream structures in Pescadero Creek at Memorial Count Park which may serve as potential impacts to steelhead and coho salmon. This assessment also helped us to develop viable alternatives to the existing dam structure that may improve fish passage and habitat.

Marty Gingras, Department of Fish and Game biologist, counseled us on particulars of this year's (2003) Fisheries Restoration Grant Program and aided us in preparing an application meant to enhance threatened steelhead and restore endangered coho habitat and migration in Pescadero Creek at Memorial County Park.

## **2. SETTING AND BACKGROUND**

### **2.1 Location and Topography**

The Pescadero Creek watershed is a steep, mountainous, coastal watershed in the Central Santa Cruz Mountains of California, measuring roughly 45.9 square miles and ranging in elevation from sea level to roughly 2,700 feet above. The eastern portion of the watershed is dominated by the rugged topography of the core of the Santa Cruz Mountains, sloping westward into uplifted marine terraces at the Pacific Coast. Memorial County Park constitutes 499 acres of this watershed, approximately 6 miles east of the Pacific Ocean in Loma Mar, California (Figure 1), situated along Pescadero Creek in San Mateo County. The Park is bounded on the north by Sam McDonald County Park and private ranchland, on the east and south by Pescadero Creek County State Park, and on the west by the community of Loma Mar. Much of the eastern part of the watershed is publicly-held open space or protected as park land; there are also substantial timber company holdings. The town of Pescadero, approximately two miles from the coast, is the center of most services for the park and its environs.

### **2.2 Climate**

The climate of San Mateo County is considered Mediterranean with 90 percent of precipitation in the form of rain between the months of November and April. Within the Pescadero Creek watershed, summer temperatures are pleasant and occasionally cool fog drifts in from the ocean. During the winter months, the air is crisp, and the ground and plants are typically moist. Frosts can occur, especially along the stream itself. Mean annual temperature for the region is 54° F. The yearly rainfall here averages about 40 inches, but can range from 40 to 250 percent of these mean values.

### **2.3 Regional Geologic Conditions**

San Mateo County has been mapped generally as an assemblage of large, fault – bounded blocks that contain unique stratigraphic sequences (Brabb and others, 1989). The region is transected by two major faults, the north-south trending San Gregorio fault to the west, and the east-west trending reverse Butano fault to the east, separating the watershed into lithologically and structurally distinct regions. The San Andreas fault is a few miles to the northeast. Lithologically, the watershed is complex, consisting mainly of a thick sequence of Tertiary marine clastic sedimentary rocks (Figure 5) overlying a crystalline basement, with minor

carbonates and volcanics interspersed amongst the predominant marine sandstones, mudstones, shales, and various Quaternary deposits.

## **2.4 Local Hydrologic and Hydrogeologic Conditions**

The USGS has monitored streamflow conditions at Pescadero gaging station I.D. # 11162500 (37° 15' 39" latitude and 122° 19' 40" longitude) beginning in 1951. Flow in this creek is very similar to other better-studied central California streams of similar size such as Waddell and Zayante Creeks, where peak winter flows, erosion and sedimentation are management issues and the low flows of summer coupled with surface diversions downstream pose additional challenges. Peak flows tend to occur during the month of February more than any other month of the water year. Figures 3 and 4 illustrate monthly mean and annual mean discharge at the Pescadero Creek gage from 1951 to 2001, both presented in cubic feet per second (cfs). These two figures are included to assist in the basic understanding of the hydrologic character of Pescadero Creek. For example, water years 1952, 1958, 1969, 1983, and 1998 had the largest annual mean and monthly mean discharges, with maximum occurring in 1998, while significant droughts occurred in 1959-1961, 1976-77, and 1987-1991.

Historically, water supply needs throughout San Mateo and Santa Cruz Counties were met first through the development of surface water and then later included in the development of ground water resources. Surface water use obviously still dominates in the Pescadero watershed; however the use of ground water for recreational supplies to park visitors is a realistic alternative to water supplies for Memorial County Park. Viable aquifer units within the Pescadero Creek watershed are those composed primarily of alluvium and colluvium, Purisima formation, Santa Margarita sandstone, Vaqueros sandstone, and San Lorenzo formation. All of these units generally contain usable ground water; however, all have generally low transmissivities, and some are recharged in part from current streamflow.

The Santa Margarita formation may be of particular importance for any future ground-water development. One of the findings of the current study is that this formation occurs at the surface in outcrops along Wurr Road, generally above the road at its eastern end, and below it near the western park boundary. Regionally, it is regarded as an important aquifer for water-supply purposes (c.f., Sylvester and Covay, 1978; Ricker, 1979), as well as one capable of

sustaining low flows important to listed fish and amphibian species in the region (Hecht and Kittleson, 1996). In the City of Scotts Valley, this aquifer has been designated as the sole source aquifer for drinking water. Throughout the Santa Cruz Mountains, this aquifer is of considerable significance. In the San Lorenzo River watershed, the Santa Margarita aquifer is thought to be quite vulnerable to contamination from near-surface sources such as septic leachfields (Ricker, 1979; Hecht and others, 1991). The Santa Margarita formation (dated as upper Miocene in age, with a usual map symbol *Tsm*) is a light gray to grayish orange to white, friable, very fine to very coarse-grained arkosic sandstone (Figure 5), characterized west of an apparent source area on Ben Lomond Mountain by very sparse but nearly-ubiquitous occurrence of red garnets (Hecht, 2003). It has not been currently mapped by the U.S. Geological Survey within the Pescadero Creek watershed; however, field investigations conducted during this study found outcrops of weathered Santa Margarita sandstone extending along Wurr Road.

The Santa Cruz mudstone (locally known as 'chalkrock') and its sandy interbeds are similar in composition to the conformably underlying Santa Margarita, but likely with much lower yields. Generally, well yields from the mudstone are thought to come primarily from the fractures found throughout this unit, but its oldest beds (such as those along the south bank of Pescadero Creek) also include a number of sandy units.

The alluvium of Pescadero Creek also is a permeable and usually-productive unit, although most flows drawn from the alluvium are replenished with flows from the creek.

In general, the alluvium of Pescadero Creek and the Santa Margarita sandstone are the most likely zones to support a well with reliable yields, with the Purisima and Santa Cruz mudstones as lower-yielding aquifers less likely to sustain the flows sought by the County but still meriting consideration, because they outcrop adjacent to the existing water-treatment plant and can be developed at much less cost (see Chapter 4).

## **2.5 Existing Seasonal Dam**

The existing flashboard dam is located 1000 feet downstream of the Wurr Road Bridge (see Figures 1, 2, and 10). It was constructed in 1938 to create a swimming and sunning area, as well as to aid the diversion of surface water 800 feet upstream. The dam is a concrete structure spanning the width of the creek (about 48 feet) and has a top width of 6.7 feet (see Figure 10 for diagram of dam and Figure 11 for a photo). The stream flows over the concrete structure, as well as through a small sluice gate in the base of the dam, near the left side of the notch. The flashboards, when placed, raise the water level of the stream by about 4 feet and pond water upstream beyond the water diversion intake, about 4 acre feet. Use of the flashboards were discontinued in 2000 per request by the California Department of Fish and Game.

Two similar dams once located downstream were removed in 2001 by Memorial County Park (see Figure 1).

## **2.6 Existing Water Diversion System**

Memorial County Park diverts surface water from Pescadero Creek, per existing water rights of up to 30 gallons per minute, from a point about 800 feet upstream of the seasonal dam (North 47° West from the Southeast corner of SW ¼ of Section 34, T7S, R4W, MDB&M; within the SE ¼ of SW ¼ of Section 34; see Figure 1). This diversion pumps surface water roughly 75 feet up the bank through a 4" pipe to a water treatment facility, where it is tested and treated for temperature, turbidity, pH, and coliform organisms. Treated waters are then transferred to and stored in one 500,000 gallon underground storage facility and three 10,000 gallon aboveground storage tanks located along Wurr Road, to meet water-supply needs in Memorial County Park.

## **2.7 Current and Future Water Use**

The first license for Diversion and Use of Water from Pescadero Creek was certified by the County of San Mateo on June 15, 1967, to the satisfaction of the State Water Resources Control Board. The rate of diversion under this license was not to exceed 7,000 gallons per day by direct diversion from May 15 to September 30 of each year and 4.75 acre-feet annually by storage to be collected from May 15 to June 30 of each year. This license also limited the park to only diverting water necessary to keep the reservoir full by replacing water lost through evaporation

and seepage, and to refill the reservoir when emptied for necessary maintenance or repair.

On August 15, 1974, Memorial County Park was issued a second license for diversion and use of water for domestic and fire protection uses. This permit was issued with a seniority date of November 10, 1936, not to exceed 0.068 cfs (or about 30.5 gallons per minute) from January 1 to December 31 of each year. If, however, there is no interference with other rights, junior as well as senior, the park may increase this diversion rate to a maximum of 0.22 cfs (or about 100 gallons per minute, equivalent to 144,000 gallons per day), provided that the total quantity of water diverted in any 7-day period does not exceed 0.94 acre-feet. The maximum diversion allowed under this license cannot exceed 29 acre-feet per year.

## **2.8 Water Rights**

Since 1914, new appropriators have been required to obtain a permit and license from the State. In the State of California, there are two principal types of water rights: riparian and appropriative. A riparian right enables an owner of land bordering a natural lake or stream to take and use water on their riparian land. Water diverted under riparian rights must be used in the same watershed as the water source; in addition, it must never have been severed from the sources of supply by an intervening parcel without reservation of the riparian right to the severed parcel. Generally, a riparian water user must also share the water supply with other riparian users. These rights may be used to divert the natural flow of a stream, but may not be used to store water longer than 30 days for later use or to divert water which will be applied in a different watershed. Water provided to other parks or to parcels not contiguous to Pescadero Creek (such as those along Wurr Road) must be obtained through exercising an appropriative right. A riparian right is typically documented by filing a 'statement of water diversion and use'. An appropriative right, on the other hand, is required for use of water on non-riparian land and for storage of water for longer than 30 days. Generally, appropriative rights may be exercised only when there is a surplus not needed by riparian water users.

The current 'Statement of Water Diversion and Use' for the Park claims water through riparian rights. This statement, which has not changed since August 10, 1996, allows for diversion of up to 30 gallons per minute (gpm) and storage of up to 545,000 gallons for recreational, domestic, and fire control uses. Four years previously, in 1992, the park began regularly recording its monthly surface diversions (Table 3), which at that time was roughly 3 to 7 million gallons per

year from Pescadero Creek. In 1993, the park began filing surface diversion reports with the State, and now diverts surface water under a riparian right. This right was established in part in the event that the stream was adjudicated. Riparian diversions cannot be stored seasonally, but can be contained for up to 30 days in a regulated reservoir.

## **2.9 Water Quality and Treatment**

Phillips (1994) characterized Pescadero Creek as calcium-bicarbonate waters. He studied the hydrogeochemistry of the creek for his Master's thesis, collecting water samples through much of the watershed, from the tributaries and main stem, as well as ground-water samples drawn from wells near the divide. He found the chemical composition of Pescadero Creek to not deviate much longitudinally, and when plotted to illustrate the ionic sign on a trilinear 'Piper' diagram, the points were tightly clustered. Conversely more variation was observed in the tributaries and from well waters. We show a composite average of the Pescadero Creek data in Figure 8 along with samples collected at the water diversion intake for the Park. His field work was conducted in June and July of 1992 and 1993, and the Park collected the intake samples in September 1981 and October 1970. Figure 8 illustrates that the mineral composition of Pescadero Creek does vary over the course of the dry season (specifically in its cation composition), probably reflecting changing proportional contributions from specific tributaries with time during the summer season. The October 1970 sample resembles well water sampled from the divide; we tentatively interpret the results as suggesting that the shales and basalt of the upper watershed are disproportionately important in sustaining streamflow late in the dry season. Water quality of the Santa Margarita formation and Santa Cruz mudstone is generally thought to have a lower mineral content (perhaps by half) than other ground-water bearing units in the watershed, owing to the relatively 'clean' sand composition.

Other water quality analyses of raw water diverted at the intake pass Title 22 water-quality standards, with the exception of turbidity (see Appendices D and E). Turbidity, a surrogate for suspended solids, increases with streamflow. The Title 22 Maximum Contaminant Level (MCL) is 5 NTU (nephelometric turbidity units). The Park monitors turbidity on a daily basis for treatment purposes and does not treat water if turbidity exceeds about 6 NTU because it is comber sum. A coagulant (polymer) and filtration is used to remove turbidity, followed by chlorination before sending it to the treated water tank. Treated turbidity for June of 2002 to May of 2003 ranged between 0.05 and 0.17 NTU.

## Nitrate and Nitrite

Recent water quality samples taken in July of 2003 show “no detect” for both nitrate (as  $\text{NO}_3$ ) and nitrite (as  $\text{NO}_2$ ) for Pescadero Creek at the current intake. There is no reason to date to test, blend, or treat water for elevated levels of nitrate or nitrite.

## Temperature

Water temperatures were monitored during summer at the USGS gaging station one mile downstream from 1965 to 1980, and sporadically thereafter. Summer water temperatures were also measured during 1992, 1993, and 1994 by Phillips (1994) as part of a larger water-quality assessment. Winter water temperatures throughout the region are not thought to constrain salmonid habitat. Summer water temperatures in this reach of the upper Pescadero watershed are generally moderate, with daily values of  $15^\circ\text{C}$  to  $18^\circ\text{C}$  being typical. Extreme values during mid-afternoon conditions at the USGS gaging station downstream are seldom above  $20^\circ\text{C}$ .

### 3. FIELD METHODS

#### 3.1 Overview

In order to suggest alternatives to the current in-stream diversion system in Pescadero Creek at Memorial County Park while maintaining existing water rights, this study entailed field activities:

1. Characterizing stream bed-sediment (substrate) conditions;
2. Surveying the longitudinal (thalweg) profile upstream and downstream of the dam;
3. Approximating the static volume of sediment in Pescadero Creek upstream of the dam to Wurr Road bridge;
4. Measuring the dimensions and assess functionality of the dam: and
5. Evaluating fish passage at the dam and at the road crossing connecting Sequoia Flat with Azalea Flat;
6. Hydrogeologic reconnaissance for potential water well sites.

#### 3.2 Terminology

The following terms are applicable to work performed and presented in this report.

*Longitudinal (thalweg) profile*- Constructed by surveying the elevation of the channel bed in a downstream direction along the deepest part of the channel. In-stream points are surveyed at all breaks-in slope, riffle crests, maximum pool depths, and tails of pools. This profile was used to establish the volume of sediment behind the dam up to the Wurr Road bridge crossing that may be released to the downstream channel if the dam is removed.

*Bed-surface composition-* Analysis of the particle-size composition is used to evaluate changes in sediment deposition and other parameters that may influence the quality of salmonid habitat affected by the bed *surface* – especially rearing. Data collection for this purpose was based on the pebble count method developed by Wolman in 1954.

*Pebble count-* Wolman’s pebble count is a random sampling of approximately 60 to 100 particles on the bed surface of a creek bed or gravel bar, which is used to evaluate substrate suitability for habitat needs, calculate entrainment (propensity of mobilize during storms) and estimate bedload transport rates, as well as to characterize part of channel roughness (Kondolf, 1997). Balance staff have modified the strict geomorphic pebble count to also include other descriptors of bed compositions, such as the proportion of the bed covered by organic material large enough to provide habitat, the area covered by sand, silt and finer material, or by bedrock (c.f., Hecht and Enkeboll, 1980), a practice now widely used. From this information, bed surface proportion, and particle size distribution can be characterized by size frequency.

*Bed-core composition-* The cores are used to describe the size of material *beneath* the bed-surface or ‘armor’ layer. It is particularly important in evaluating spawning and fry-emergence conditions, and is also a useful predictor of the sizes of materials recently transported and likely to be transported as bedload during subsequent storms, as well as in comparing bed conditions between streams. Before sampling takes place, the surface layer is scraped away to a depth of about twice the typical bed-surface material size; then, a 6-inch sampler is carefully driven into the bed, sealed at the bottom with a metal sheet, extracted, and bagged after slowly decanting the water. Each sample is then dried and sieved and measured for its geometric mean ( $D_{50}$ ) and standard deviations ( $D_{16}$  and  $D_{84}$ ) or other indices, as computed by weight.<sup>1</sup> As in other studies in the region, bed core samples were usually taken from tails of pools or heads of glides, the most recent and regular areas of deposition. We believe that the composition of bed cores will approximate that in the alluvium of Pescadero Creek, and can be used to assess its water-bearing properties for well-design purposes once a successful borehole has been developed.

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<sup>1</sup> As with bed-surface material, the range of sizes in natural gravels is so great that data are usually log-transformed (or plotted on log-transformed graph paper).

*Cobble embeddedness* – Embeddedness is measured as the percentage of the depth to which rocks larger than 45 mm<sup>2</sup> in diameter on a river bottom are buried in finer sediment, and used to evaluate if salmonid spawning areas are becoming degraded with sand. Typically, rocks that are more than 30 to 40 percent embedded are regarded as poor habitat for rearing steelhead and coho; the lower value is more typical of conditions statewide, while the latter is a more realistic value for the Santa Cruz Mountains, where embeddedness with fine sand originating from the widespread marine sandstones is nearly ubiquitous.

### **3.3 Technical Approach**

#### **3.3.1 Bed-sediment conditions**

Bed sediment was characterized at the dam site with three field methods:

1. Conducting field measurements of the bed-surface sediment-size class;
2. Conducting field measurements of the bed-surface cobble embeddedness; and,
3. Collecting bed-core samples and analyzing them for particle-size class.

Bed-core samples (also referred to as pool-fill sediment and sub-surface material) were collected in three locations (see Figure 7 for locations):

1. In the first pool, 35 feet downstream of Wurr Road bridge, at the tail waters of the pool formed when the flashboards are placed;
2. On an in-stream bar 10 feet upstream of the dam; and,
3. On the first glide 95 feet upstream of the dam, just upstream of the in-stream bar behind the dam.

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<sup>2</sup> The line of division between gravels and cobbles is 64 mm (or about 2.5 inches) in intermediate diameter, but senior biologists Dave Dettman and Don Kelley concluded more than 20 years ago that somewhat smaller particles are used for cover by young-of-the-year salmonids in the sandier streams of the Central Coast region, and 45 mm is now widely used.

The sample collected downstream of bridge may reflect bed conditions as they would be without the existing dam, because the effects of impoundment probably end at this distance upstream of the dam. Recognized differences with the samples collected upstream of the dam, can be used to estimate bed conditions before and after dam removal, as well as what size material will be released if the dam is removed. It is important to note that these samples are not intended to assess properties of spawning gravels in Pescadero Creek as a whole.

The bed-surface of a creek or river is generally composed of either coarse or fine sediment, bedrock, and woody or organic debris. Coarser grained sediments are transported during heavy flows, becoming sorted and redistributed as flows recede. Finer grained sediments, composed primarily of sands and silts, are generally winnowed from riffles and move from pool to pool with moderate flows. Bed-surface material at the heads of riffles is a good descriptor of both spawning gravel stability and (logically, but not yet conclusively established) spawning gravel permeability. Bed-surface material also is a good metric for the suitability of summer rearing habitat for steelhead. Conversely, the percentage of bed material that is less than 4 mm in diameter is typically a good index for the extent of sedimentation which might impair that habitat. We characterize the bed-surface material by conducting pebble count and cobble embeddedness measurements along 100-foot longitudinal transects beginning at the riffle head immediately downstream (about 35 feet) of the Wurr Road bridge to assess the bed as it would be without the existing dam. The setting here in Pescadero Creek is comparable to the riffle in Zayante Creek at the Woodwardia weir (Hecht and Enkeboll, 1980; Hecht and Kittleson, 1998), standing four feet high with a seasonal flashboard.

### 3.3.2 Longitudinal profile

A 2000-foot longitudinal section along Pescadero Creek, both upstream and downstream of the existing dam, was surveyed to assess the local bed profile (see Figure 7 for location). Field work was conducted in part on February 28, 2003, and then completed on April 9, 2003. Survey transects began and ended at riffle crests and survey distances were measured along the centerline of the high-flow channel. Water levels, elevations of gravel bars and high-water marks were also measured. The length of this survey was approximately 35 to 40 channel widths. Elevations were surveyed with an automatic level.<sup>3</sup>

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<sup>3</sup> The error in elevation at closure for survey upstream of the dam was 1.05 percent, and for the downstream portion of the survey, 0.1 percent.

The longitudinal profile was used to assess 1) the volume of sediment behind the dam, 2) the functionality of the dam for upstream water diversion, and 3) the local bed gradient.

### 3.3.3 Volume and mass of sediment wedge behind dam

We estimated the volume and mass of sediment on a 1000-foot reach of Pescadero Creek extending from the dam to the Wurr Road bridge crossing (see Figure 7 for the location). We divided the sediment into two types: 1) sediment forming in-stream bars behind the dam that would likely be mobilized if the dam were removed; and 2) channel alluvium forming the creek bed. We based the estimate on the results of our longitudinal thalweg profile.

We first estimated the total volume of sediment. The depth of bedrock was estimated on the longitudinal profile by drawing a linear baseline that connected the two deepest pools on the reach: the splash pool immediately downstream of the dam, and the pool at the water diversion intake where bedrock was observed near surface. The depth to bedrock from the thalweg was then used to calculate the average depth of sediment. This was then multiplying by the channel width and length to calculate the total volume. We used the channel width that we measured at the dam (48 feet) as the average channel width.

We then estimated the volume of the in-stream bars by similarly drawing a baseline on the longitudinal profile connecting the bed surface of the pools and runs between the bars, calculating the average depth and multiplying it by the channel width and length.

Bulk density of the sediment was used to convert from volume to mass in tons. Based on a previous study in an area with many of the same geologic formations (Brown, 1973), we assumed that the bulk density of sediments in Pescadero Creek at this location is approximately 1500 kilograms per cubic meter (or 2500 pounds per cubic yard, or about 92.6 pounds per cubic foot).

### 3.3.4 Dimensions and operations of dam and evaluation of fish passage issues

We met with John Kenney and Don Curran at the Park on February 13, 2003, walked the site and discussing on the operations and alternatives for the dam and flashboards.

On February 28, 2003, fisheries biologist Jeff Hagar visited the site and conducted a reconnaissance to evaluate potential impacts to steelhead and coho salmon from operation of the seasonal flashboard dam in Pescadero Creek at Memorial County Park. We met him on site and discussed three options for the dam: 1) seasonal use of the flashboards, 2) use of the dam

without the flashboards, and 3) removal of the dam. We also examined the existing fish ladder at the downstream road crossing between Azalea Flat and Sequoia Flat. He prepared a technical memo, which is located in Appendix B, further exploring these alternatives.

We later returned on April 9, 2003 and measured the dimensions of the dam with a tape and surveying rod when we conducted the longitudinal survey. The height of the dam was measured from the lowest point in the channel at the downstream toe of the dam in the splash pool.

### 3.3.5 Water-well site reconnaissance

We requested driller's logs and production data for wells in the Pescadero watershed east of the community of Pescadero from San Mateo County Environmental Health Department. A search of their files found that no such information was available. Other subsurface data for this area are also limited. Without directly hydrogeologic information, candidate areas for wells were then selected using multiple lines of evidence to effectively optimize yield and water quality. We reviewed a) existing hydrologic and geologic data, including ground-water quantity and quality data of the local aquifers, b) access to the site for power and such that maintenance and operational needs may be met, and c) distance from the well location to the treatment facility. Exploratory drilling was not within the scope of this study.

Hydrogeologic reconnaissance was conducted on February 13, 2003 by Barry Hecht, Charlotte Hedlund, and Gustavo Porras in order to identify feasible ground-water well locations within Memorial County Park. During the field visit, physical site conditions and well-drilling logistics were evaluated including potential locations of ground water, site access, proximal utilities, service areas, and potential hazards. Three main regions of the park were explored for potential well sites: 1) the Purisima bedrock formation at and just west of the water treatment plant, and 2) the Santa Margarita sandstone along Wurr Road near Jeep Trail; two high-yielding domestic wells exist north of Wurr Road at this location, suggesting some likelihood of a viable water well at this site, although we suspect (absent well logs) that the wells may be developed in both the alluvium (as terraces) and in the Santa Margarita, making assignment of properties somewhat equivocal. In addition, we also evaluated the alluvium along Pescadero Creek, with special attention to the downstream portion of the park, where it seems deepest and widest; this alternative was discarded at an early stage, since the alluvium is sufficiently thin and little

advantage over the existing direct diversions could be seen in (a) treatment requirements, (2) water rights, (3) reliability/resilience, and (4) operational costs.

## 4. FINDINGS

### 4.1 Characterization of Bed Sediment Upstream of the Dam

We estimated that there are 3,300 cubic yards of sediment behind the dam, roughly divided 60 percent channel alluvium and 40 percent overlying in-stream bars (Table 2). The in-stream bars would logically be first to mobilize if the dam were to be removed, and constitute 1,400 cubic yards (or about 0.86 acre feet) of sediment. We sampled the particle-size composition of the bar nearest the dam (seen in Figure 10) and found 74 percent gravel and 26 percent sand (<4 mm).<sup>4</sup> Results are present in Table 1.

Underlying the in-stream bars, we estimated about 1,900 cubic yard of active channel alluvium (Table 2). Our spot sample of this material (95 feet upstream of the dam) showed 48 percent cobbles, 51 percent gravel and 1 percent sand (Table 1). Because of the coarseness, as well as it being at a lower elevation relative to the bars, we consider this material to be less mobile if the dam were to be removed – conceivably a coarse metastable alluvial bed surface on the channel, one likely to gradually be lowered over a period of years following potential removal of the dam.

Our sediment samples of the riffle near Wurr Road bridge, at the very head of the impounded area formed when the flashboards are in place, consisted of 11 percent sand and the remainder as cobbles and gravel (Table 1). Bed-surface armor was not present. We expect similar composition through the reach if the dam were to be removed. Coho salmon redds can be situated in substrates composed of up to 10% fines (Emmet, et al, 1991), but in general, spawning success and fry survival are favored by clean gravel consisting of less than 5% fines.

The degree to which gravel-sized and larger particle are surrounded, enclosed, or covered by sand-sized and smaller particles is known as percent embeddedness. Experiments have shown that embedded levels of 50 to 60% cause complete departure of salmonid fry. Changes in benthic macroinvertebrate fauna occurs at 67% embeddedness. While many Northwest experts call for percent embeddedness to not increase above natural levels at any time (Harvey, 1989),

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<sup>4</sup> Classifications systems worldwide consider sand to be finer than 2 mm. The Wentworth-Udden system used by the U.S. Geological Survey and Corps of Engineers classifies materials of 2 to 4 millimeters as 'granules' and particles of 4 to 64 mm as 'gravels'. For most purposes related to anadromous-fish habitat, it is a useful simplification to classify sand as material finer than 4 mm, provided it is so identified.

central California streams are by their very nature episodic, with embeddedness and overall bed sedimentation varying over time.

The mean cobble embeddedness of bed-surface material just downstream of the Wurr Road bridge crossing is 0.25 (Table 1), which means on average 25 percent of the cobbles are buried by smaller sized sediment. This may be evaluated against the criteria of McCabe and others, 1985:

<u>Percent Embeddedness</u>	<u>Habitat Quality</u>
< 25%	Excellent conditions
25 – 50%	Good conditions
50 – 75%	Fair Conditions
> 75%	Poor conditions

The Regional Water Quality Control Board lists sediment as an impairing constituent throughout the Pescadero/Butano watershed. This may be an artifact of the fine-grained nature of the bed surface, having a median gravel and cobble size of about 40 mm and 11 percent sand (see Table 1). We anticipate that changes in bed conditions associated with the alternatives presented will be relatively small, and that embeddedness will not be greatly affected.

The occurrence of woody and organic material on the bed surface immediately downstream of the Wurr Road bridge crossing constitutes 5% of the sampled bed area. The sampled wood, however, was not large, which forms pools and allows for increased cover, habitat variety, fish feeding stations, and general ecological health.

## **4.2 Use of the Dam and Impacts to Fisheries**

The flashboard dam structure was originally constructed in 1938 to develop a reliable water source and recreational swimming pool during the summer months. The pool behind the dam provides a swimming area, and constructed concrete terraces on the right bank, a sunning and picnicking area (see Figure 10). When the flashboards are placed, raising the water level about 4 feet, the pool behind the concrete foundation extends upstream beyond the water diversion intake and Wurr Road bridge. The deeper and larger pool has value for swimmers, otherwise it is simply a spot to cool off and get wet.

The Park has typically placed the flashboards seasonally for the summer, and removed them for winter high flows. Recently, the California Department of Fish and Game (CDFG) has expressed concern that the dam may serve as a migration barrier to steelhead trout and coho salmon, and has not permitted placement of the flashboards. In addition, lifeguards have been increasingly more difficult to employ. The summer of 2000 was the last year the flashboards were placed. Downstream of the dam, the Park as removed two similar dams in 2001, and has plans to improve fish passage at the road crossing connecting Sequoia Flat with Azalea Flat.

Currently, the dam likely prevents juvenile upstream migration. Although adults spawn above the dam and are seen migrating past the dam at baseflow levels, the dam exceeds baseflow criteria for maximum velocity and maximum hydraulic drop for both adult and juvenile salmonids. Even under winter baseflow conditions, we measured water velocity through the sluice gate at 7 feet per second and the hydraulic fall over the top of the dam exceeded 12 inches. Immediately upstream of the dam, surface water velocities averaged 1 foot per second.

Fisheries biologist Jeff Hagar has identified dam related issues (Appendix B). Continued operation of the dam and seasonal placement of the flashboards require permitting with CDFG and consultation with NOAA Fisheries (NMFS), may involve extensive studies and/or monitoring, as well as criteria for flashboard operations, to address fish passage and habitat issues. Mitigation features including fish passage enhancements such as a fish ladder may be required.

Permit requirements for discontinuing use of the flashboard dam but leaving the concrete foundation in place are unclear. Generally, for seasonal dams, CDFG defines the 'project' as the action of flashboard placement and removal, and if there is no action, then there is no 'project' requiring permits or CEQA compliance. Many of the impacts to fisheries would be avoided by discontinuing use of the flashboards; modifications to the foundation may be needed to improve passage, particularly for juveniles, but not legally mandated. If sought, permits would likely be required to modify the foundation to improve fish passage.

Full removal of the dam would eliminate regulatory issues with CDFG and NOAA Fisheries, but the degree to which it would benefit steelhead and coho is not certain, particularly regarding the loss of pool rearing habitat, and considering that adults are currently spawning above the dam and migrating past the dam at baseflows. Regulatory issues are moot for dam

removal; it is regarded as eliminating possible dam-related 'take', regardless of the stream habitat change. Temporary deconstruction-related impacts would likely require a CDFG stream alteration permit.

### **4.3 Potential Water Well Sites**

We identified two areas where it may prove feasible to develop ground water wells as an alternative to Memorial County Parks water supply. Both sites are situated within aquifer formations, Pliocene Purisima formation (Tpt) and Santa Margarita sandstone (Tsm), which have historically proven to be productive. The Purisima formation sustains many wells in coastal San Mateo County, although yields can be exceedingly variable and water quality can be satisfactory to unusable. As mentioned previously, the Santa Margarita sandstone aquifer is a significant regional water supplier within the Santa Cruz Mountains, although unproven in the Pescadero watershed, its northernmost extent.

The first site with well potential is within a strip of outcrops of Santa Margarita sandstone along Wurr Road, south of the park boundary. This formation has not previously been mapped near Pescadero Creek, but is present in the same stratigraphic position near the top of the ridge to the south. It is exposed intermittently over a mile along Wurr Road, and pinches out to the southeast along Peterson Creek. During field reconnaissance on February 13, 2003, ground water discharge was observed from the entire length of the outcrop. Figure 6 is a photograph of this outcrop, showing the overwhelming preponderance of quartz, with lesser feldspar and mica; trace amounts of garnet were also observed. This mineralogical composition is characteristic of the Santa Margarita elsewhere on the western slope of Ben Lomond Mountains, where it usually yields high quality ground water. However, due to the permeable nature of this aquifer, it has become susceptible to nitrate contamination.

Surface water is currently diverted from Pescadero Creek, transferred to the water treatment facility just north of Tan Oak Flat, and then pumped over ½ a mile to storage facilities near the intersection of Wurr and Memorial Park Roads. Ground water development within the Santa Margarita aquifer along Wurr Road could be transferred just a short distance (roughly 200 feet) to the existing water storage tanks and would eliminate the needs and costs associated with treatment and transfer.

The second site with well potential is within the Tahana Member of the Purisima aquifer adjacent to the existing water treatment facility. This formation is mostly a sandstone and siltstone, with some mudstone. In Memorial Park, it also consists of dark-gray porcellaneous mudstone, with pebble conglomerates occurring near the eastern base of the park. Exposures of the Tahana Member aquifer, which currently serves a water supply to Capitola, Soquel, and Aptos, meeting all health standards, is shown at the existing water diversion intake pipe and pump station (Figure 12).

This formation constitutes roughly 25% of the Pescadero Creek watershed upstream of the existing dam and serves as a significant source of baseflow to Pescadero Creek. Field reconnaissance also revealed the proximity of coarse grained alluvial deposits along the creek, adjacent to the treatment facility. If the park were to develop a well at this location, it would most likely draw from a combination of these aquifers, increasing its potential as a viable water source.

## 5. DISCUSSION

### 5.1 Habitat Suitability for Salmonids

To varying degrees, the dam affects bed conditions, passage, and possibly water quality. Discussion of each can assist San Mateo County Parks staff in choosing how and when to proceed with alternatives for the dam and for future water supplies.

#### Bed Conditions

The conditions at the site most intensively sampled – just downstream from the Wurr Road bridge – appear suited for spawning, incubation and rearing, based on comparisons with other streams in the region which are known to support steelhead and (in some instances) coho. Bed-surface material is of generally similar size, with sufficient gravel and cobble to provide a matrix for spawning (Table 1). The sediments composing the bed surface are noticeably finer than in Newell Creek below Loch Lomond, a generally-similar stream without appreciable bedload, so it is likely that bed conditions are poorer than typically prevailed several hundred years ago.

We selected this site because it appears upstream of the geomorphic influence of the dam. If the dam does affect slope or deposition at this location, the effects are likely to be very small. Similar (or coarser) bed conditions prevail for some distance downstream from the dam. We conclude that bed conditions throughout the impounded reach would likely be within the range typical for Pescadero Creek and for other salmonid streams if the sediment stored behind the dam were to be removed or washed away.

Under conditions prevailing in 2003, the bed-surface sediment behind the dam appears only slightly finer than can be found upstream from Wurr Road or downstream of the immediate effects of dam-generated turbulence. The bed in riffles or the tails of glides, however, was distinctly ‘softer’ and more susceptible to entrainment. It is probable that steelhead would preferentially not choose to spawn in these less-stable riffles, and if they did, the eggs would almost certain incur higher mortality than usual.

The volume of material stored behind the dam – about 3300 cubic yards or 4200 tons (Table 2) -- is not large relative to the mean annual movement of sediment through the park. Sediment yields for the Pescadero watershed are presently under review as part of an ongoing watershed study. Pending updated data, it may be reasonable in this case to apply an estimate of 2500 tons per square mile developed by Bill Brown (USGS) to the Zayante watershed, underlain by similar rock types. If so, the annual sediment load passing through the Park is on the order of 100,000 to 120,000 tons per year. The material stored behind the dam would thus amount to about 4 percent of the mean annual sediment load. This proportion is sufficiently low such that (a) most well-reported downstream effects of dams on either geomorphic or biologic conditions are not apparent, (b) present effects on water quality or turbidity are probably minimal, and (c) removal of the dam is not likely to have a long-term (or even a short-term) effect beyond its immediately vicinity.

If the dam were removed or modified in a way that eliminated sediment storage, we estimate that about 40 percent of the sediment nearest the bed surface would be rapidly mobilized, perhaps during the initial year or few years following implementation. The remaining sediment prism would probably be removed at a more gradual rate, principally over the following decade. Relative to other dam-removal projects which have been proposed or completed, these effects would probably not be large. Local effects within the Park may be mitigable.<sup>5</sup>

#### Passage:

Adult salmonids currently migrate past the dam during high flow as well as during dry-season base flows. On February 28, 2003, Jeff Hagar noted evidence of spawning along the left bank about 70 feet upstream of the dam (Appendix B), as well as on the first riffle downstream of the dam, and while he was at the dam, an adult female steelhead (about 20 inches long) swam upstream through the sluice gate. The sluice gate may constrain passage though, particularly for juveniles.

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<sup>5</sup> NOAA Fisheries is presently in the late stages of developing guidelines for sediment removal. A draft was circulated for per review in May 2003. Removal of sediment should occur in compliance with this document, in its final form, to the extent that it proves applicable to the Park.

Current CDFG criteria for new and replacement culverts include:

- Minimum width of 3 feet
- Maximum slope of 0.5 percent
- Embedment of the bottom below the natural channel
- Maximum average velocity of 6 feet per second for adults, and 2 fps for juveniles (short distances only);
- Maximum hydraulic drop of 1 foot for adults, and 6 inches for juveniles;
- Minimum water depth of 1 foot for adults, and 6 inches for juveniles.

Given these criteria, the principal constraint for salmonid habitat is passage, particularly for juveniles. On April 9, 2003, when the water level behind the dam was at the top of the concrete foundation and a sheet of water was flowing across the top (Figure 11), we measured the average velocity of the water through the sluice gate at 7.5 feet per second. The velocity would presumably decrease later in the dry season as streamflow and the water level behind the dam lowered; at this time, though, the depth of water in the sluice gate might pose an issue. In addition, the width of the sluice gate is 1 foot and it does not have a natural channel bottom.

#### Temperature:

None of the projects under consideration are expected to appreciably raise water temperatures above the moderate summer levels reported for this reach.

#### Turbidity and Other Water-Quality Constituents:

Turbidity is not a chronic issue for salmonid in the Park; levels are elevated only during storm flows, which is common in the Santa Cruz mountains. Salmonid-egg tolerance for turbidity (a surrogate for suspended sediment) is less than 10 NTU. High turbidity is detrimental to emergence, feeding, and growth (Emmett and others, 1991) and can also diminish the dissolved oxygen content of water. During the wet-season 2003, turbidity of diverted raw waters ranged between 0.32 and 6.3 NTU, and 22 days exceeded 6 NTU. Water quality samples collected on March 1, 2001 (Blume, Kenneth and Brown, 2001) measured 10.8 NTU at a streamflow of 19 cfs at Homestead in the Park (see Figure 7 for location). Other water quality parameters that typically constrain fisheries (such as temperature, pH and dissolved oxygen) appear to be at acceptable levels (Appendix D).

## 5.2 Alternatives for the Dam and Impacts of Dam Removal

We identified three potential alternatives for the dam: 1) Continued operation of dam and seasonal flashboards; 2) Discontinued use of the seasonal flashboards and potentially modifying the concrete foundation to improve juvenile salmonid (steelhead and coho) migration; and 3) Full removal of dam. The largest reduction to salmonid impacts caused by the dam is gained from discontinuing the use of the flashboards. Modification of the concrete foundation for juvenile migration would further benefit fisheries habitat, as would dam removal. Full removal of the dam (including the concrete foundation) although would optimize fish passage and eliminate dam-related 'take', may reduce rearing habitat, and therefore, the degree to which it would benefit steelhead and coho is not certain.

If the dam is removed, approximately 11% of the sediment released to the downstream reaches of Pescadero Creek will be 4mm or less in diameter; roughly 22% will be cobble sized (Table 1). Removal of the dam therefore will allow for the necessary transport of coarse sediment to the downstream reaches of Pescadero Creek. The majority of sediment released during dam removal will be coarse materials, which will be advantageous to salmonid habitat in the downstream reaches of Pescadero Creek.

The volume of material stored behind the dam – about 3300 cubic yards or 4200 tons (Table 2) -- is not large relative to the mean annual movement of sediment through the park. Sediment yields for the Pescadero watershed are presently under review as part of an ongoing watershed study. Pending updated data, it may be reasonable in this case to apply an estimate of 2500 tons per square mile developed by Bill Brown (USGS) to the Zayante watershed, underlain by similar rock types. If so, the annual sediment load passing through the Park is on the order of 100,000 to 120,000 tons per year. The material stored behind the dam would thus amount to about 4 percent of the mean annual sediment load. This proportion is sufficiently low such that (a) most well-reported downstream effects of dams on either geomorphic or biologic conditions are not apparent, (b) present effects on water quality or turbidity are probably minimal, and (c) removal of the dam is not likely to have a long-term (or even a short-term) effect beyond its immediately vicinity.

If the dam were removed or modified in a way that eliminated sediment storage, we estimate that about 40 percent of the sediment nearest the bed surface would be rapidly mobilized, perhaps during the initial year or few years following implementation. The remaining

sediment prism would probably be removed at a more gradual rate, principally over the following decade. Relative to other dam-removal projects which have been proposed or completed, these effects would probably not be large. Local effects within the Park may be mitigable.<sup>6</sup> Table 9 summarizes considerations and measures that may be taken to mitigate, based on NOAA Fisheries' recent guidance document for sediment removal.

### **5.3 Alternatives to the Current In-Stream Diversion**

Two primary alternatives to the current in-stream diversion in Pescadero Creek at Memorial County Park have been considered for viable water supplies. These are infiltration galleries, which can be designed to very specific hydrologic parameters, and ground water well development. A detailed description of each of these options and their feasibility follows, and associated costs are shown in Table 4.

#### **5.3.1 Infiltration galleries**

Infiltration galleries (Figure 13) are used usually to supply large quantities of water where wells are unable to supply water needs, especially where hydrogeologic barriers may limit well efficiency or where surface water sources are too shallow for intake screens. Several types can be designed according to the local conditions and can be constructed either parallel to or across stream beds. The first gallery type involves the building of a trench parallel to the river bank to a depth below the river bed to intercept baseflow by collecting pipes. These pipes can then be connected to a collector well sited on the river bank or other adjacent area. The length of the gallery will depend on the amount of water required and the hydraulic characteristics of the water-bearing sediments. In general, the primary benefit to infiltration galleries over other water supply methods is the elimination of small, or push up dams. Placement of infiltration galleries as a water supply alternative for Memorial County Park must take into account the following factors:

1. Galleries located under the water source will have higher yields, yet will diminish in yield as sedimentation reduces the hydraulic conductivity of the surrounding filter pack.

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<sup>6</sup> NOAA Fisheries is presently in the late stages of developing guidelines for sediment removal. A draft was circulated for per review in May 2003. Removal of sediment should occur in compliance with this document, in its final form, to the extent that it proves applicable to the Park.

2. For galleries located adjacent to a water source as opposed to underneath it, the filtration process is more extensive decreasing turbidity and bacterium concentrations.
3. Typically, installation of galleries adjacent to a water source requires less area alterations.
4. Bed-mounted galleries tend to require more maintenance due to sedimentation, and
5. Varying water levels can either cover or uncover bed-mounted galleries, affecting their permeability.

Common infiltration gallery design criteria include:

- Through-slot velocity should not be greater than 30.5 mm per second (approximately 0.1 feet per second).
- Axial velocity (flow inside the screen) should not be greater than 915 mm per second (roughly 3 feet per second).
- The gravel pack should have high permeability, and be of uniform size, clean and well rounded.
- The slot opening should be roughly half the smallest particle size of the gravel pack. Infiltration galleries are not effective at screening finer materials from flow. It is also recommended that the slot width not exceed 1.5 mm
- For fresh water applications, type-304 stainless steel or PVC is suitable. Type-316 stainless steel is more typical of salt water applications.

It is suggested that the installation of bed-mounted infiltration galleries at Memorial County Park, should the Park choose this as an alternative to water supplies, take place at or near the existing water intake upstream from the dam in an effort to reduce costs associated with connecting to the current water transfer and treatment system.

Design criteria specific to bed-mounted galleries:

- In an effort to reduce silt build-up, stream velocity above the galleries should be a minimum of 300 mm per second.
- The screen should be buried in the gravel pack between 1 m and 1.5 m below the stream bed surface.

- In multiple screen installations, screens should be placed a minimum of 3 m apart.
- The filter pack should extend at least 1.5 m on all sides of, and at least 0.3 m below, the screens.
- All screens include a backwash capability, and that rate should be twice the maximum pumping rate.

Design criteria specific to on-shore galleries:

- The screen should be buried at least 1.2 m beneath the static water level at low flow, but no more than 7.6 m.
- To determine required screen width, the point of no drawdown must be found empirically by using a series of observation wells.

The Krumbein and Monk equation was used to estimate the permeability of sediments (in darcies) roughly 35 feet downstream of Wurr Road bridge.

$$k = 760(Gm_e)^2 e^{(-1.31s_F)}$$

where:

$k$  = intrinsic permeability in darcies

$Gm_e$  = geometric mean diameter (in mm) =  $(D_{16} + D_{50} + D_{84})/3$

$s_F$  = standard deviation (phi scale) =  $(D_{84} - D_{16}/4) + (D_{90} - D_{10}/6.6)$

This resulted in a value of  $2.34 \times 10^{-7}$  darcies, which was then converted into hydraulic conductivities ( $K$ ) in centimeters per second (cm/sec) using the relation:

$$K = k \rho / \mu$$

where:

$K$  = hydraulic conductivity (cm/sec)

$\rho$  = density of water = 0.9982 g/cm<sup>3</sup> at 20° C

$g$  = acceleration of gravity =  $980 \text{ cm/sec}^2$

$\mu$  = dynamic viscosity of water =  $0.01 \text{ g/(cm sec)}$  at  $20^\circ \text{ C}$

$k$  = permeability (in units of  $\text{cm}^2$ ) (conversion factor:  $9.87 \times 10^{-9} \text{ cm}^2/\text{darcy}$ )

This results in a hydraulic conductivity of  $2.3 \times 10^{-2} \text{ cm/sec}$ .

The Santa Margarita sandstone aquifer has often been contrasted with the Paso Robles formation in past studies, showing that it typically has lower hydraulic conductivity values of approximately  $10^{-4} \text{ cm/sec}$ .

Routine inspections of galleries should be carried out in the normal course of work, and flow rates monitored. Any unusual reduction or increase in flow can be determined from meter readings. The condition of gallery hatches, pump wells, ladders, float switches, suction pipes, gallery pipe entries and concrete bases should also be inspected during regular water salinity monitoring. Annual inspections of all galleries and their associated equipment should be conducted. The inspections at each gallery should include examination of the base of the gallery pump stations (to check for structural integrity and amount of sediment on floor); the concrete pump wells (to inspect wells for any signs of structural failure, and to check the integrity of seal between well and inflow pipes); the float switch (to check its general condition, to measure level relative to base of pump well, and to check against previous levels to ensure continued accurate level readings); the suction pipe, strainer, and mounting brackets (to check their general condition); covers and hatches (to check their general condition); and, the pumps, meters, and valves (to check their general condition - meters and valves also require internal inspection, and cleaning if necessary).

The main components of galleries that may require the most maintenance are the gallery conduits. If these conduits are constructed from PVC, and there are sufficient manholes to allow access to these pipes, maintenance should be a relatively simple task. It is essential that galleries have an easy means of access to permit periodic cleaning of sediment from the conduits. While it is difficult to estimate the amount of sediment in the pipes by inspection, as they are laid below the water table, the need for cleaning will usually become evident by a larger drawdown than normal within the pump well for a given pumping rate. Regardless of any sediment problems that may have occurred in gallery pipes, it is recommended that all

gallery pipes be cleaned out after two years of operation. If PVC pipes are chosen, pipes should be at least 100 mm or larger nominal diameter to ensure that they can be cleaned. If no or very little sediment is found, then the procedure will not need to be repeated again unless problems arise in the future. However, if a reasonable amount of sediment is found, then the procedure should be repeated regularly every two years.

All waters diverted through infiltration galleries will likely be considered “ground water under the influence of surface water” under water-quality regulations applicable to campgrounds and other community facilities (“Title 22”). Monitoring and testing requirements are similar to those for surface water diversions. The Park, however, will realize some benefits in turbidity and possibly coliform reduction if surface diversions are substituted with infiltration galleries.

It should also be noted most conventional infiltration gallery designs are emplaced at depths of 8 to 10 feet (or more) beneath the bed of the stream. Pescadero Creek has limited areas in which such depths can be approached or attained.

### 5.3.2 Ground-water development

We concluded that the units within the boundaries of the Park most likely to provide reliable and high yields are the Santa Margarita sandstone and Purisima formation. The former is relatively distant from the water-treatment plant, and the latter is likely to be drawing underflow from Pescadero Creek.<sup>7</sup> Therefore, alternative for supplies within the Purisima formation merit initial consideration.

In addition to properties of the source aquifer, well design and development will affect the performance of the well and the selection of the site where the well is to be developed. A typical well should be designed to keep entrance water velocities low enough to avoid degassing or alteration of water quality. The pack should be as thin as possible in order to remove fine particles yet thick enough to provide borehole support and equal distribution of material around the screen. Generally, a minimum of two inches is sufficient. The ground

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<sup>7</sup> Costs of access, storage, and pipelines needed to develop the Santa Margarita sandstone for water-supply purposes are likely to be several hundred thousand dollars, primarily in pipeline costs. Substantial delays and costs may be incurred while an underflow determination is made if water within the alluvial aquifer is developed as a source, and depth of the aquifer may not be sufficient to sustain flows during dry years.

water well to be developed would be drawing on a 'bedrock' aquifer, then tested and built to drinking water well specifications as they are imposed by the State Department of Water Resources. Unit drilling costs for this finished well are likely to be about \$60/foot for a 6" diameter casing, a total depth of roughly 200 feet, and a 50-foot well seal. Overall well costs, with wellhead improvements, pumps and plumbing are likely to be on the order of \$25,000 to \$30,000, exclusive of well-site access expenses. Several other logistical factors need to be taken into consideration when installing a drinking water well, such as access to the drilling site, availability of power, constraints on equipment, ability to obtain permits, disposal of development water, ability to develop and sample the well, and costs of well completion. It should also be noted that not every attempt to drill a well is successful, and (especially in the Purisima formation) one or more dry holes may be expected and should be budgeted. Unit costs for boreholes drilled but not completed as wells are typically in the range of \$18.00 to \$22.00 per foot, or about \$4,000 per dry hole.

Costs of well development in the Santa Margarita sandstone may prove similar, but drilling should not be attempted before a hydrogeologic evaluation of the aquifer is conducted. To our knowledge, there are no wells drawing upon this unit, which has not yet been properly mapped. Our previous experience in successfully completing a development program for newly-tapped aquifers serving community water supplies is that 3 to 5 years may be needed to most economically test the yield, reliability, and quality of the unit. In this case, a number of individual lot owners south of Wurr Road will need to be contacted to arrange for access to their properties to allow mapping, as well as seek information from them about existing well or spring development. We are optimistic about the potential for producing from this unit, but a sound and steady exploration program is warranted before commitments to significant distribution infrastructure can be responsibly be made.

## 6. PROPOSED PROJECT ALTERNATIVES FOR WATER SUPPLY

We have identified three project alternatives for water supply:

1. Maintain existing water-diversion and permitting placement of seasonal flashboards and a fish ladder;
2. Divert water from infiltration galleries installed in the stream bed, suited only at best in bed sediment behind the dam where the sediment is deepest, then requiring modification of the dam foundation to improve salmonid passage and discontinued use of the flashboards;
3. Complete removal of the dam and installation of a ground-water well to supplement water supply, which diversifies water supply sources, particularly needed at times of low streamflow when diverting water may not be possible, and when turbidity is high or if other water quality issues arise.

This section opportunities and constraints of each alternative and recommends a preferred project alternative.

### 6.1 Project #1: Maintain Existing Water-Diversion and Permitting of Seasonal Flashboards and a Fish Ladder.

Proposed water supply project #1 reestablishes historic operations of the flashboard dam and existing diversion located 800 feet upstream of the dam. Seasonal placement of the flashboards would pond streamflow upstream beyond the diversion intake so that the diversion is maintained at very low streamflow. Continued use of the swimming hole behind the dam is also maintained, as well as its use as for salmonid rearing. Salmonid migration across the flashboards is mitigated with seasonal placement of a portable fish ladder<sup>8</sup>, installed when placing the flashboards. The project requires CEQA compliance, permitting with CDFG and consultation with NOAA Fisheries (NMFS). Additional studies and/or monitoring, as well as criteria for flashboard operations, will likely be needed to address fish passage and downstream

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<sup>8</sup> We understand that ladders for the use of juvenile salmonids have yet to be demonstrated as a sustainable technology and may prove unacceptable to the resource agencies.

habitat issues related to water temperature impacts. We estimate the cost of the project at \$42,000, detailed in Table 5.

As with current operation of the diversion, continued turbidity monitoring for water treatment purposes will be needed, and possible contamination by upstream sources exist. As well, regular removal of debris and equipment maintenance will be needed.

## **6.2 Project #2: Divert Water from Infiltration Galleries Installed in the Bed Sediment Behind the Dam, and Improve Salmonid Passage by Modifying the Foundation.**

This project alternative entails the design, construction, and installation of an infiltration gallery behind the existing dam foundation, as well as modification to the dam to improve salmonid passage. The infiltration gallery would most likely be bed-mounted parallel to the streambed and the existing dam, within the several feet of the streambed alluvium. The gallery should be slotted to accommodate a hydraulic conductivity of  $2.3 \times 10^{-2}$  cm/sec (calculated for the bed material below the Wurr Road bridge crossing) and constructed from with type-304 stainless steel or PVC. The depth of sediment behind the dam however is speculated to be too thin, therefore an accurate depth measurement should be made and the manufacturer should be consulted for design recommendations.

The dam foundation would be modified to improve salmonid passage, particularly for juveniles. This modification may include, lowering the dam to near streambed elevations, notching the dam, or widening the current sluice gate from 1 to 3 feet while preserving the function of the dam and flashboards.

Total costs for this project are estimated at \$101,000.

The elements of this project increase salmonid passage, favor the dam foundation pools for salmonid rearing, and allow for the continued diversion of surface waters during low streamflows. Alternatively, constraints of this alternative maintain the effects of turbidity on water treatment and the loss of the summer swimming hole. Likely impacts from this project are minimal and include increased turbidity as a result of construction, requiring a California Department of Fish and Game 1601 streambed alteration permit and CEQA compliance in the

form of a negative declaration. Mitigation would likely not be required for this project; generally, for seasonal dams, CDFG defines the 'project' as annual placement and removal of the flashboards, and if these actions are not taken there is technically no project, no project impacts, and no need for CEQA compliance.

Regular maintenance of the gallery and removal of any debris will need to be considered. In addition, bed sediment behind the dam may frequently scour from high flows or wood jams, exposing the infiltration gallery. Ultimately, we concluded that infiltration galleries will likely not be suited to the reaches near the existing water treatment facility due to limited depth to bedrock. They may, however, prove useful elsewhere in the park.

### **6.3 Project #3: Complete Dam Removal and Installation of a Ground-Water Well to Supplement Water Supply.**

This project involves complete removal of the existing dam, including the concrete foundation. This would result in the loss of the seasonal impoundment, which provided tail-water past the diversion intake and secured diversions at very low streamflows. To compensate, development of a ground-water supply well within the park boundaries either from the Purisima formation adjacent to the water treatment facility or the Santa Margarita sandstone along Wurr Road is proposed (refer to Figure 1).

Dam removal fundamentally improves salmonid passage at the compromise of dam-related salmonid rearing habitat. The swimming hold behind the dam will also be compromised. Ground-water well installation offers the park a different water sources that should prove to be reliable during drought periods. Use of ground water as opposed to surface water may lend to increased mineral content, possibly including iron and manganese, but will likely decreased turbidity, and may eliminate water treatment efforts all together. Additional piping will be required if the ground water well is developed far from the treatment plant.

As with Project #2, the CDFG technically views this project as eliminating 'take', so CEQA compliance and mitigation may not be required. Temporary impacts are de-construction related and include increased turbidity, requiring similar permits as project #2 in addition to a well drilling permit. Total costs for this project are estimated at \$77,000.

## **6.4 Recommended Water Supply Alternative**

We compared the three proposed water supply alternatives relative to the existing conditions during 2003 (Table 4). Selecting a preferred alternative ultimately involves reaching a balance amongst the water-supply, recreational, and habitat-protection goals of the Division of Parks and Recreation for Memorial County Park. The greatest benefits to salmonid habitat over existing conditions is gained from discontinuing the use of the flashboards and improving passage, a benefit of projects #2 and #3. Compromising seasonal ponding behind the flashboard dam potentially exposes the water diversion intake at very low streamflows and constrains water supply. Project #2 solves this issue with proposed installation of infiltration galleries, but we suspect that this solution may not be feasible because of limited amount of channel alluvium and potential stream-bed mobility. Project #3 proposes supplementing supplies with one or more ground-water wells, which provides additional benefits from having multiple sources of water – drought reliability, reduced turbidity, and diminished treatment, testing and monitoring. Implementing Project #3 would preclude a summer recreation impoundment on the stream, a major change in the purposes and uses of the park. Consistent with a request from the Division of Parks and Recreation, we have prepared a grant proposal directed to the California Department of Fish and Game to implement Project #3 (Appendix F) should it choose to be pursued.

## **6.5 Permitting Fees**

Although they seldom affect selection of the preferred alternative, costs of permits are increasing an element of project budgeting or phasing. Permits to be obtained under various alternatives are considered below. These data were also used in the cost tables included with Appendix F. They exclude grading permits, which will be issued by the County to the County.

*RWQCB 401: \$500.* These fees can range between \$500 and \$20,000 depending on whether technical certification conditions must be developed and the size of the proposed impact (in acres or fill of cubic yards of dredging). Certifications without technical conditions are charged \$500. The fee schedule for technically continued projects can be found in California Code of Regulations, Title 23, Section 2200 (1) C.

*DFG 1601, Streambed Alteration Agreement: \$770.* Section 1601 (construction that adversely affects wildlife areas) of the State's Fish and Game Code requires an agreement for any

construction that modifies a streambed. This permit, requested by a public agency, also mandates erosion controls to protect streambeds and prohibits discharge of trash, debris, or soil-laden water into streams. The total cost of this permit comes from a \$154 non-refundable application fee plus \$618 additional processing fee for projects costing from \$25,000 to \$500,000.

*NOAA Fisheries (ESA): \$820.* The Endangered Species Act of 1973 (ESA) provides a means to conserve the ecosystems upon which endangered or threatened species depend. It also provides for the conservation of such endangered and threatened species.

*CEQA Compliance: between \$2,000 and \$20,000.* For any project subject to the California Environmental Quality Act (CEQA), state law requires evidence of compliance with CEQA, either through preparation, circulation, and adoption or certification of an environmental document.

*Well drilling permit: \$435.* The installation of groundwater monitoring wells, including geotechnical wells, requires a permit from San Mateo County.

## 7. CONCLUSIONS

- We suggest developing ground-water resources in the Park for drinking water supply. One alternative is a water well adjacent to the existing water treatment facility approximately 200-feet deep, completed in bedrock. This location will reduce the costs of transferring ground water to the treatment facility in the event that treatment is necessary. Purisima formation constitutes the bedrock at this location; generally but far from universally, it has been an adequate aquifer in the Pescadero/Butano Creek and nearby watersheds, although the unit may be relatively cemented at this location. Other viable aquifer units are the Pescadero Creek Quaternary alluvium and upper Miocene Santa Margarita sandstone.
  
- We located an apparently viable source of ground water in the Santa Margarita formation, located south of the river in a band of outcrop parallel to Wurr Road. Water quality of this ground-water source would likely have lower mineral content relative to other ground-water sources in the region. Treatment needs may be minimal, but if not, a pipeline exceeding a half mile in length to the existing treatment plant would be needed. An appropriate exploratory program is warranted.
  
- Bed conditions affecting both spawning and rearing habitat at Wurr Road are similar to those encountered in other salmonid streams of similar size in the Santa Cruz Mountains. Spawning habitat here is generally good and depicts the bed as it might if the dam were removed. Weathered bedrock in the watershed supplies the stream bed with sand, gravel, cobbles, lending importance to large wood in the channel for rearing habitat; large wood and wood jams create pools and cover that serve as rearing habitat for juvenile salmonid. In the park reach, the quantity of in-stream large wood appears low. Similar to wood jams, the dam foundation has created pool rearing habitat, but passage through the sluice gate seems to be constrained, particularly for juveniles. Currently, adult steelhead migrate through the sluice gate and spawn above the dam, but velocities seem too high for juvenile passages. At low base flows, when water levels are low, passage through the sluice gate may not be possible for both adults and juveniles.

- We prepared cost estimates for two projects: 1) complete removal of the flashboard dam and installation of a water supply well, costing \$73,000; and 2) permitting seasonal operation of the flashboards and temporary fish ladder, which is estimated at \$43,000. We prepared a grant proposal (Appendix F) to apply for California Department of Fish and Game funding for project #1. The grant was primarily developed based on the CDFG's desire for complete removal of the existing flashboard dam, including the foundation.

## 8. RECOMMENDATIONS

- We suggest that San Mateo County focus on ground water development as a water supply alternative. A useful initial first step is to explore immediately adjacent to the existing water treatment facility, in order to minimize pipeline costs and water-quality effects of the intensively-used campground. The cost of completing such a well, exclusive of pump and wellhead improvements is likely to be about \$25,000. While other target aquifers are present in the general area, the capital and operating costs of a well near the existing infrastructure is very low relative to other water-supply alternatives. Our preference is to install structures that are more effective over the long term with minimal maintenance requirements.
  
- The source aquifer may be either the alluvium of Pescadero Creek or the Purisima formation in the vicinity of the water-treatment plant. If alluvium is used as a source, it should be regarded as directly replenished or recharged by Pescadero Creek. For water-rights purposes, this approach would constitute a diversion under existing appropriative and riparian rights. From a water-supply perspective, water pumped from the alluvium will be regarded as 'ground water under the influence of surface water', and will be subject to the same level of treatment and water-quality testing as the existing diversion; the principal change will be in turbidity, expected to be markedly lower, reducing wear-and-tear on the existing distribution system and possibly diminishing the extent of chlorination needed. Alternative source aquifers are the Purisima formation at the treatment plant, or the Santa Cruz mudstone, which outcrops immediately on the opposite side of the creek. Wells immediately adjacent to the creek in these units are likely to be drawing from the creek, but at distances greater than approximately 100 feet, water will be likely be taken from true ground-water sources.
  
- We identified three potential water-supply alternatives and recommend pursuing complete removal of the dam foundation and any future use of the flashboards. We conclude that this can be accomplished with channel-stability and sediment-release impacts likely to be deemed minor. Implementing this alternative would preclude a summer recreation impoundment on the stream and tail-water ponding upstream of the water diversion intake, a major change in the purposes and uses of the park. To supplement supplies, particularly when diversions are constrained by very low

streamflow, we also recommend exploring ground-water resources and drilling a water well; we initially sited two possible locations. Selecting a preferred alternative ultimately involves reaching a balance amongst the water-supply, recreational, and habitat-protection goals of the Division of Parks and Recreation for Memorial County Park. We do note, however, that the greatest benefits to salmonid habitat over existing conditions is gained from discontinuing the use of the flashboards and improving passage. We have prepared a grant proposal directed to the California Department of Fish and Game to implement removal of the dam and ground-water exploration (Appendix F) should it choose to be pursued.

## 9. LIMITATIONS

This report was prepared in general accordance with the accepted standard of practice existing in central coastal California at the time the investigation and design plans were completed. No other warranties, expressed or implied, are made. It should be recognized that interpretation and evaluation of channel morphology change, sediment transport and ground-water stream interactions is a difficult and inexact art. Judgment leading to conclusions and recommended, conceptual design plans are generally made with an incomplete knowledge of the conditions present. More extensive studies, including annual sediment transport monitoring above and below the historically mined area can reduce the inherent uncertainties associated with such studies. If the client wishes to reduce the uncertainty beyond the level associated with this study, Balance Hydrologics should be notified for additional consultation.

Balance Hydrologics has prepared this report for the client's exclusive use on this particular project. The report is based in part on work performed by experts in related fields, information provided by the client, information provided in previous studies related to the present study and upon reference values commonly used in the area or developed by sources generally held to be reliable. We have not independently verified their validity, accuracy or representative to this or other sites. The recommendations and conceptual channel design provided in this report are based on the assumption that an appropriate and adequate follow-up program will be conducted, and that our firm will be retained at key stages (design implementation) to revise the findings, recommendations and conceptual designs described in this report.

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## **TABLES**

**Table 1.** Particle size and embeddedness measurements, Pescadero Creek in County Memorial Park, San Mateo County, California.

Site	Date	Sample Size	Mean Embeddedness of Cobbles (>45 mm)	Proportion of bed area occupied by					Particle-size descriptors (mm) <sup>1</sup>					
				Cobbles (>64mm)	Sand (<4mm)	Bedrock	Organics	Artifacts	D <sub>10</sub>	D <sub>16</sub>	D <sub>50</sub>	D <sub>84</sub>	D <sub>90</sub>	
<i>Bed-surface (pebble count) samples</i>														
<b>Pescadero Creek</b>														
Wurr Rd. Bridge	4/9/03	130	0.25	0.22	0.11	0.06	0.05	0.01	16	20	41	74	90	
<b>Other salmonid streams, Santa Cruz Mts</b>														
Waddell Creek at Shapovalov weir <sup>3</sup>	8/30/76	100	na	0.35	0.07	0.00	0.00		11	21	68	121	136	
San Lorenzo R. bar below Felton Diversion <sup>4</sup>	2/8/80	138	na	0.15	0.06	0.00				17	37	63		
Zayante Cr. riffle above Woodwardia weir <sup>5</sup>	10/24/96	156	na	0.51	0.04	0.00				26	66	125		
Newell Cr. below Loch Lomond <sup>6</sup>	4/4/79	102	na	0.68	0.00	0.00				36	103	268		
<i>Bed-core (sieve) samples</i>														
<b>Pescadero Creek</b>														
35 feet downstream of Wurr Road bridge	4/9/03								3.1	6.7	37	96	107	
95 feet upstream of dam in second glide	4/9/03								13	17	54	102	111	
10 feet upstream of dam on gravel bar	4/9/03								0.43	1.3	15	41	49	
<b>Other salmonid streams, Santa Cruz Mts</b>														
Zayante Cr. pool above Woodwardia weir <sup>5</sup>	Nov.1979								0.49	0.7	1.15	7	13	
Zayante Cr. at Conference Road	Nov.1979								0.61	0.82	2.3	11	16	

**Notes:**

1. Size of the 10th, 16th, 50th, 84th, and 90th percentiles of material sampled; describes sizes greater than 4 mm of bed-surface samples and greater than 0.0625 mm of bed-core samples. Bed-surface particle sizes are for the intermediate (or 'b') axis, or about the size of sieve on which a particle of this size would be retained.
2. na = not applicable
3. Approximately 1 mile inland; drainage area of about 34 square miles (Hecht, 1976)
4. First riffle below major inflatable diversion; drainage area of about 104 square miles (Hecht and Enkeboll, 1980)
5. Riffle above weir of similar size as at County Memorial Park; drainage area of about 14 square miles (Hecht and Kittleson, 1998 for bed surface data, Hecht and Enkeboll, 1980 for bed core)
6. Analogous to Woodwardia data, except most coarse sediment removed at Loch Lomond, 0.8 mi. upstream; drainage area of about 9.5 sq. mi. (Hecht and Enkeboll, 1980)
7. Downstream of the Bean Creek confluence, drainage area of 26 square miles (Hecht and Enkeboll, 1980)

**Table 2.** Estimated volume and mass of sediment in Pescadero Creek impounded behind the dam upstream to Wurr Road bridge, San Mateo County, California.

Sediment type	Volume		Mass <i>tons</i>	Average depth of sediment <sup>1</sup> ft	Percent of total sediment behind dam
	<i>ft</i> <sup>3</sup>	<i>yd</i> <sup>3</sup>			
Sediment wedge behind dam	90000	3330	4210	1.88	100%
Bars only	37400	1390	1750	0.78	42%
Underlying active alluvium	52600	1940	2460	1.10	58%

**Notes:**

1. Reach length = 1000 feet; reach width = 48 feet = to 2500 lbs per cubic yard
2. Assumes a density of 1.5 (or 92.6 lbs per cubic foot).

**Table 3.** Direct monthly surface water diversions (gallons) from Pescadero Creek, 1992 to 2002, for Memorial County Park, San Mateo County, California.

	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
<b>JANUARY</b>	220,500	76,894	111,935	80,500	51,510	35,760	87,500	392,000	365,200	264,025	461,589
<b>FEBRUARY</b>	151,000	139,726	61,415	171,600	0	205,410	87,500	534,500	387,300	565,025	466,330
<b>MARCH</b>	188,550	458,075	163,530	90,700	0	460,250	291,800	572,500	409,343	237,000	162,800
<b>APRIL</b>	228,550	655,846	687,520	109,800	289,955	274,470	104,700	689,900	483,429	132,100	157,500
<b>MAY</b>	565,925	927,744	365,200	306,425	275,210	525,330	484,400	632,800	526,976	592,300	581,846
<b>JUNE</b>	503,100	861,621	374,220	296,260	594,875	441,200	546,900	687,400	683,100	972,334	621,990
<b>JULY</b>	662,925	1,170,022	336,150	365,500	558,900	404,200	664,400	925,900	774,100	772,270	737,776
<b>AUGUST</b>	755,175	1,072,034	684,350	592,270	848,528	843,600	755,700	1,001,300	992,372	949,552	772,500
<b>SEPTEMBER</b>	472,425	708,506	498,500	1,005,200	368,600	366,500	349,900	766,300	103,600	455,475	322,200
<b>OCTOBER</b>	444,225	573,043	242,000	138,230	391,300	499,100	148,800	183,300	648,012	467,800	528,389
<b>NOVEMBER</b>	255,450	342,600	101,800	874,700	321,490	119,700	0	292,700	0	218,900	194,800
<b>DECEMBER</b>	327,750	174,150	233,800	133,050	32,540	225,600	183,500	628,800	67,875	55,720	223,700
<b>AVERAGE</b>	<b>397,965</b>	<b>596,688</b>	<b>321,702</b>	<b>347,020</b>	<b>311,076</b>	<b>366,760</b>	<b>308,758</b>	<b>608,950</b>	<b>453,442</b>	<b>473,542</b>	<b>435,952</b>

**Notes:**

Data collected and provided by Memorial County Park staff

**Table 4. Comparison of proposed project alternatives for water supply <sup>1</sup>  
Memorial County Park, San Mateo County, California**

<b>Alternatives</b>	<i>2003 Conditions: Surface-water diversion 800 feet upstream of the dam, discontinued use of flashboards.</i>	<i>Project #1: Maintain existing surface-water diversion and permitting of seasonal flashboards with a fish ladder for juvenile salmonids.</i>	<i>Project #2: Divert water from infiltration galleries installed in the bed sediment behind the dam, and improve salmonid passage by modifying/notching the foundation.</i>	<i>Project #3: Complete dam removal and installation of one or more ground-water wells to supplement water supply.</i>
<b>Opportunities</b>	<ol style="list-style-type: none"> <li>Continued use of diversion intake</li> <li>Use of seasonal impoundment for salmonid rearing</li> </ol>	<ol style="list-style-type: none"> <li>Improved salmonid passage</li> <li>Use of seasonal impoundment for salmonid rearing</li> <li>Able to divert surface water at very low streamflows</li> <li>Continued summer swimming hole use</li> </ol>	<ol style="list-style-type: none"> <li>Improved salmonid passage</li> <li>Use of dam foundation pools for salmonid rearing</li> <li>Able to divert surface water at very low streamflows</li> </ol>	<ol style="list-style-type: none"> <li>Much improved salmonid passage</li> <li>Multiple water-supply sources for drought reliability</li> <li>Reduced turbidity in raw water</li> <li>May reduce or eliminate water treatment efforts</li> <li>Discontinued dam maintenance and removal of debris</li> </ol>
<b>Constraints</b>	<ol style="list-style-type: none"> <li>Impaired salmonid migration through the sluice gate, especially for juveniles.</li> <li>Loss of summer swimming hole</li> <li>Continued turbidity issue for water treatment</li> <li>Possible loss of diversion at very low streamflows</li> </ol>	<ol style="list-style-type: none"> <li>Continued turbidity issue for water treatment</li> </ol>	<ol style="list-style-type: none"> <li>Likely continued turbidity issue for water treatment</li> <li>Loss of summer swimming hole</li> </ol>	<ol style="list-style-type: none"> <li>Loss of pools created both upstream and downstream by the dam foundation</li> <li>Loss of seasonal impoundment for salmonid rearing</li> <li>Loss of summer swimming hole</li> </ol>
<b>Impacts <sup>2</sup></b>	none	<ol style="list-style-type: none"> <li>Possible effects on downstream aquatic invertebrate populations</li> </ol>	<ol style="list-style-type: none"> <li>Construction related impacts such as turbidity are temporary</li> </ol>	<ol style="list-style-type: none"> <li>Construction related impacts such as turbidity are temporary</li> </ol>
<b>Likely mitigation</b>	none	<ol style="list-style-type: none"> <li>Monitoring juvenile salmonid migration, and modification to improve passage if needed</li> <li>Mitigation to address structural impacts, if any</li> </ol>	none	none

**Table 4. Comparison of proposed project alternatives for water supply <sup>1</sup>  
Memorial County Park, San Mateo County, California**

<b>Alternatives</b>	<i>2003 Conditions: Surface-water diversion 800 feet upstream of the dam, discontinued use of flashboards.</i>	<i>Project #1: Maintain existing surface-water diversion and permitting of seasonal flashboards with a fish ladder for juvenile salmonids.</i>	<i>Project #2: Divert water from infiltration galleries installed in the bed sediment behind the dam, and improve salmonid passage by modifying/notching the foundation.</i>	<i>Project #3: Complete dam removal and installation of one or more ground-water wells to supplement water supply.</i>
<b>Permitting <sup>3</sup></b>	none	1. CDFG streambed alteration permit 1601 2. Consultation with NOAA Fisheries (ESA) 3. RWQCB CWA 401 permit 4. Ppublic water supply permit 5. CEQA compliance	1. CDFG streambed alteration permit 1601 2. CEQA negative declaration 3. RWQCB CWA 401 permit 4. Ppublic water supply permit	1. CDFG streambed alteration permit 1601 2. CEQA negative declaration 3. RWQCB CWA 401 permit 4. Ppublic water supply permit 5. Well drilling permit
<b>Other considerations</b>	1. Regular winter maintenance and removal of wood and other debris trapped by the dam	1. Regular winter maintenance and removal of wood and other debris trapped by the dam	1. Debris removal and some periodic cleaning and equipment maintenance needed 2. Depth of bed sediment may be too shallow, pending manufacturer's recommendation 3. Bed sediment may scour at times from very high flows or wood jams, possibly exposing infiltration gallery.	1. Periodic well cleaning and equipment maintenance may be needed 2. Likely increased mineral content including iron and manganese of water supply 3. Additional water mains needed
<b>Estimated Cost</b>	none	\$42,000 (Table 5), plus existing treatment, testing and monitoring	\$101,000 (Table 6), plus existing treatment, testing and monitoring	\$77,000 (Table 7), with diminished treatment, testing and monitoring
<b>Notes</b>	<p>1. Comparisons are relative to existing conditions where flashboards are not placed and no improvements for fish passage at the dam foundation.</p> <p>2. Current regulatory practices associate all impacts (and "take" under the Endangered Species Act) with project facilities and operations. Generally, for seasonal dams, CDFG defines the 'project' as annual placement and removal of the flashboards. If these actions are not taken there is technically no project, no project impacts, and no need for permits or CEQA compliance by lead agency.</p>			

**Table 5.** Estimated Costs Associated with project #1: maintain existing water-diversion and pursue permitting of seasonal flashboards and fish ladder.  
Memorial County Park

Project Tasks		Design Professionals					Ladder Design		Sub-Contract	Regulatory Compliance					Cost Totals		
Number	Task Description	Principal	Senior Professional	Project Professional	Staff Professional	Assistant Professional	Principal	Staff Professional	Park Staff	Principal	Senior Professional	Senior Technical	Technical Staff	Support Staff	Total Labor	Direct Costs	Total Costs
	Hourly Rate	\$165	\$130	\$115	\$90	\$80	\$115	\$90	\$30	\$160	\$150	\$125	\$90	\$75			
	<b>Task 1 Project Administration</b>								20						\$600	\$24.00	\$624
	<b>Task 3 Juvenile Fish Ladder Installation</b>																
	3.1 Assessment of Creek Hydrology	4	4		20	10									\$3,780	\$151	\$3,931
	3.2 Engineering and Hydraulics						20	20							\$4,100	\$164	\$4,264
	3.3 Dam Modification				10		10	10							\$2,050	\$82	\$2,132
	3.4 Contrsuction of 10 Fish Boxes						20	20							\$4,100	\$164	\$4,264
	3.5 Construction of Fish Screen						25								\$2,875	\$115	\$2,990
	3.6 Control of Drawdown							20							\$1,800	\$72	\$1,872
	3.7 NMFS Compliance																
	<b>Task 4 Permitting</b>																
	4.2 Public Water Supply Permit				4										\$435	\$17	\$452
	4.3 CWA 401 Permit, RWQCB				4										\$500	\$20	\$520
	4.4 Streambed Alteration Agreement, 1601				4										\$500	\$20	\$520
	4.5 NOAA Fisheries (ESA)				4										\$770	\$31	\$801
	<b>Task 5 CEQA Compliance</b>														\$500	\$20	\$520
	5.1 Establish CEQA project description									4	4				\$1,240	\$50	\$1,290
	5.2 File Notice of Preparation									4	4		4	4	\$1,900	\$76	\$1,976
	5.3 Prepare Administrative Draft EIR									6	6		6	10	\$3,150	\$126	\$3,276
	5.4 Prepare Draft EIR (Notice of Completion)									8	12		12	10	\$4,910	\$196	\$5,106
	5.5 Prepare 'Response to Comments' addendum/Final EIR									8	10		12	10	\$4,610	\$184	\$4,794
	5.6 Prepare Mitigation Monitoring and Reporting Program										4	4	12	4	\$2,480	\$99	\$2,579
	<b>Total Hours</b>	4	4	0	46	10	75	70	20	30	40	4	46	38			
	<b>Total Costs</b>	\$660	\$520	\$0	\$4,140	\$800	\$8,625	\$6,300	\$600	\$4,800	\$6,000	\$500	\$4,140	\$2,850	\$14,745	\$1,612	<b>\$41,912</b>

**Notes:**

Peter Haas of Fall Creek Engineering provided cost estimates and design criteria for a juvenile fish ladder in Pescadero Creek at Memorial County Park

**Table 6.** Estimated costs associated with project #2: discontinued operation of the flashboards, divert water from infiltration galleries installed in the bed sediment behind the dam foundation, and improve salmonid passage by modifying the dam foundation.

Memorial County Park

Project Tasks		Design Professionals					Construction Sub Contractor						Gallery Design			Regulatory Compliance					Cost Totals			
Number	Task Description	Principal	Senior Professional	Project Professional	Staff Professional	Assistant Professional	Park Staff	Excavator	Loader	Dump Truck	Labor	Recycling	Principal	Project Professional	Staff Professional	Principal	Senior Professional	Senior Technical	Technical Staff	Support Staff	Total Labor	Direct Costs	Total Costs	
	Hourly Rate	\$165	\$130	\$115	\$90	\$80	\$30	\$150	\$50	\$75	\$35	\$225	\$130	\$15	\$90	\$160	\$150	\$125	\$90	\$75				
<b>Task 1 Project Administration</b>							20														\$600	\$600.00	\$1,200	
<b>Task 2 Development of Infiltration Galleries</b>																								
	2.1 Assessment of Creek Hydrology	10	10		20	10							20	20	20							\$8,450	\$338	\$8,788
	2.2 Engineering and Hydraulics/Design	10	20	30	20								25	50	50							\$6,700	\$268	\$6,968
	2.3 Construction of Infiltration Galleries			4									50	100	100							\$8,460	\$338	\$8,798
	2.4 Installation of Infiltration Galleries			2	8		50	50	50	50	50		25	50	50							\$33,200	\$1,328	\$34,528
	2.5 Diversion Control					8	20		50	50												\$5,490	\$220	\$5,710
	2.6 Cleaning and Maintenance						200			100			20	20	20							\$12,400	\$496	\$12,896
	2.7 NMFS Compliance																							
<b>Task 3 Dam Modification</b>																								
	3.1 Contracting and supervision						10															\$300	\$120	\$420
	3.2 Concrete breaking								10													\$5,000	\$2,000	\$7,000
	3.3 Excavation of bank channel									10												\$1,100	\$440	\$1,540
	3.4 Rubble removal									10												\$1,600	\$640	\$2,240
	3.5 Haul rubble									5												\$1,350	\$540	\$1,890
	3.6 Clean-up and restoration									4												\$200	\$80	\$280
	3.7 Erosion control									4												\$550	\$220	\$770
	3.8 Recycling fees							15														\$2,600	\$1,040	\$3,640
<b>Task 4 Permitting</b>																								
	4.1 Public Water Supply Permit					4																\$500	\$20	
	4.2 CWA 401 Permit, RWQCB					4																\$500	\$20	\$520
	4.3 Streambed Alteration Agreement, 1601					4																\$770	\$31	\$801
	4.4 NOAA Fisheries (ESA)					4																\$500	\$20	\$520
<b>Task 5 CEQA Compliance</b>																								
	5.1 Application for Negative Declaration																	16				\$2,000	\$80	\$2,080
<b>Total Hours</b>		20	30	36	64	18	300	80	133	50	260	50	140	240	240	0	0	16	0	0				
<b>Total Costs</b>		\$3,300	\$3,900	\$4,140	\$5,760	\$1,440	\$9,000	\$12,000	\$6,650	\$3,750	\$9,100	\$11,250	\$18,200	\$3,600	\$21,600	\$0	\$0	\$2,000	\$0	\$0		\$92,090	\$8,839	<b>\$100,589</b>

**Notes:**  
 Costs associated with development of infiltration galleries were provided by the Ranney Division of Reynolds-Ohio and Collector Wells International, Inc.  
 Cleaning and maintenance costs are based on one full year of operation

**Table 7.** Estimated costs associated with project #3: complete dam removal and installation of a ground-water well to supplement water supply.  
Memorial County Park

Project Tasks		Design Professionals					Construction Sub Contractor						Drilling/E-Log		CEQA Firm					Cost Totals		
Number	Task Description	Principal	Senior Professional	Project Professional	Staff Professional	Assistant Professional	Park Staff	Excavator	Loader	Dump Truck	Labor	Recycling	Equipment	Containment	Principal	Senior Professional	Senior Technical	Technical Staff	Support Staff	Total Labor	Direct Costs	Total Costs
	Hourly Rate	\$165	\$130	\$115	\$90	\$80	\$30	\$150	\$50	\$75	\$35	\$225	\$360	\$80	\$160	\$150	\$125	\$90	\$75			
	<b>Task 1 Project Administration</b>						20													\$600		\$600
	<b>Task 2 Siting, Drilling, and Well Completion</b>																					
	2.1 Obtain access to alternate sites						10													\$300	\$12	\$312
	2.2 Mobilize, drill and log well			30								33								\$15,330	\$613	\$15,943
	2.3 E-logging (gamma)			4								3								\$1,540	\$62	\$1,602
	2.4 Well design and completion			2	8															\$950	\$38	\$988
	2.5 Well development and water containment					7.5							17							\$6,720	\$269	\$6,989
	2.6 Waste containment and disposal								10		10		1	2						\$3,520	\$141	\$3,661
	2.7 Aquifer test and water quality analysis		10	15	20								15	9						\$10,945	\$438	\$11,383
	2.8 Connections to existing distribution system				10		10						3							\$2,280	\$91	\$2,371
	<b>Task 3 Removal of Dam Structure</b>																					
	3.1 Contracting and supervision						40													\$1,200	\$480	\$1,680
	3.2 Temporary coffer dam and bypass								15		10									\$5,000	\$2,000	\$7,000
	3.3 Concrete breaking									20										\$3,700	\$1,480	\$5,180
	3.4 Excavation of bank channel									15	10									\$3,100	\$1,240	\$4,340
	3.5 Rubble removal									15	5									\$3,200	\$1,280	\$4,480
	3.6 Haul rubble										4									\$200	\$80	\$280
	3.7 Clean-up and restoration										4									\$900	\$360	\$1,260
	3.8 Erosion control									15										\$2,950	\$1,180	\$4,130
	3.9 Recycling fees																					
	<b>Task 4 Permitting</b>																					
	4.1 Well Drilling Permit					4														\$435	\$17	\$452
	4.2 Public Water Supply Permit					4														\$500	\$20	\$520
	4.3 CWA 401 Permit, RWQCB					4														\$500	\$20	\$520
	4.4 Streambed Alteration Agreement, 1601					4														\$770	\$31	\$801
	4.5 NOAA Fisheries (ESA)					4														\$500	\$20	\$520
	<b>Task 5 CEQA Compliance</b>																					
	5.1 Application for Negative Declaration																16			\$2,000	\$80	\$2,080
	<b>Total Hours</b>		10	51	58	7.5	80	65	38	10	100	10	72	11			16					
	<b>Total Costs</b>		\$1,300	\$5,865	\$5,220	\$600	\$2,400	\$9,750	\$1,900	\$750	\$3,500	\$2,250	\$25,920	\$880			\$2,000			\$60,335	\$9,952	\$77,092

*Notes:*  
This itemized budget was submitted for the fisheries grant

**Table 8.** Costs for water quality treatment of source water, Memorial County Park, San Mateo County, California.

Treatment	Analyses	Frequency	Estimated Annual Ongoing Cost	Remarks
<b><i>Diversion from Pescadero Creek (current needs)</i></b>				
Suspended solids removal and chlorination	Turbidity of raw water to assess amount of coagulant added	Each time water is treated (approximately daily)	\$9,400 (6 hrs Park staff per week)	Higher turbidity requires more coagulant; the Park finds it impractical to treat above 6 ntu, about 22 days in WY2003.
	Turbidity of treated water and chlorine residual	Each time water is treated (approximately daily)	\$9,400 (6 hrs Park staff per week)	
	Coliform	Quarterly from three pressure zones	\$1,500 (4 hrs Park staff per month + lab)	The Park tests one zone per month
	Nitrate in raw water	Annually	\$300 (4 hrs Park staff per year + lab)	Required starting in 2003
	Nitrite in raw water	Triannually	\$100 (4 hrs Park staff per week every 3 years + lab)	Required starting in 2003
	Treatment supplies and equipment maintenance	Supplies used daily; maintenance periodic	\$2,500	Chlorine, coagulant, parts and power
			<b>Subtotal = \$23,200</b>	
<b><i>Diversion from Pescadero Creek with infiltration gallery</i></b>				
Suspended solids removal and chlorination	Turbidity of raw water to assess amount of coagulant added	Each time water is treated (approximately daily)	\$6,200 (4 hrs Park staff per week)	May require less treatment effort if bed sediment appreciably filters out turbidity
	Turbidity of treated water and chlorine residual	Each time water is treated (approximately daily)	\$6,200 (4 hrs Park staff per week)	
	Coliform	Quarterly from three pressure zones	\$1,500 (4 hrs Park staff per month + lab)	The Park tests one zone per month
	Nitrate in raw water	Annually	\$300 (4 hrs Park staff per year + lab)	Required starting in 2003
	Nitrite in raw water	Triannually	\$100 (4 hrs Park staff per week every 3 years + lab)	Required starting in 2003
	Treatment supplies and equipment maintenance	Supplies used daily; maintenance periodic	\$2,000	May require less coagulant
			<b>Subtotal = \$16,300</b>	
<b><i>Water well source (no treatment for Iron, Manganese and Nitrate)</i></b>				
No treatment	Coliform	Quarterly from three pressure zones	\$1,500 (4 hrs Park staff per month + lab)	The Park tests one zone per month
	Equipment maintenance	Maintenance periodic	\$1,000	Power and pump
			<b>Subtotal = \$2,500</b>	

**Notes:**

- Costs are approximate, reflecting conditions prevailing in 2002, and do not include quality control, re-tests, statistical analysis of time trends or community reporting.
- Balance Hydrologics recommends a minimum of 10% contingency allowed for any actual water-quality program, although these are presented mainly for comparison of alternatives.

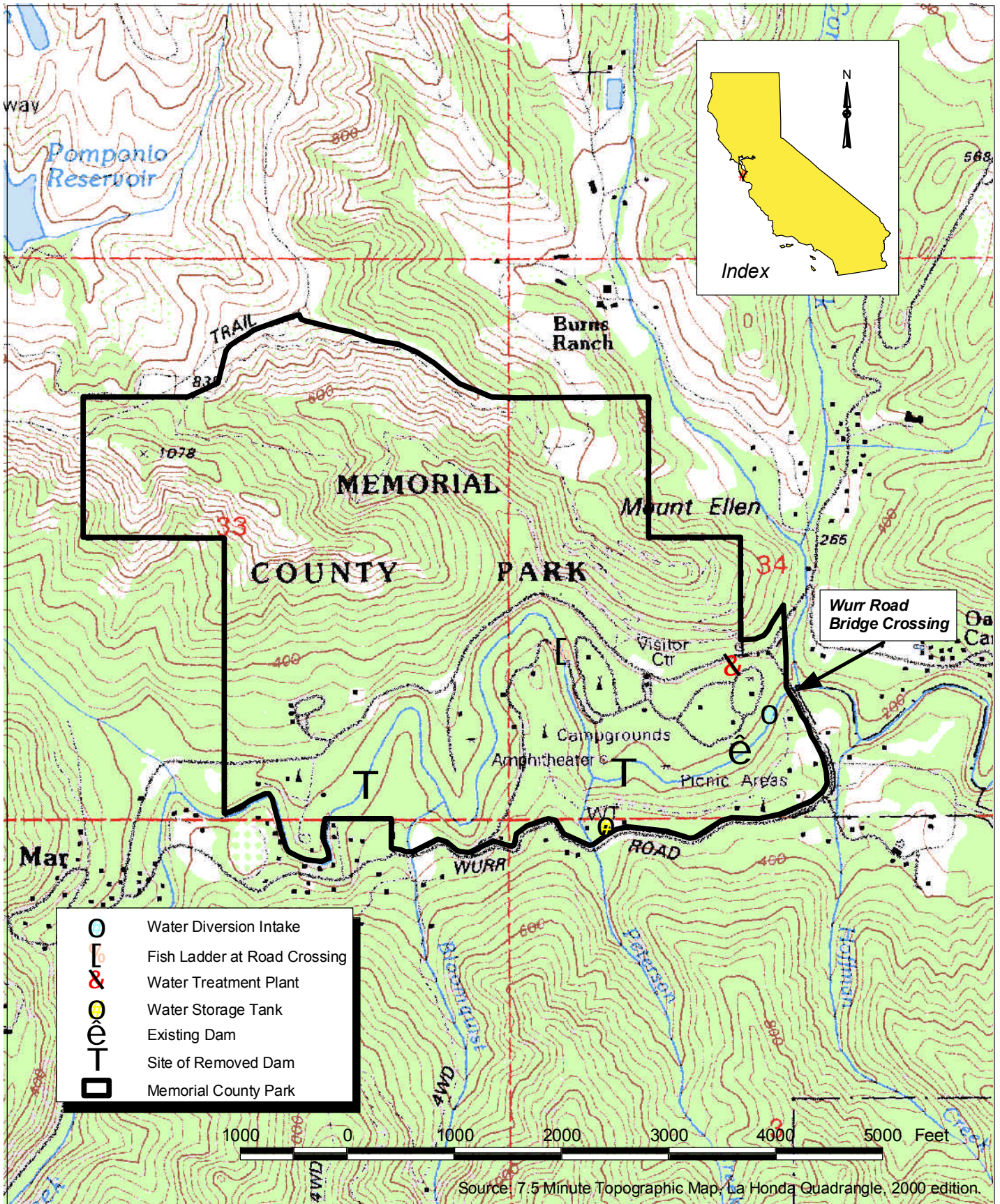
**Table 9.** Recommended sediment removal strategies to protect various salmonid habitat, Pescadero Creek below Wurr Road, Memorial County Park, San Mateo County, California.

<b>Life Stage</b>	<b>Habitat Required</b>	<b>Limiting Physical Process</b>	<b>Guidelines for Sediment Removal Behind Dam</b>
<b>Adult and Juvenile Migration</b>	Natural channel conditions including roughness elements, cover, shade, resting pools, LWD.	Minimum flow depth of 2 feet, off-setting quality of cover, roughness, resting stations.	Minimum vertical offset from low flow channel. Free draining extraction surfaces. Avoid riparian vegetation along migration channel. Place LWD.
	Unimpaired water quality. No constraining barriers	Localized additional sediment load.	Minimal increase in sediment load within area. Bypass flow during removal
<b>Spawning</b>	Suitable spawning beds.	Sediment sorting processes. Premature redd scour.	Vertical offset to ensure negligible increase in bed scour in spawning locations during spawning periods.
	Unimpaired water quality.	Adequate hyporheic intra-gravel flow. Localized additional sediment load. Sedimentation of spawning beds. Scour of spawning beds.	Negligible decrease in hyporheic flow. Negligible increase in sediment load or turbidity from disturbed areas. Removal to occur prior to first storms of season to cleanse spawning beds.
<b>Incubation and Emergence</b>	Stable substrate. Natural hyporheic flow.	Premature redd scour. Hyporheic flow. Localized additional sediment load.	Limit excavation depth to minimize spawning area scour, or increase in sediment load or turbidity from disturbed areas.
	Unimpaired water quality.	Hyporheic flow. Localized additional sediment load. Sedimentation of spawning beds.	Negligible decrease in hyporheic flow. Negligible increase in sediment load from extraction or stockpile surfaces.
<b>Rearing</b>	Unembedded riffles and pools with volumes deeper than 12 inches (coho). Pools. Food source. Cover. Natural water quality including cool, well oxygenated water.	Minimal filling of pools and glides. Pool scour to connect with water table. Coarse and clean substrate. Riparian health.	Retain pool riffle geometry with appropriate dimensions; operate from bank without riparian vegetation. Retention of bar geometry to bankfull flow or effective flow to ensure negligible decrease in pool maintenance process, disturbance of riparian community, reduction.

**Notes:**

Based in large part on "Sediment removal from freshwater salmonid habitat: Guidelines to NOAA staff for evaluating sediment removal actions from California streams", a draft guidance document dated May 9, 2003, and the coho recovery plan for the central coast, with supplemental additions by Balance staff and Jeff Hagar (Appendix B).

## FIGURES



**Figure 1. Location of Memorial County Park, San Mateo County, California.**



**Balance Hydrologics, Inc.**

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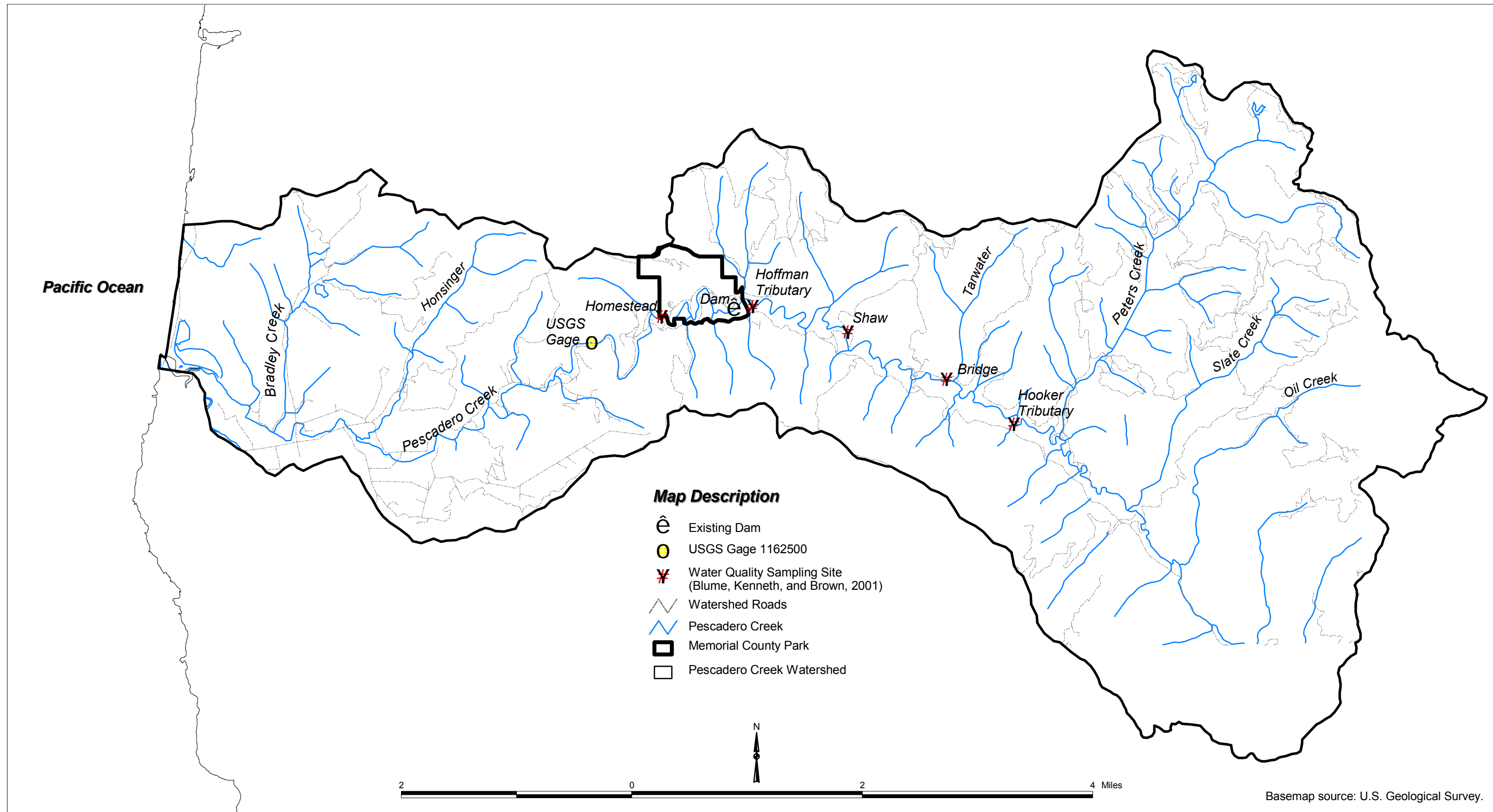
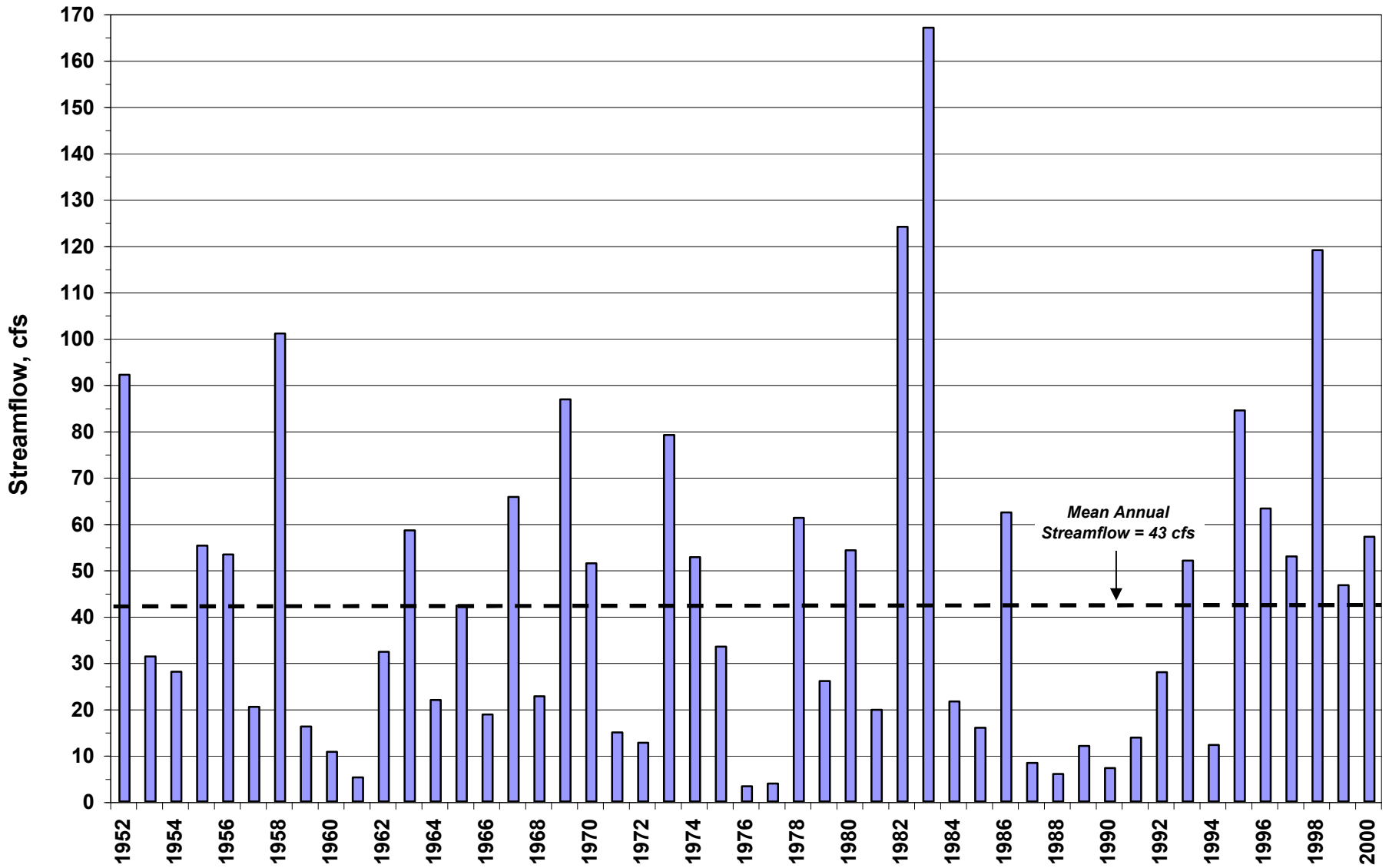
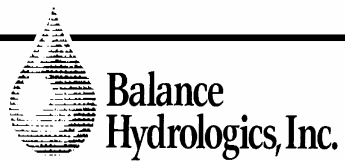
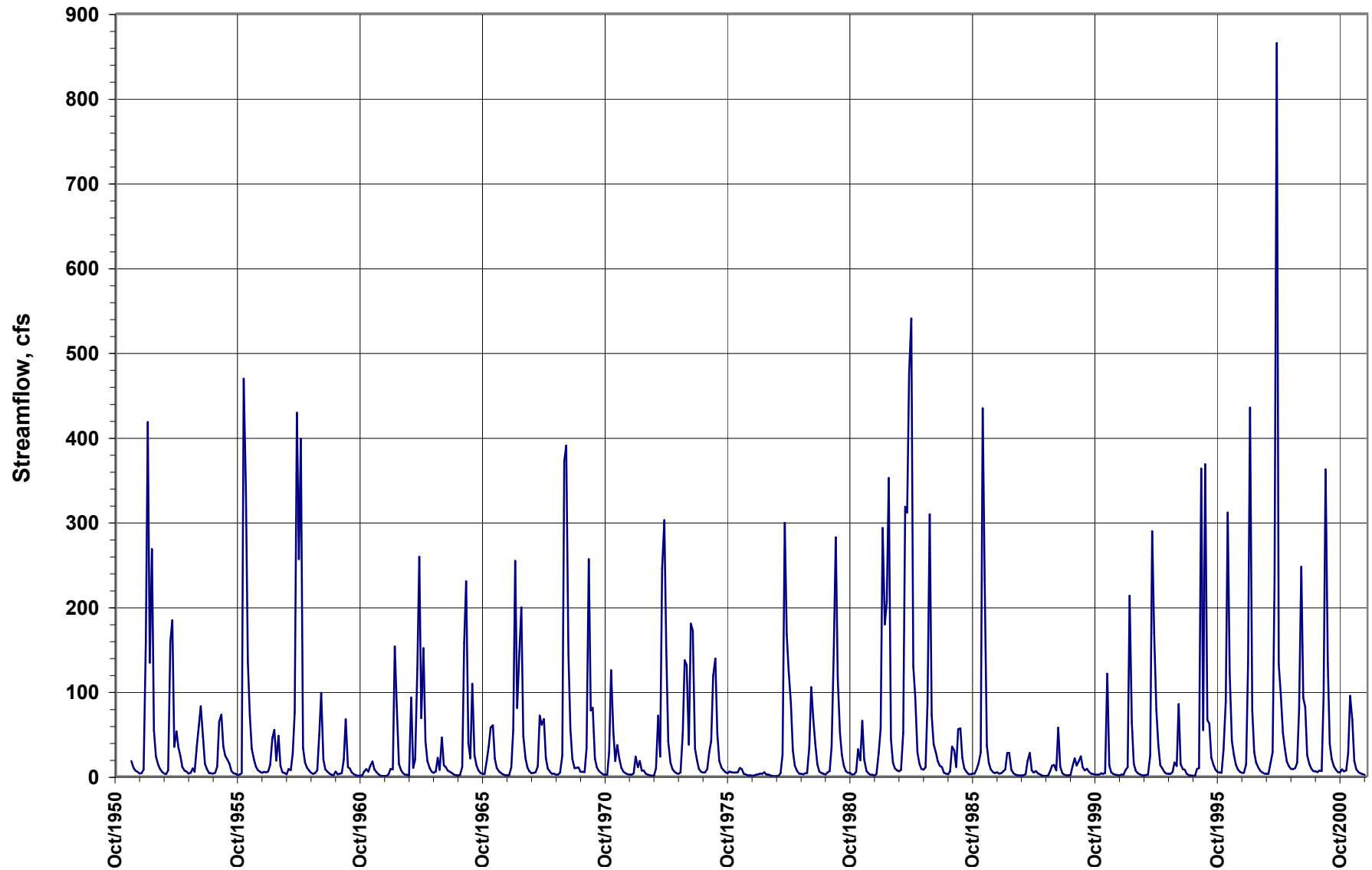


Figure 2. Hydrologic map of the Pescadero Creek watershed, San Mateo County, California.

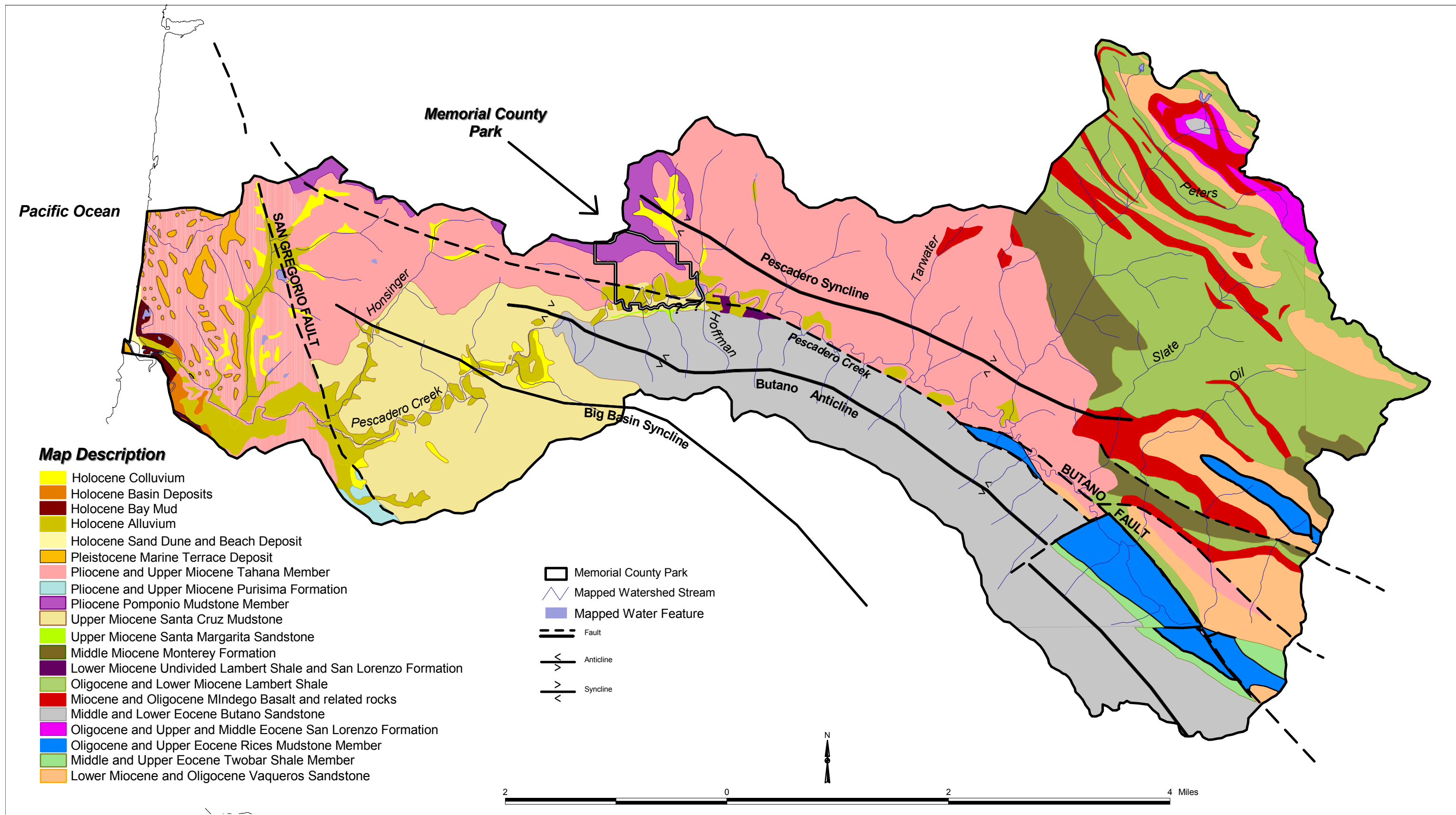


**Balance  
Hydrologics, Inc.**

**Figure 3. Annual mean discharge recorded at Pescadero Creek near Pescadero, USGS gaging station 11162500, 1952-2000.**



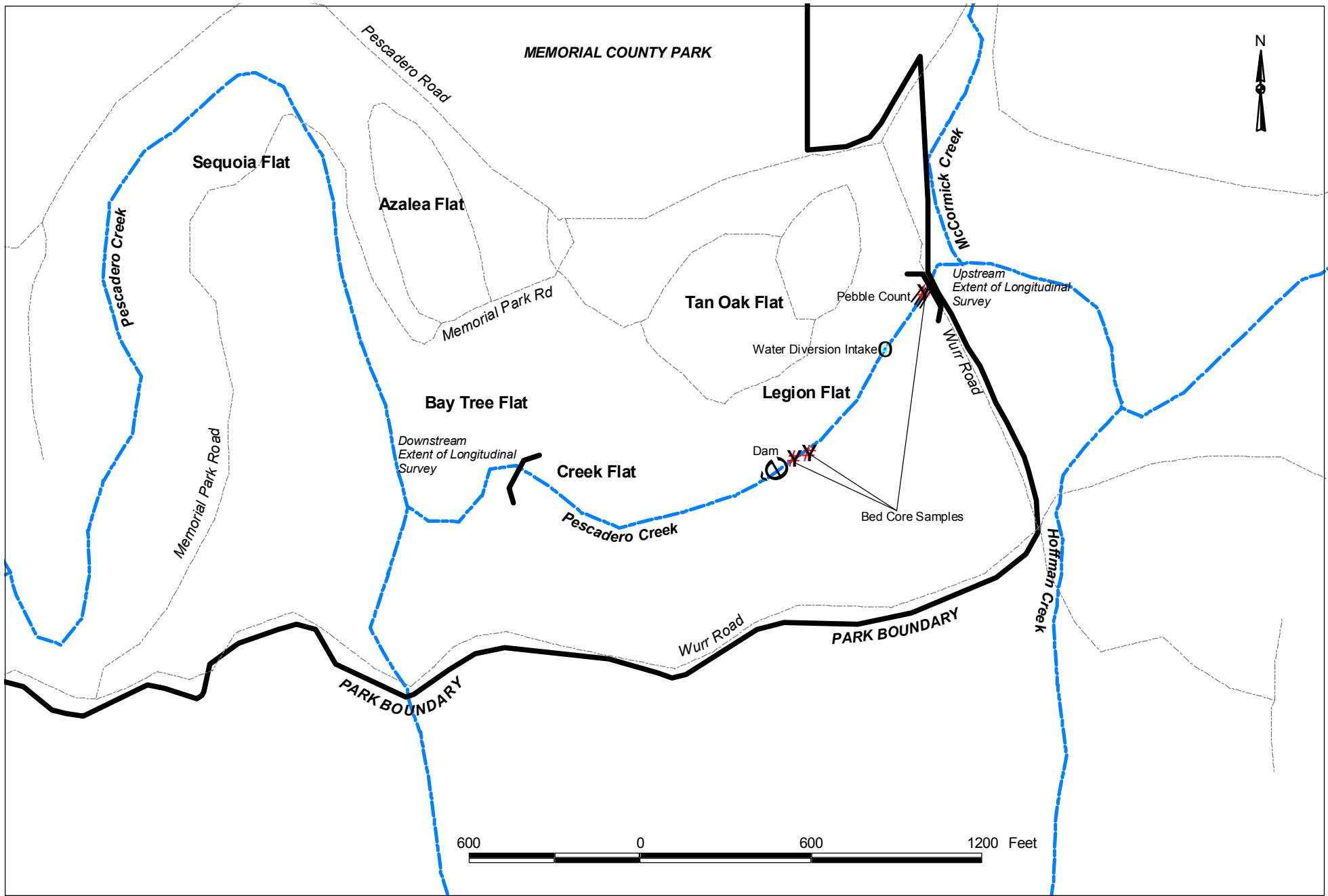
**Figure 4. Monthly mean discharge recorded at Pescadero Creek near Pescadero, USGS gaging station 11162500, 1951-2001.**



**Figure 5. Geologic map of the Pescadero Creek watershed, San Mateo County, California.**  
 Adapted from Brabb and Pampeyan, 1983; Brabb, 1989.

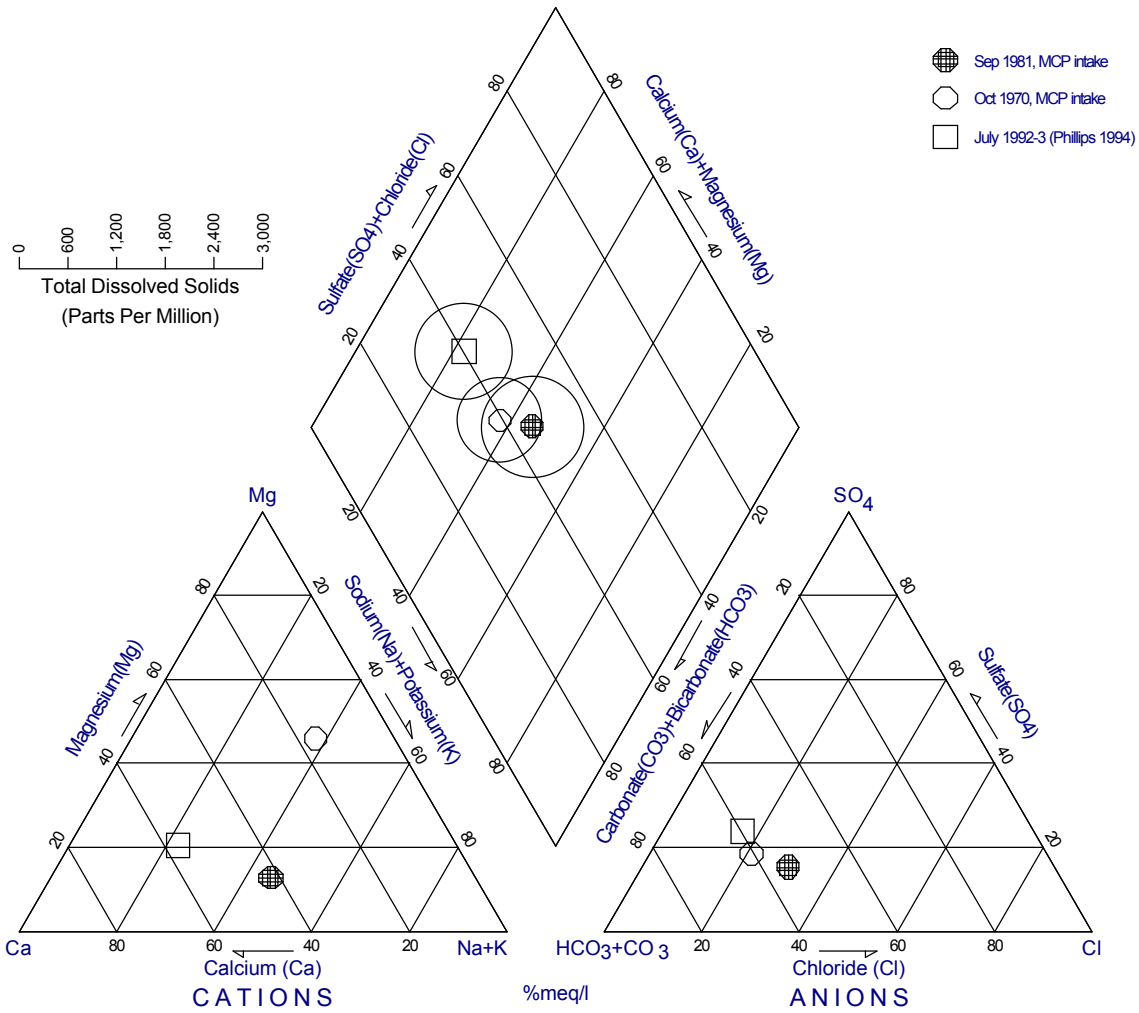


**Figure 6.** Outcrop of Santa Margarita Sandstone (Tsm) along Wurr Road, Loma Mar, San Mateo County, California.



**Figure 7. Sampling and survey locations on Pescadero Creek, Memorial County Park, San Mateo County, California.**

Memorial County Park  
San Mateo County, California

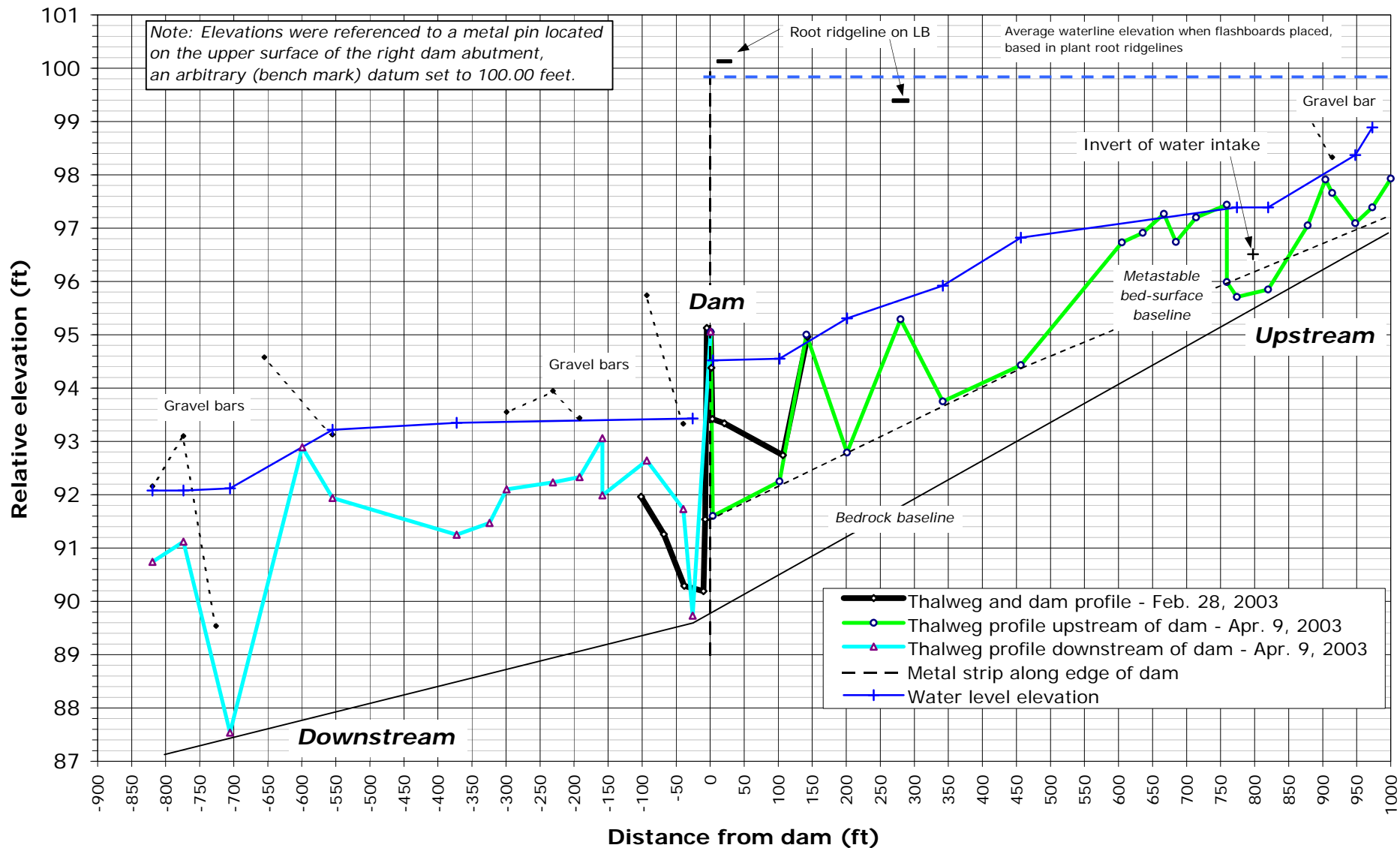


*This diagram shows cations in the ternary plot on the left and anions on the right plot. The double ternary (diamond) plot in the center separates hardness dominated water (on the left) from monovalent-salt dominated water (on the right). The radius of circle around the plotted points represents the concentration of dissolved solids, calibrated to the scale shown.*

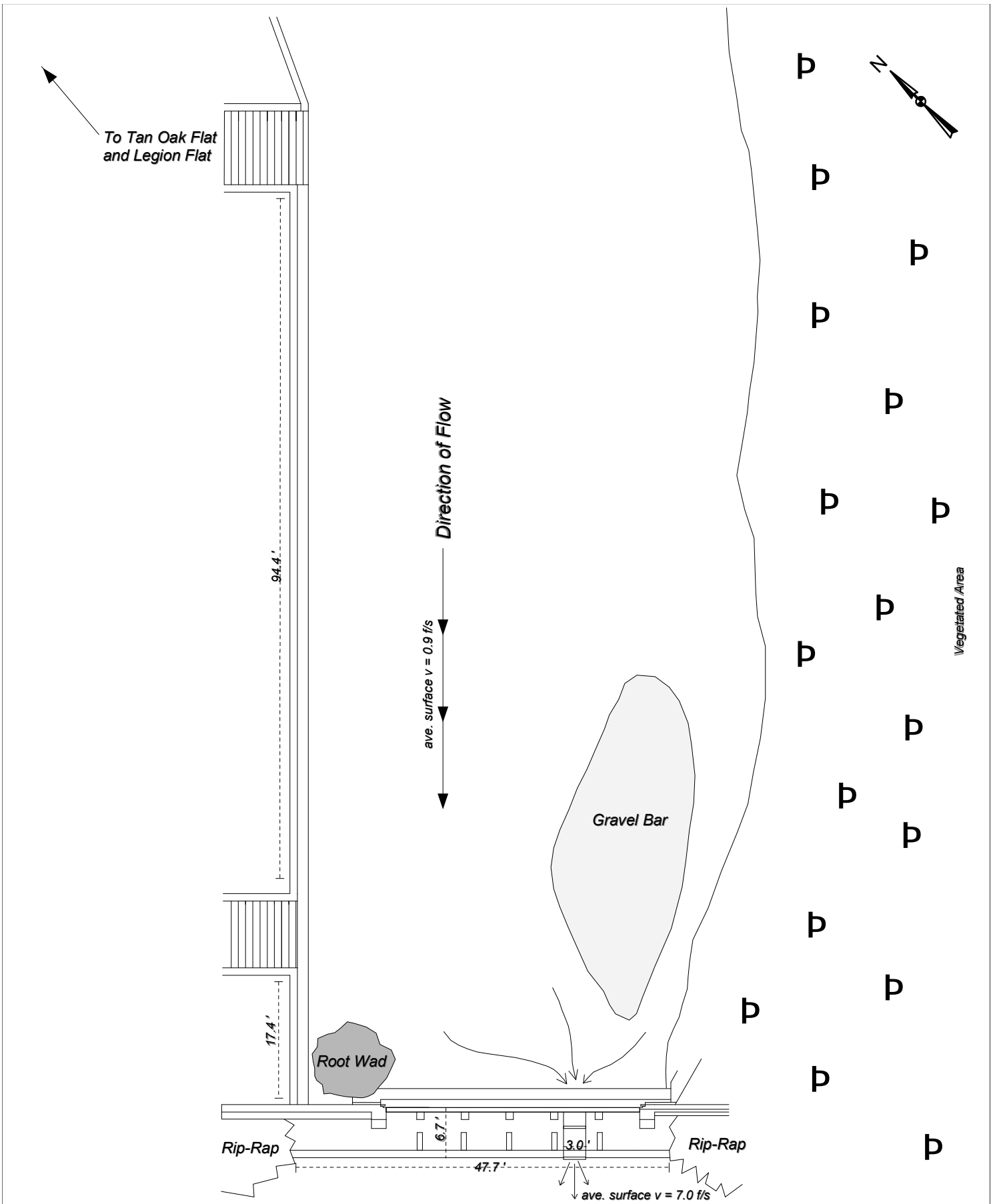


**Balance  
Hydrologics, Inc.**

**Figure 8. Piper diagram illustrating ionic signatures of water samples collected at the water diversion intake, Pescadero Creek, San Mateo County, California.**



**Figure 9. Longitudinal profile of Pescadero Creek at the dam and diversion location, Memorial County Park, San Mateo County, California.**



**Balance  
Hydrologics, Inc.**

**Figure 10. Plan View of Existing Dam Structure**  
Pescadero Creek at Memorial County Park,  
Loma Mar, California.



**Balance  
Hydrologics, Inc.**

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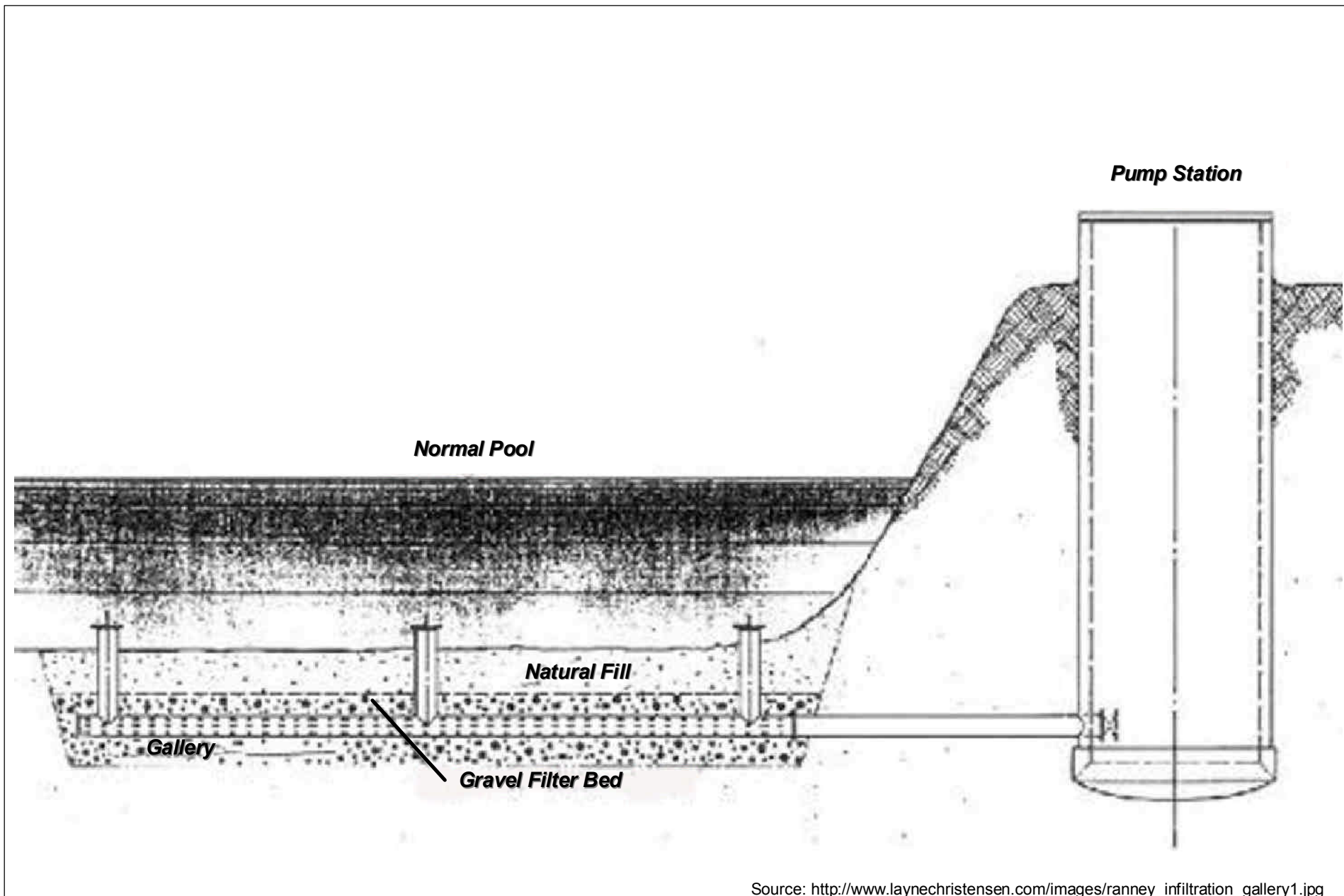
**Figure 11.** Photograph of existing dam on Pescadero Creek,  
Memorial County Park, San Mateo County, California.



**Balance  
Hydrologics, Inc.**

figure location: d:/gis/smco/memorial park.apr

**Figure 12.** Photograph of existing water diversion intake pipe and pump station, Pescadero Creek, Memorial County Park, San Mateo County, California.



**Figure 13. Schematic diagram of an infiltration gallery.**

Typically natural streambanks are not disturbed during construction.

## **APPENDICES**

## **APPENDIX A**

California water rights and those allocated to Memorial County Park  
by the State Department of Water Resources

## **California water rights and those allocated to Memorial County Park by the State Department of Water Resources**

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This appendix contains a sampling of the information available related to water rights maintained by San Mateo County for Memorial County Park. Information characterizing these water rights and how they have been used is presented below simply to inform readers needing some familiarity with these materials before reaching a decision regarding future water-supply planning at the park. As further explained below, it is not intended to be comprehensive.

In California, there are two major kinds of surface water rights: riparian rights which generally come with land bordering a water source, and appropriative rights, which are granted by the State Water Resources Control Board (SWRCB). This dual system of water rights originated in 1850 when California became a state, recognizing first riparian rights, followed by appropriative rights in 1851.

A water right is the legal entitlement which authorizes the diversion of water from a particular source for beneficial use. All water rights are limited to amounts reasonably necessary for the intended use and do not extend to wasteful or unreasonable use or means of diversion. A water right however, is not ownership of water but an opportunity to share in the responsible development and beneficial use of a public resource.

An appropriative right allows for the entitled to take a specific amount of water from a specific source for a specific use at a specific location during a specific period of time. It also allows for seasonal storage of water. Diversions initiated after December 19, 1914 require a permit from the SWRCB.

A riparian right typically comes with ownership of land bordering a stream, lake, or pond and has a higher priority than most appropriative rights. Riparian owners may use natural flows for beneficial purposes on riparian land without filing for a right. However, the owner must obtain a water right permit in order to store water during one season for use during another season.

The current water right held by Memorial County Park in Loma Mar, California, diverts surface waters of up to 30 gallons per minute from Pescadero Creek under a riparian

right. All diverters of surface water, with certain exceptions, are required to file a Statement of Water Diversion and Use with the SWRCB and applies to water diverted under a riparian right and to appropriations initiated prior to December 19, 1914, the effective date of the California Water Commission Act.

Riparian rights are not defined by the State of California statute, but a modification of the common law doctrine of riparian rights has been established by decisions of the court and confirmed by the provisions of section 3, Article XIV of the California Constitution. Lands that are within, traverse, or border a natural watercourse, may be riparian. Each owner may therefore have the right, which is correlative with the right of each other riparian owner, to share in the reasonable beneficial use of the natural flow of water which passes on their land. No permit is required for such a use. According to the State Water Resources Control Board, natural flow does not include return flows derived from ground water, water seasonally stored and later released, or water diverted from another watershed. The following 13 doctrines, administered by the California Water Code, are relative to riparian rights in California:

1. The riparian right exists by reason of ownership of land abutting upon a stream or body of water and affords no basis of right to use water upon riparian land. (Rancho Santa Margarita v. Vail, 11 Cal. 2d 501, 81 P. 2d 533)
2. In order to divert water under claim of riparian right, the diverter must use the water on riparian land but need not own the land at the point of diversion. That is, such diverter may divert at a point upstream from his land so long as permission is granted to use that point of diversion, and intervening land owners between the point of diversion and the place of use are not adversely affected by such practices. (Turner v. James Canal Co., 155 Cal. 82, 99 P. 520 (1909)).
3. A parcel of land loses its riparian right when severed from land bordering the stream by conveyance unless the right is reserved for the severed parcel. The riparian right also may be destroyed when purportedly transferred apart from the land by grant, contract, or condemnation. Once lost, it cannot be restored.
4. As between riparian owners, priority of use established no priority of right; i.e., one cannot claim superior right merely because water was used first. (Pabst v. Finmand, 190 Cal. 124, 211 P. 11 (1922))
5. The riparian right is neither created by use nor lost by nonuse.

6. If there is insufficient water for the reasonable beneficial requirements of all riparian owners, they must share the available supply. Apportionment is governed by various factors, including each owner's reasonable requirements and uses. In the absence of mutual agreement, recourse to judicial determination may be necessary.
7. As between riparian owners, one of them may take the whole supply if necessary for strictly domestic use; that is, for so-called "natural uses... arising out of the necessities of life on the riparian land, such as household use, drinking, watering domestic animals." (1 Weil, 3d ed., *Water Rights in the Western States*, page 795; *Deetz v. Carter*, 232 Cal. App. 2d 851)
8. The riparian owner is subject to the doctrine of reasonable use, which limits all rights to the use of water to, that quantity reasonably required for beneficial use and prohibits waste or unreasonable use or unreasonable methods of use or diversion. (Sec. 3, Art. XIV, Const. of Cal.; *Peabody v. City of Vallejo*, 2 Cal 2d 351, 40 Pac. 2d 486; *Tulare Irr. Dist. Et al v. Lindsay Strathmore Irr. Dist.*, 2 Cal. 2d 489, 45 Pac 2d 972; *Rancho Santa Margarita v. Vail*, 11 Cal. 2d 501, 81 P. 2d 533).
9. A riparian right may be impaired or lost through prescription. A prescriptive water right is one that is secured by appropriation and does not depend upon use for any given length of time. This right, however, is subordinate and subject to all prior vested rights, whether appropriative or riparian. This limitation may be removed by continuous use adverse to prior rights for five years and failure of the owners of the prior rights to file legal action to protect themselves during that time.
10. The riparian right attaching to a particular parcel of land is subject to appropriative rights established by diversion upon vacant public domain before the first valid steps were taken to acquire said parcel of land from the United States, whether diversion was made at points upstream or downstream.
11. The riparian right cannot be transferred for use upon another parcel of land.
12. The riparian right does not apply to foreign water; i.e., water originating in a different watershed cannot be used under claim of riparian right. (*E. Clemens Horst Co. v. New Blue Point Mining Co.*, 177 Cal. 631, 171 P. 417)
13. Water cannot be stored and withheld for a deferred use (other than regulatory storage) under claim of riparian right. (*Seneca Consol. Gold Mines Co. v. Great Western Power Co.*, 209 Cal. 206, 287 Pac. 93).

Included in this appendix are selected supporting documents of the appropriative and riparian water rights claimed by Memorial County Park in Loma Mar, California for water years 1993 to 2001. This appendix is not meant to be exhaustive or to present a legal position. For further information, please contact San Mateo Counties Division of Parks and Recreation, or the State Water Resources Control Board, Division of Water Rights.

Discussion based on materials supplied by Santa Mateo County Parks and text from the California Department of Water Resources.

## **APPENDIX B**

“Memorial County Park, San Mateo County, Evaluation of Instream Structures” evaluation by fisheries biologist Jeff Hagar

# **DRAFT**

## **Technical Memorandum**

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*Prepared for:* **Balance Hydrologics, Inc.**  
*Prepared by* **Hagar Environmental Science**

### **MEMORIAL COUNTY PARK, SAN MATEO COUNTY, EVALUATION OF INSTREAM STRUCTURES**

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A site visit was conducted on February 28, 2003 to evaluate potential impacts to steelhead and coho salmon from operation of a seasonal flashboard dam in Pescadero Creek in Memorial Park. This Technical Memorandum describes on site observations and discusses fishery issues for alternative management options.

#### **Existing Structure**

The dam was observed during the site visit on February 28; the flashboards were not in place. Average flow for the day was 21 cfs at the USGS Pescadero Creek at Pescadero gage (USGS internet data). The dam foundation is a concrete structure spanning the width of the creek, about 30 feet. The structure has a cross-section top width of approximately 6 feet. At the time of the survey there was a change in water surface elevation of about 1.5 feet from the lower edge of the structure to the upper edge. There was a thin sheet of water flowing over the structure; however, a significant amount of the flow was conducted through a small chute through the foundation on the left side (Figure 1). The chute is approximately one foot square with the upper edge approximately even with the downstream water surface elevation. The flashboards, when in place, would rise to an elevation about 3.5 feet above the top of the concrete foundation.

During the site visit, an adult female steelhead, approximately 20-22 inches in length, appeared at the upper edge of the chute in the dam and swam upstream of the foundation. There was evidence of spawning immediately upstream of the foundation with a large area of gravel disturbed. There was also evidence of spawning along the left bank about 70 feet upstream of the dam and in the first riffle downstream of the dam.

#### **Fishery Issues**

##### **Option 1: Continued seasonal operation of flashboard dam**

The permitting status of the existing facility is not known. Continued operation of the dam including seasonal placement of the flashboards would presumably be conducted under a California Department of Fish and Game streambed alteration permit and consultation with NOAA Fisheries on issues related to take of listed steelhead and coho salmon. Issues that may arise in the permitting process include provision of suitable passage conditions for spawning adults, emigrating smolts, and possibly, rearing juveniles; impoundment effects on downstream water temperature; loss of stream rearing habitat when the impoundment is filled; impoundment impacts on downstream aquatic invertebrate populations and juvenile rearing habitat; sediment transport; and bypass flows during draining and filling of the impoundment. Addressing these

issues may involve extensive studies and/or monitoring. Mitigation features including fish passage enhancements such as a fish ladder may also be required.



**Figure 1.** View of dam foundation from upstream. Large area of disturbed gravel at upper edge of foundation is steelhead redd. Chute through foundation is visible at upper right.

### **Option 2: Discontinued use of flashboard dam.**

Many of the issues related to impounding stream flows would be avoided under this alternative. The primary issues to be addressed would be passage at the existing foundation. The existing chute appears to allow passage of spawning adults although the hydraulic conditions and size of the chute may not meet current passage criteria under some flow conditions. The chute also may not meet criteria for juvenile passage due to excessive velocity under some flow conditions. More thorough evaluation of hydraulic conditions would be required to fully assess passage potential.

Some structural modifications to the dam foundation may be needed to meet current passage criteria under a suitable range of stream flows but, since the foundation is an existing structure, such modifications may not be legally mandated. However, if current requirements for new and replacement culverts were applied at this site, applicable relevant criteria could include:

- Minimum chute width of 3 feet

- Maximum slope of 0.5%
- Embedment of the bottom of the chute below the natural channel bottom
- Maximum average velocity of 6 fps for adult salmonid upstream passage
- Maximum average velocity of 2 fps (for short distance only) for juvenile salmonid upstream passage
- Maximum hydraulic drop of 1 foot for adults and 6 inches for juveniles
- Minimum water depth of 1 foot for adult salmonids and 6 inches for juveniles

The simplest modification could involve notching the top of the dam to provide sufficient depth and hydraulic drop conditions. Permit requirements for discontinuing use of the dam but leaving the foundation in place are unclear. Generally, for seasonal dams, CDFG defines the "project" as annual placement and removal of the flashboards. If these actions are not taken there is technically no project, and no need for permits or CEQA compliance. On the other hand, permits would likely be required to modify the foundation to improve passage conditions, particularly if grant funding is pursued.

### **Option 3: Discontinued use of flashboard dam, removal of dam foundation.**

Full removal of the dam would eliminate regulatory issues with CDFG and NOAA Fisheries. The degree to which this would benefit steelhead and coho salmon is not certain. In some coastal streams, there is evidence that juvenile steelhead use seasonal impoundments for rearing and that substantial numbers of smolts can be produced with a shorter development period than in adjoining free flowing stream habitat. It is not known whether this is the case at the Memorial Park site. Gravel suitable for spawning has accumulated upstream of the existing foundation. Removal of the foundation will likely facilitate movement of this gravel and may eliminate spawning habitat that is currently used by steelhead. Current regulatory practices associate all impacts (and "take" under the Endangered Species Act) with project facilities and operations. Therefore, removal of facilities or discontinued operations are regarded as eliminating the possibility of "take", regardless of whether this may actually eliminate habitat (even if artificial) that is used by the species. Removal of the dam foundation would likely require a streambed alteration permit. Most impacts would be temporary, construction related impacts such as disruption of passage and mobilization of sediments. These issues would have to be addressed in construction planning documentation.

### **Other Issues**

A brief evaluation of the road crossing between Sequoia Flat and Azalea Flat was also made during the site visit. Although a fish ladder has been constructed through the road crossing, the ladder has features that are less than ideal for passage of both adult and juvenile steelhead or coho salmon. First, there is not a good entrance pool. The entrance to the fishway is on a concrete apron resulting in very shallow flow. At high flows when water is flowing across the road surface, a significant amount of flow may be across the apron making the entrance to the fishway difficult for fish to find. In addition, the Washington type baffles used in the fishway have collected a significant amount of sediment and debris as is typical for this design. A large boulder is partially obstructing one of the lower baffles. This type of ladder requires frequent cleaning and maintenance, particularly after high flows, and may be clogged with debris during prime migration periods. Although adult steelhead are obviously getting past the structure, as indicated by the presence of redds and one adult fish upstream, some fish may be delayed or prevented from passing. In addition, passage of juveniles may be restricted during low flow periods.

## **APPENDIX C**

Sediment data collected in Memorial County Park by Balance  
Hydrologics during 2003

**FIELD DATA COLLECTED**

*SITE INFORMATION*

Project Name: Memorial County Park  
 Project No. 202092  
 Stream: Pescadero  
 Site Name: Wurr Rd. Bridge  
 Water Year: 2003  
 Date: 4/9/2003

Segment:	Riffle	<input checked="" type="checkbox"/>
	Pool	<input checked="" type="checkbox"/>
	Glide	<input type="checkbox"/>

Method:	Tape and offset	<input checked="" type="checkbox"/>
	Pace and toe touch	<input type="checkbox"/>
	Pace and offset	<input type="checkbox"/>

*PEBBLE COUNT DATA TAKEN IN FIELD*

	Pass No.		1		1'		2		2'		3		3'		4		4'		5		5'		total embeddedness	total count	mean embeddedness	proportion of bed	
	Observer	GP	GP	CH	CH	GP	GP	CH	CH	GP	GP	CH	CH	GP	GP	E	#	E	#	E	#	E					#
Size Class mm	E	#	E	#	E	#	E	#	E	#	E	#	E	#	E	#	E	#	E	#	E	#	E	#	E	#	
boulder	1450																						0.0	0	0.00	0.000	
	1024																							0.0	0	0.00	0.000
	730																							0.0	0	0.00	0.000
	512																							0.0	0	0.00	0.000
	360																							0.0	0	0.00	0.000
	256																								0.0	0	0.00
cobble	180				0.6	1																	0.6	1	0.60	0.008	
	128			0.7	1			0.6	1								0.8	2					2.1	4	0.53	0.031	
	90	0.4	1			0.0	1					0.0	1	0.0	1					0.6	2		1.0	5	0.20	0.038	
gravel	64	0.0	1			0.1	2					0.0	1	0.3	1	0.0	2	0.5	2	0.2	2		1.1	11	0.10	0.085	
	45	0.0	1	0.6	1	1.8	3	0.5	2	2.4	5	0.8	2	0.0	2	0.7	6	0.6	2				7.4	24	0.31	0.185	
	32	0.0	1	0.0	1	0.0	4	1.5	4	0.8	3	0.0	1	0.0	3	0.0	2	0.8	3				3.1	22	0.14	0.169	
	22.6	0.0	1	0.2	3	0.6	1	0.3	3	0.1	2	0.7	2					0.8	2				2.7	14	0.19	0.108	
	16	0.2	2	0.6	2			0.0	1	0.1	1	0.2	1	0.5	2	0.0	1				0	1	1.6	11	0.15	0.085	
	11.3				1								3	1									0.0	5	0.00	0.038	
	8				1											1							0.0	2	0.00	0.015	
	5.6									1													0.0	1	0.00	0.008	
4		1									1											0.0	2	0.00	0.015		
Subtotals																											
>64 (cobble)	0.4	2	0.7	1	3.1	12	0.6	1	0.0	0	0.0	1	0.3	2	0.0	2	1.3	4	0.8	4			7.2	29	0.25	0.223	
>45	0.4	3	1.3	2	3.1	12	1.1	3	2.4	5	0.8	3	0.3	4	0.7	8	1.9	6	0.8	4			12.8	50	0.26	0.385	
>16	0.6	7	2.1	8	3.1	12	2.9	11	3.4	11	1.7	7	0.8	9	0.7	11	3.5	11	0.8	5			19.6	92	0.21	0.708	
>4 (gravels)	-	7	-	10	-	12	-	11	-	12	-	11	-	10	-	12	-	11	-	5			-	101	-	0.777	
<4 (sand)	-	3	-	1	-	1	-	2	-	1	-	1	-	2	-	1	-	1	-	1			-	14	-	0.108	
Bedrock																	1				7		0.0	8	0.00	0.062	
Organics		2		2								1		1									0.0	6	0.00	0.046	
Artifacts																	1						0.0	1	0.00	0.008	
Total	0.6	13	2.1	13	3.1	13	2.9	13	3.4	13	1.7	13	0.8	13	0.7	13	3.5	13	0.8	13			-	130	-	1.000	

D-10:	16.10	(mm)
D-16:	19.53	(mm)
D-50:	41.17	(mm)
D-84:	74.17	(mm)
D-90:	89.94	(mm)

Notes :

- 1) Method described in detail in the accompanying text.
- 2) Embeddedness (E) is the ratio of the depth of fine material surrounding a rock in the channel to the height of the rock.
- 3) For a rock to be considered bedrock, it had to be of the same type exposed in the banks or lower hillslopes, and of similar bed orientation, if distinguishable.

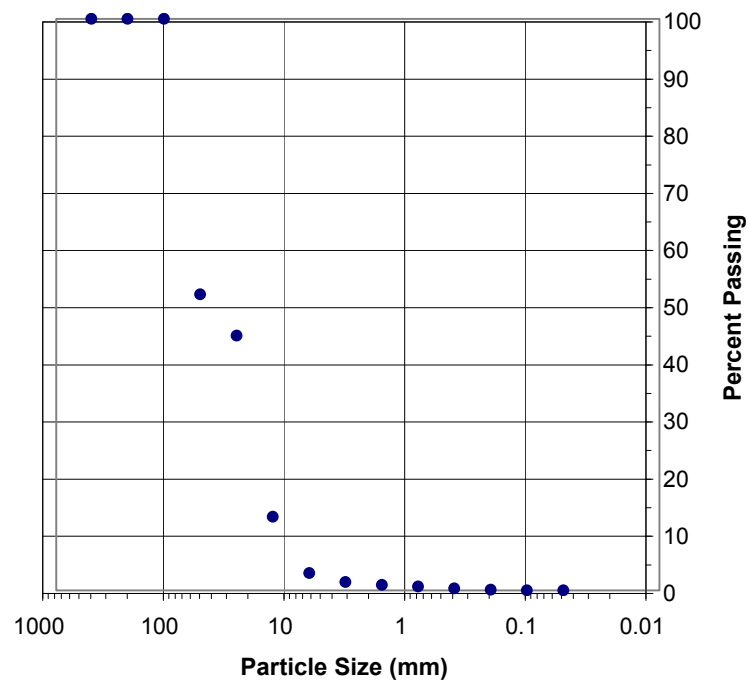
Particle size-class analysis of a bed-core sample collected in Memorial County Park, San Mateo County, California.

**GENERAL INFORMATION**

Gage No.: not applicable  
 Stream: Pescadero Creek  
 Location: 95 feet upstream of dam in second glide  
 Date: 4/9/2003  
 Time: 18:00  
 Observer: ch, gp  
 Weighed by: ch

**SIEVE ANALYSIS**

	Sieve Opening (mm)	Phi	Weight Retained (g)	Weight Passing (g)	Cumulative Percent Finer by Weight (% passing)
boulder	512	-9	0	1075.1	100.00
	256	-8	0	1075.1	100.00
cobble	128	-7	0	1075.1	100.00
	64	-6	518.5	556.6	51.77
gravel	32	-5	77.5	479.1	44.56
	16	-4	340.5	138.6	12.89
	8	-3	106	32.6	3.03
	4	-2	17.2	15.4	1.43
sand	2	-1	5	10.4	0.97
	1	0	3.3	7.1	0.66
	0.5	1	3.5	3.6	0.33
	0.25	2	2.3	1.3	0.12
	0.125	3	1	0.3	0.03
	0.0625	4	0.3	0	0.00
	pan	> 4	0	0	0.00



**CHARACTERISTIC SIZES (mm)**

D-10: 13.06  
 D-16: 17.13  
 D-50: 54.0  
 D-84: 101.7  
 D-90: 111

**WEIGHT CHECK**

Initial weight of bulk sample (g): 1077.5  
 End weight of bulk sample (g): 1075.1  
 Net Loss (g): 2.4  
 % Loss: 0.22%  
 Remarks :

**Notes:**

phi = -log (size) (log is the base 2 log). ie size = 1/2^phi.  
 observers: Charlotte Hedlund (ch), Gustavo Porras (gp)

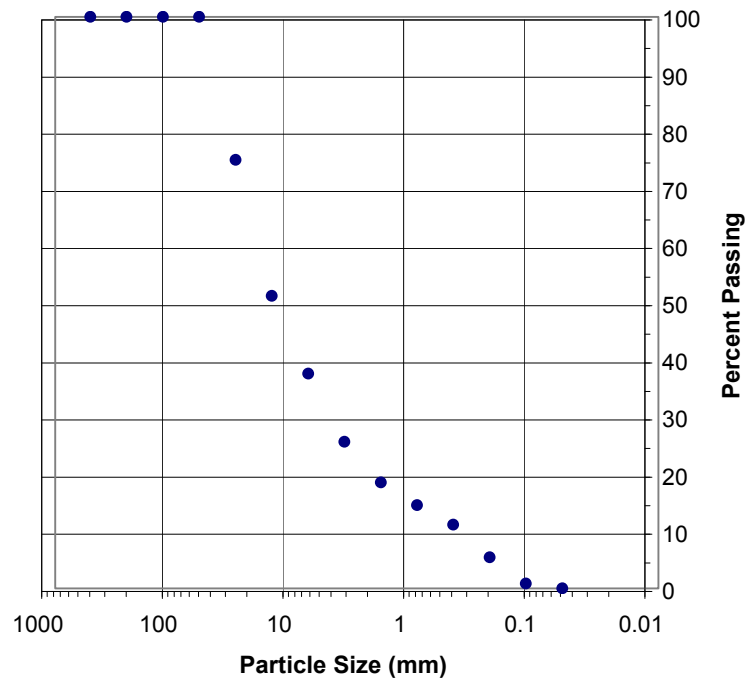
Particle size-class analysis of a bed-core sample collected in Memorial County Park, San Mateo County, California.

**GENERAL INFORMATION**

Gage No.: not applicable  
 Stream: Pescadero Creek  
 Location: 10 feet upstream of dam on gravel bar  
 Date: 4/9/2003  
 Time: 18:30  
 Observer: ch, gp  
 Weighed by: ch

**SIEVE ANALYSIS**

	Sieve Opening (mm)	Phi	Weight Retained (g)	Weight Passing (g)	Cumulative Percent Finer by Weight (% passing)
boulder	512	-9	0	1923.8	100.00
	256	-8	0	1923.8	100.00
cobble	128	-7	0	1923.8	100.00
	64	-6	0	1923.8	100.00
gravel	32	-5	481.8	1442	74.96
	16	-4	457.2	984.8	51.19
	8	-3	262.5	722.3	37.55
	4	-2	229.4	492.9	25.62
sand	2	-1	136.4	356.5	18.53
	1	0	76	280.5	14.58
	0.5	1	65.8	214.7	11.16
	0.25	2	110.7	104	5.41
	0.125	3	87.5	16.5	0.86
	0.0625	4	16.5	0	0.00
	pan	> 4	0	0	0.00



**CHARACTERISTIC SIZES (mm)**

D-10: 0.43  
 D-16: 1.28  
 D-50: 15.1  
 D-84: 41.1  
 D-90: 49

**WEIGHT CHECK**

Initial weight of bulk sample (g): 1927.8  
 End weight of bulk sample (g): 1923.8  
 Net Loss (g): 4.0  
 % Loss: 0.21%  
 Remarks :

**Notes:**

phi = -log (size) (log is the base 2 log). ie size = 1/2^phi.  
 observers: Charlotte Hedlund (ch), Gustavo Porras (gp)

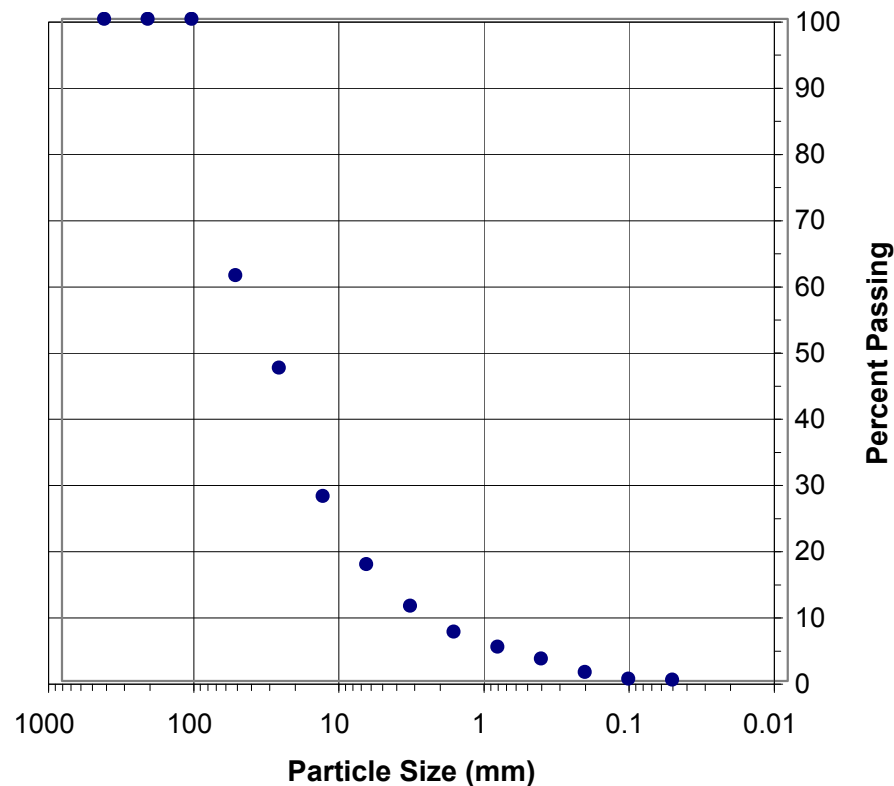
Particle size-class analysis of a bed-core sample collected in Memorial County Park, San Mateo County, California.

**GENERAL INFORMATION**

Gage No.: not applicable  
 Stream: Pescadero Creek  
 Location: 35 feet downstream of Wurr Road bridge  
 Date: 4/9/2003  
 Time: 17:00  
 Observer: ch, gp  
 Weighed by: ch

**SIEVE ANALYSIS**

	Sieve Opening (mm)	Phi	Weight Retained (g)	Weight Passing (g)	Cumulative Percent Finer by Weight (% passing)
boulder	512	-9	0	3142.4	100.00
	256	-8	0	3142.4	100.00
cobble	128	-7	0	3142.4	100.00
	64	-6	1216.3	1926.1	61.29
gravel	32	-5	439.5	1486.6	47.31
	16	-4	608	878.6	27.96
	8	-3	324	554.6	17.65
	4	-2	198.2	356.4	11.34
sand	2	-1	122.2	234.2	7.45
	1	0	71.1	163.1	5.19
	0.5	1	57	106.1	3.38
	0.25	2	62.9	43.2	1.37
	0.125	3	32	11.2	0.36
	0.0625	4	5.6	5.6	0.18
	pan	> 4	5.6	0	0.00



**CHARACTERISTIC SIZES (mm)**

D-10: 3.15  
 D-16: 6.67  
 D-50: 36.6  
 D-84: 96.1  
 D-90: 107

**WEIGHT CHECK**

Initial weight of bulk sample (g): 3146.8  
 End weight of bulk sample (g): 3142.4  
 Net Loss (g): 4.4  
 % Loss: 0.14%  
 Remarks :

**Notes:**

phi = -log (size) (log is the base 2 log). ie size = 1/2^phi.  
 observers: Charlotte Hedlund (ch), Gustavo Porrás (gp)

## **APPENDIX D**

Supplemental water quality data, Pescadero Creek, San Mateo County, California, (Blume, Kenneth & Brown, 2001 and Memorial County Park staff)

Surface water quality results from aquatic monitoring for Pescadero Creek, San Mateo County, California.

Parameter	Homestead			Hoffman Tributary			Shaw			Bridge			Hooker Tributary		
	2/8/2001	3/1/2001	4/5/2001	2/8/2001	3/1/2001	4/5/2001	2/8/2001	3/1/2001	4/5/2001	2/8/2001	3/1/2001	4/5/2001	2/8/2001	3/1/2001	4/5/2001
<b>Air Temperature (°C)</b>	10.00	11.50	12.80	n/a	11.00	12.30	7.90	8.50	13.10	12.80	12.90	13.80	n/a	10.70	19.00
<b>Water Temp (°C)</b>	5.10	7.70	9.80	n/a	8.90	9.70	5.30	7.50	9.90	4.80	7.80	9.10	n/a	9.00	8.90
<b>Width of Stream (ft)</b>	17.10	35.20	33.00	n/a	4.80	1.50	19.00	14.20	19.80	27.00	35.00	33.90	n/a	3.60	4.20
<b>Discharge (cfs)</b>	5.22	18.87	4.51	n/a	0.13	0.03	3.23	5.05	3.74	6.30	15.26	3.10	n/a	0.13	0.22
<b>Turbidity (NTU)</b>	1.69	10.80	1.31	n/a	14.30	10.00	1.31	6.82	1.30	2.82	7.54	8.94	n/a	6.31	8.94
<b>Dissolved Oxygen (mg/l)</b>	13.40	9.75	9.44	n/a	9.46	9.02	13.40	9.84	9.68	12.80	9.80	9.68	n/a	9.07	8.15
<b>Dissolved Oxygen sat. (%)</b>	100.90	101.20	104.70	n/a	101.00	97.20	104.80	103.00	106.40	99.30	103.10	105.00	n/a	99.20	93.30
<b>Specific Conductance (Micromhos/cm @ 25° C)</b>	594.00	259.00	512.00	n/a	350.70	340.60	599.00	385.00	359.30	375.40	274.40	518.00	n/a	208.00	118.50
<b>pH (standard units)</b>	8.10	8.10	8.10	n/a	7.80	7.90	8.00	8.00	8.10	7.80	8.30	8.20	n/a	7.60	7.40
<b>Total Suspended Solids (mg/l)</b>	0.10	0.00	0.20	0.11	0.10	0.10	0.10	0.10	0.00	0.00	0.00	0.40	0.10	0.00	0.10
<b>Aluminum (mg/l)</b>	0.05	0.88	0.00	0.00	0.50	0.00	0.04	0.00	0.22	0.02	0.00	0.00	0.00	0.01	0.00
<b>Copper (mg/l)</b>	0.00	3.00	0.00	0.00	231.00	0.00	0.70	0.90	1.10	1.20	0.00	2.00	0.80	0.00	0.00
<b>Nitrate (mg/l)</b>	0.02	0.05	0.00	0.04	0.02	0.04	0.08	0.02	0.03	0.07	0.05	0.03	0.00	0.01	0.00
<b>Phosphorus (mg/l)</b>	0.14	0.39	0.00	0.06	1.23	0.14	0.12	0.35	0.35	0.14	0.31	0.41	0.43	1.35	0.00
<b>Sulfate (mg/l)</b>	75.00	67.00	34.00	59.00	40.00	32.00	75.00	65.00	75.00	75.00	74.00	75.00	31.00	27.00	23.00
<b>Alkalinity (mg/l)</b>	82.00	114.00	144.00	102.00	88.00	60.00	104.00	138.00	132.00	80.00	110.00	130.00	60.00	60.00	122.00
<b>Ammonia (mg/l)</b>	0.13	0.11	0.04	0.08	0.06	0.10	0.11	0.07	0.05	0.07	0.07	0.08	0.17	0.16	0.06
<b>Chromium (mg/l)</b>	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.38	0.00

**Notes:**

This data supplements water quality information for surface diversions from Pescadero Creek at Memorial County Park, and serves to provide broader watershed information.

Data collected by Brown and Brown, University of San Francisco, 2001.

Reading left to right, sites are listed from downstream to upstream. n/a = data not available

## **APPENDIX E**

Title 22, California Code of Regulations

May 16, 2003

Includes MCL changes effective June 12, 2003

(<http://www.dhs.ca.gov/ps/ddwem/publications/regulations/MCLrevisions6-12-03.pdf>)

*NOTE: This extract from Title 22 of the California Code of Regulations is prepared as an aid to staff of the DHS Drinking Water Program and cannot be relied upon by the regulated community as the State of California's representation of the law. The published codes are the only official representation of the law.*

**TITLE 22, CALIFORNIA CODE OF REGULATIONS**

**DIVISION 4. ENVIRONMENTAL HEALTH**

**CHAPTER 15. DOMESTIC WATER QUALITY AND MONITORING**

**ARTICLE 4. PRIMARY STANDARDS—INORGANIC CHEMICALS**

**Section 64431. Maximum contaminant levels - inorganic chemicals**

**Table 64431-A**

Maximum Contaminant Levels  
Inorganic Chemicals

<i>Chemical</i>	<i>Maximum Contaminant Level, mg/L</i>
Aluminum	1.
Antimony	0.006
Arsenic	0.05
Asbestos	7 MFL*
Barium	1.
Beryllium	0.004
Cadmium	0.005
Chromium	0.05
Cyanide	0.15
Fluoride	2.
Mercury	0.002
Nickel	0.1
Nitrate (as NO <sub>3</sub> )	45.
Nitrate + Nitrite (sum as nitrogen)	10.
Nitrite (as nitrogen)	1.
Selenium	0.05
Thallium	0.002

\*MFL = million fibers per liter; MCL for fibers exceeding 10 um in length.

**Article 4.1. FLUORIDATION**

**Section 64433.2. Optimal fluoride levels**

**Table 64433.2-A**  
Optimal Fluoride Levels

<i>Annual average of maximum daily air temperatures, degrees</i>		<i>Optimal fluoride level, mg/L</i>	<i>Control Range, mg/L</i>	
<i>Fahrenheit</i>	<i>Celsius</i>		<i>Low</i>	<i>High</i>
50.0 to 53.7	10.0 to 12.0	1.2	1.1	1.7
53.8 to 58.3	12.1 to 14.6	1.1	1.0	1.6
58.4 to 63.8	14.7 to 17.7	1.0	0.9	1.5
63.9 to 70.6	17.8 to 21.4	0.9	0.8	1.4
70.7 to 79.2	21.5 to 26.2	0.8	0.7	1.3
79.3 to 90.5	26.3 to 32.5	0.7	0.6	1.2

**ARTICLE 5. RADIOACTIVITY**

**Section 64441. Natural radioactivity**

**Section 64443. Man-made radioactivity**

**Table 4**  
MCL Radioactivity

<i>Constituent</i>	<i>Maximum Contaminant Level, pCi/l</i>
Combined Radium-226 and Radium-228	5
Gross Alpha particle activity (including Radium-226 but excluding Radon and Uranium)	15
Tritium	20,000
Strontium-90	8
Gross Beta particle activity	50
Uranium	20

**ARTICLE 5.5. PRIMARY STANDARDS—ORGANIC CHEMICALS**

**Section 64444. General requirements**

**Table 64444-A**  
 Maximum Contaminant Levels  
 Organic Chemicals

<i>Chemical</i>	<i>Maximum Contaminant Level, mg/L</i>
(a) Volatile Organic Chemicals (VOCs)	
Benzene	0.001
Carbon Tetrachloride	0.0005
1,2-Dichlorobenzene	0.6
1,4-Dichlorobenzene	0.005
1,1-Dichloroethane	0.005
1,2-Dichloroethane	0.0005
1,1-Dichloroethylene	0.006
cis-1,2-Dichloroethylene	0.006
trans-1,2-Dichloroethylene	0.01
Dichloromethane	0.005
1,2-Dichloropropane	0.005
1,3-Dichloropropene	0.0005
Ethylbenzene	0.3
Methyl- <i>tert</i> -butyl ether	0.013
Monochlorobenzene	0.07
Styrene	0.1
1,1,2,2-Tetrachloroethane	0.001
Tetrachloroethylene	0.005
Toluene	0.15
1,2,4-Trichlorobenzene	0.07
1,1,1-Trichloroethane	0.200
1,1,2-Trichloroethane	0.005
Trichloroethylene	0.005
Trichlorofluoromethane	0.15
1,1,2-Trichloro-1,2,2-Trifluoroethane	1.2
Vinyl Chloride	0.0005
Xylenes	1.750*

**Table 64444-A (continued)**  
**Maximum Contaminant Levels**  
**Organic Chemicals**

<i>Chemical</i>	<i>Maximum Contaminant Level, mg/L</i>
<b>(b) Non-Volatile Synthetic Organic Chemicals (SOCs)</b>	
Alachlor	0.002
Atrazine	0.001
Bentazon	0.018
Benzo(a)pyrene	0.0002
Carbofuran	0.018
Chlordane	0.0001
2,4-D	0.07
Dalapon	0.2
Dibromochloropropane (DBCP)	0.0002
Di(2-ethylhexyl)adipate	0.4
Di(2-ethylhexyl)phthalate	0.004
Dinoseb	0.007
Diquat	0.02
Endothall	0.1
Endrin	0.002
Ethylene Dibromide (EDB)	0.00005
Glyphosate	0.7
Heptachlor	0.00001
Heptachlor Epoxide	0.00001
Hexachlorobenzene	0.001
Hexachlorocyclopentadiene	0.05
Lindane	0.0002
Methoxychlor	0.03
Molinate	0.02
Oxamyl	0.05
Pentachlorophenol	0.001
Picloram	0.5
Polychlorinated Biphenyls	0.0005
Simazine	0.004
Thiobencarb	0.07
Toxaphene	0.003
2,3,7,8-TCDD (Dioxin)	$3 \times 10^{-8}$
2,4,5-TP (Silvex)	0.05

\*MCL is for either a single isomer or the sum of the isomers.

**ARTICLE 16. SECONDARY DRINKING WATER STANDARDS**

**Section 64449. Secondary maximum contaminant levels and compliance**

**Table 64449-A**  
 Secondary Maximum Contaminant Levels  
 Consumer Acceptance Limits

<i>Constituents</i>	<i>Maximum Contaminant Levels/Units</i>
Aluminum	0.2 mg/L
Color	15 Units
Copper	1.0 mg/L
Corrosivity	Non-corrosive
Foaming Agents (MBAS)	0.5 mg/L
Iron	0.3 mg/L
Manganese	0.05 mg/L
Methyl- <i>tert</i> -butyl ether (MTBE)	0.005 mg/L
Odor—Threshold	3 Units
Silver	0.1 mg/L
Thiobencarb	0.001 mg/L
Turbidity	5 Units
Zinc	5.0 mg/L

**Table 64449-B**  
 Secondary Maximum Contaminant Levels - Ranges

<i>Constituent, Units</i>	<i>Maximum Contaminant Level Ranges</i>		
	<i>Recommended</i>	<i>Upper</i>	<i>Short Term</i>
Total Dissolved Solids, mg/L or	500	1,000	1,500
Specific Conductance, micromhos	900	1,600	2,200
Chloride, mg/L	250	500	600
Sulfate, mg/L	250	500	600

## **CHAPTER 17.5. LEAD AND COPPER**

### **ARTICLE 1. GENERAL REQUIREMENTS AND DEFINITIONS**

#### **Section 64672.3. Determination of compliance with lead and copper action levels**

(a) The lead action level is exceeded if the concentration of lead in more than 10 percent of tap water samples collected during any monitoring period conducted in accordance with Article 6 is greater than 0.015 mg/L (i.e., if the "90th percentile" lead level is greater than 0.015 mg/L).

(b) The copper action level is exceeded if the concentration of copper in more than 10 percent of tap water samples collected during any monitoring period conducted in accordance with Article 6 is greater than 1.3 mg/L (i.e., if the "90th percentile" copper level is greater than 1.3 mg/L).

## **APPENDIX F**

Fisheries Restoration Grant, submitted to San Mateo County, May 9,  
2003

**Fisheries Restoration Grant Program  
Proposal Solicitation Notice  
March 14, 2003**

**Proposal Application Form**

**Section 1: Summary Information**

1. Project type: HB
2. Project title: Pescadero Creek at Memorial County Park Fish Passage
3. Amount requested: \$77,092.00
4. Total project cost: \$77,092.00
5. Salmonid species benefited: Chinook  Coho  Steelhead  Cutthroat
6. Project summary: The objective of the project is to enhance Threatened Steelhead and restore Endangered Coho habitat and migration along reaches of Pescadero Creek. Objectives are to remove the dam structure, as well as maintain Park water rights of 30 gallons per minute by implementation of a drinking water well within Park boundaries. Expected results from this project include increased steelhead spawning and rearing habitat and a more reliable and less costly source of drinking water to the Park.
7. Applicant name: San Mateo County Department of Parks and Recreation
8. Contact person: Sam Herzberg
9. Address: 455 County Center, Fourth Floor
10. City: Redwood City
11. State: California
12. ZIP: 94063
13. Telephone number: 650-363-1823
14. FAX number: 650-599-1721
15. Email address: sherzberg@co.sanmateo.ca.us
16. Type: Public Agency  Nonprofit Organization  Private Enterprise  Indian Tribe
17. OSBCR Certified Small Business?   
If yes, specify the industry group and Small Business Reference Number:
18. Past contractor?
19. Federal taxpayer ID:
20. Stream: Pescadero Creek
21. Tributary to: Pacific Ocean
22. Major drainage system: Pescadero Creek
23. County(ies): San Mateo and Santa Cruz
24. Within Coastal Zone?  Within Trinity River basin?  Within Klamath River basin?

## Section 2: Location Information

1. Township, Range, Section: T 7 S., R 4 W., Section 34
2. Latitude, Longitude (in decimal degrees): 37.260833, -122.327778 NAD 27
3. Location description: Approximately 0.2 miles downstream of Wurr Rd. bridge and confluence of McCormick Creek.
4. Directions:  
Memorial County Park is approximately 4.7 miles east of Pescadero.

When coming to Memorial Park from the bayside of the peninsula, use Highway 84 west from either Highway 280, 101 or 35 (Skyline Boulevard). Travel westbound down Highway 84 from Skyline Boulevard to Pescadero Road near the Town of La Honda. Turn left (south) on Pescadero Road. Follow Pescadero Road to the park entrance.

When coming to Memorial Park from the coastside, use Highway 1 to Pescadero Road. Follow Pescadero Road to the park entrance.

## Section 3: Watershed Information

1. Watershed name: Pescadero Creek
2. Watershed area: 40.5 square miles
3. Watershed area included in this proposal: 0.8 square miles (499 acres)
4. Land use statement: The following landuses currently exist within the Pescadero Creek watershed:
  1. Bays and Estuaries
  2. Commercial and Services
  3. Cropland and Pasture
  4. Evergreen Forest Land
  5. Herbaceous Rangeland
  6. Lakes
  7. Mixed Rangeland
  8. Mixed Urban or Built-Up
  9. Nonforested Wetland
  10. Other Agricultural Land
  11. Residential
  12. Shrub & Brush Rangeland
  13. Institutional
5. Watershed area ownership:      % private: 78%      % state: 22%      % federal: 0%
6. Watershed area with landowners supportive of proposal: Not Applicable
7. Watershed length of blue line streams: 94.9 miles
8. Length of blue line streams affected by proposal: Approximately 0.3 miles will have a direct physical affect; approximately 62.3 miles of Pescadero Creek and its tributaries will be further opened for access by proposed project.

9. Salmonids present: Steelhead (*Onchorhynchus mykiss*)

10. Source(s) of above information:

Coastal Watershed Council, 2003. Gazos Creek Watershed Assessment and Enhancement Plans.

California Department of Fish and Game, 1998. Strategic Plan for Restoration of the Endangered Coho Salmon South of San Francisco Bay.

Hagar Environmental, 2003. Technical memo from site visit on February 28, 2003.

Smith, J. J. 1990. The Effects of Sandbar Formation and Inflows on Aquatic Habitat and Fish Utilization in Pescadero, San Gregorio, Waddell and Pomponio Creek Estuary/Lagoon Systems, 1985-1989.

11. Salmonids historically present: Coho salmon (*Oncorhynchus kisutch*)  
Steelhead (*Onchorhynchus mykiss*)

12. Source(s) of above information:

Anderson, K.R. 1995. A status review of the coho salmon (*Oncorhynchus kisutch*) in California south of San Francisco Bay. Report to the Fish and Game Commission, California Department of Fish and Game, Region 3, Monterey.

California Department of Fish and Game. 1998. Draft Central California Coast Coho Recovery Plan. Monterey, CA

California Department of Fish and Game. 1998. Draft Strategic Plan for Restoration of the Endangered Coho Salmon South San Francisco Bay.

Coastal Watershed Council, 2003. Gazos Creek Watershed Assessment and Enhancement Plans.

Smith, J. J. 1990. The Effects of Sandbar Formation and Inflows on Aquatic Habitat and Fish Utilization in Pescadero, San Gregorio, Waddell and Pomponio Creek Estuary/Lagoon Systems, 1985-1989.

13. Limiting factors to salmonids: Water quality, excessive sediment yield, spawning requirements, migration barrier, and rearing requirements.

14. Source(s) of above information:

Blume, Kenneth & R. James Brown, 2001. Pescadero Creek Aquatic Monitoring Report.

Department of the Army, 1969. Water Resources Development Interim Survey Report for Pescadero Creek Pacific Coastal Streams, San Mateo County, California.

Phillips, R.D., and S. Rojstaczer, 2001. Chemical weathering in a region of active orogeny: Pescadero Creek, California.

Phillips, R., 1994. Hydrogeology and hydrogeochemistry of the Pescadero Creek drainage basin, California, MS, Department of Geology, Duke University.

Sequoia Audubon Society, 1986. Pescadero-Butano Creek Watershed Program.

San Mateo County, Planning and Building Division, 1998. Local Coastal Program.

Steele, T.D., Seasonal variations in chemical quality of surface water in the Pescadero Creek watershed, San Mateo County, California, Ph.D. dissertation, Stanford Univ., Stanford, Calif., 1968.

Welsh, et al., 2001. Distribution of Juvenile Coho Salmon in Relation to Water Temperatures in Tributaries of the Mattole River, California.

## Section 4: Project Objectives

1. **Background and Need for project:** This project proposes work along segments of Pescadero Creek, one of the largest watersheds of Central California with over 95 miles of blue line streams supporting federally listed fish species and water supplies to both Memorial County Park and Portola Redwoods State Park. It is one of three creeks south of San Francisco Bay that still has viable steelhead (*Oncorhynchus mykiss*) populations. There is also a need to restore coho salmon (*Oncorhynchus kisutch*) to the Creek. Memorial County Park, founded in 1924, has maintained surface water diversion rights from Pescadero Creek of 30 gallons per minute. In addition, the Park continues to maintain one of three seasonal concrete dam structures on the Creek. The Parks and Recreation Division of San Mateo County removed two former dam structures under Department of Fish and Game funding in 2001. Due to former and present land uses, salmonid habitat within Pescadero Creek has been degraded. Water quality, hydrology, and excessive sediment have significantly reduced spawning and rearing habitats. Sedimentation behind the dam structure further impairs bed conditions and contributes to higher water temperatures. Implementation of a drinking water well adjacent to the existing water treatment facility will help maintain the Parks water rights in addition to reducing the costs of treatment inherent with utilizing surface water as a drinking source. The objective of this project is to remediate problems that are negatively impacting coho and steelhead habitat in Memorial County Park along reaches of Pescadero Creek as well as maintain the Parks water rights of 30 gallons per minute.

### 2. **Known limiting factors addressed by project:**

2. Water Quality
4. Excessive Sediment Yield
5. Spawning Requirements
6. Rearing Requirements

### 3. **Limiting factor remediation:**

1. **Water Quality:** Water quality is a significant consideration for water supply alternatives and fish passage in Pescadero Creek. In Pescadero Creek at Memorial County Park, high turbidity, dissolved oxygen, and pH have negatively impacted fish habitat in addition to increasing the costs associated with water treatment and usage. For bodies of water identified as providing salmonid spawning, the following water quality criteria are of concern:

- The concentration of dissolved oxygen should not be less than 11.0 mg/l, unless the minimal intergravel dissolved oxygen, measured as a spatial median, is 8.0 mg/l or greater, than the DO criterion is 9.0 mg/l.
  - Successful salmonid spawning, egg incubation, and fry emergence from the egg and from gravels will most likely occur in waters that do not exceed 55.0 degrees Fahrenheit.
  - Salmonid tolerance for turbidity should not exceed 10 NTU (nephelometric turbidity units).
- Appendix 1 contains surface water quality data for multiple locations along Pescadero Creek.

Task 2, Siting, Drilling, and Well Completion, and Task 3, Removal of Dam Structure, serve to mitigate these limiting factors.

2. **Excessive Sediment Yield:** The size of available streambed gravels can limit the success of spawning by salmonids. Bed material may be too coarse for spawning fish to move, a problem particularly common where dams eliminate supplies of smaller, mobile gravels. Spawning salmonid females must be able to move gravels to excavate a depression in the bed to create a redd. Successful incubation of salmonid occurs when bed gravels are sufficiently free of fine sediment and flow of water through the gravel is adequate to bring dissolved oxygen to eggs (C.F. Kondolf, 2000).

Task 3, Removal of Dam Structure, will allow for the downstream mobility of spawning gravels. An initial assessment of the bed material in Pescadero Creek at Memorial County Park reveals that sediment upstream of the dam is better suited for spawning and rearing of salmonids than sediment downstream of the dam.

The volume of material which may be mobilized is about one percent (1%) of the stream's estimated

sediment load, and is not expected to have significant downstream impacts.

3. Spawning Requirements: The existing dam structure at Memorial County Park serves to negatively impact spawning requirements by presenting a physical obstruction to both adult and juvenile salmonids as well as inhibiting the movement of spawning gravels downstream.

Task 2, Siting, Drilling, and Well Completion, serves to enhance salmonid rearing potential requirements by allowing the Park to utilize alternative sources for drinking water should withdrawals from Pescadero Creek prove to negatively impact fish habitat and migration by depleting water levels in pools and resting areas. Additionally, by converting to a well at some distance from the stream, will eliminate diurnal fluctuations at late-spring or summer flows that might strand fry or dewater redds.

Task 3, Removal of Dam Structure, will enhance gravels downstream of the existing structure and in the reach impounded by the dam. Presently, bed material downstream of the dam is dominated by fines.

4. Rearing Requirements: Removal of the dam structure at Memorial County Park will assist adult and juvenile salmonids in moving upstream. Currently, the dam prevents summer movement of juveniles up and downstream and impedes movement of some adults. It creates flow scenarios that exceed maximum average surface water velocity and maximum hydraulic drop criteria for both adult and juvenile salmonid. Surface water velocity through the chute feature of the dam average 7 feet per second and the hydraulic gradient over the top of the dam can be over 12 inches.

Task 3, Removal of Dam Structure, will help restore spawning riffles and complex pools downstream, including woody debris, and moderate water temperatures.

#### 4. Additional objectives:

1. To develop a cooperative venture between the San Mateo County Department of Parks and Recreation, Memorial County Park, and the Department of Fish and Game.

### **Section 5: Project Tasks and Results**

1. Detailed Project Tasks: The following list of tasks will be provided through this proposal.

Task 1. Project Administration.

Task 2. Siting, Drilling, and Well Completion - a 200 foot water well, constructed to meet drinking well specifications, will be developed adjacent to the existing water treatment facility, between 60 and 250 feet from the Creek. This well will serve to maintain the Parks water rights of 30 gallons per minute in addition to enhancing salmonid rearing potential. Protection against surface and ground water contamination will be practiced. The following information will be provided once the well has been completed and proper site clean-up has been performed:

- Name of property owner
- Address of owner/property
- Well location map
- Well installation method, type, and date
- Purpose of well
- Diameter of well
- Depth of casing
- Depth to water
- Formation type
- Material overlying bedrock
- Materials and quantities used to fill well in specific zones and methods used
- Casing either removed or left in place
- Name and address of firm conducting work

Memorial County Park diverts an average of 3-7 million gallons (15-18 acre-feet) of water from Pescadero Creek annually, with peak diversions during July and August. These surface water diversions are then transferred to a water treatment facility where the main constituents of concern for drinking water standards and fish passage are pH, coliforms, dissolved oxygen, and turbidity.

Task 3. Removal of Dam Structure - The remaining dam in Memorial County Park is approximately 0.2 miles downstream of the confluence of McCormick Creek. Figure 2 is a schematic of the dam. This concrete structure spans the entire width of Pescadero Creek at his location, roughly 40 feet. It has a cross-section top spanning 7.6 feet with a three foot wide rectangular chute near the center-left bank side. Removal of the dam structure will help the Park meet passage criteria for both adult and juvenile salmonids. Currently, the dam prevents upstream migration of juveniles and impedes movement of some adults. It creates flow scenarios that exceed maximum average surface water velocity and maximum hydraulic drop criteria for both adult and juvenile salmonid. Surface water velocity through the chute feature of the dam average 7 feet per second and the vertical gradient over the top of the dam can be over 12 inches. This task also includes mobilization and preparation of the site for dam removal and restoration of the area to natural conditions.

Tasks 4 and 5. Permitting and CEQA Compliance- No work for this project will proceed until all CEQA requirements are satisfied. It is anticipated that the project will required a Mitigated Negative Declaration. The following permits are anticipated as needed:

- Army Corps of Engineers 404
- RWQCB 401 Certification
- CDFG Section 1603 Streambed Alteration Agreement
- County of San Mateo Well Development Permit
- County of San Mateo Public Water Supply Permit

2. Time frame: Work would begin in Summer 2004, to be completed by October 15, 2005. Depending on conditions and progress of the project, work may continue during the Summer of 2005.

3. DFG acceptable protocols used in project development and completion:

- DFG Restoration Manual  
List:
- DFG Monitoring Protocols  
List:
- Fish, Farms and Forestry Coalition Draft Protocols  
List:
- PWA Road Assessment
- Star Worksheet Road Assessment
- V-Star residual Pool Volume
- Juvenile summer abundance estimation
- Out-migrant trapping and efficiency
- California Content Standards
- National Science Content Standards

4. Other protocols: Water-well drawdown simulation by Prickett-Lonquist; Harbaugh and McDonald (USGS) models (MODFLOW).

5. Deliverables: The following items will be prepared and delivered to the California Department of Fish and Game:

1. Water supply report including: well characteristics report including lithology, water quality results as they pertain to drinking standards, hydraulic properties, e-log, final costs, location map, and simulations of cone of depression.
2. Geologic, topographic, soils, and landuse maps for the watershed.

3. Aerial photographs used for interpretation within Memorial County Park.
4. Stream classification criteria: channel width, depth, velocity, discharge, channel slope, roughness of channel materials, sediment load, and sediment size.
5. CEQA compliance report in the form of a negative declaration.
6. Salmonid habitat and migration assessment report for Pescadero Creek at Memorial County Park.
7. Application for streambed alteration agreement.
8. Mitigation monitoring plan.

6. **Expected Quantitative Results:**

- a. Stream length treated/assessed/made more accessible (distance in feet): 62.3 Miles
- b. Instream habitat structures to be installed (number): 0
- c. Fencing length to be installed/repared (distance in feet): 0
- d. Road length treated/assessed (distance in miles): 0
- e. Stream crossings treated (number): 0
- f. Sediment prevented from entering the stream (volume in cubic yards): 0
- g. Trees planted (number): 0
- h. Area planted/preserved/assessed (area in acres): 0
- i. Public meetings (number): 0
- j. Public meeting attendees (number): 0
- k. Students trained (number): 0
- l. Juvenile fish produced: 0 released: 0

7. **Other products and results:**

8. **Applicant's qualifications and experience:**

Need qualifications for San Mateo County Staff.

**Section 6: Landowners, Access and Permits**

1. **Landowners granting access for project** (Please attach access agreements):

Not Applicable

2. **Permits:**

1. Well Drilling Permit
2. Public Water Supply Permit
3. Regional Water Quality Control Board 401 Permit
4. Streambed Alteration Agreement

3. **Lead CEQA agency:** San Mateo County Department of Parks and Recreation.

4. **Required mitigation?**

**Section 7: Project Budget**

1. **Summary Project Costs** (Please attach detailed budget):

Sources of Funds	Cash	In-kind (if applicable)	Total
Fisheries Restoration Grant Program	\$77,092.00		\$77,092.00
Other State Agencies <u>Name(s) and amount(s) of each:</u>			
Federal <u>Name(s) and amount(s) of each:</u>			
Applicant			
Other Sources <u>Name(s) and amount(s) of each:</u>			
Total	\$77,092.00		\$77,092.00

2. Standardized Costs:

3. Budget justification:

## Section 8: Supplemental or Specialized Information

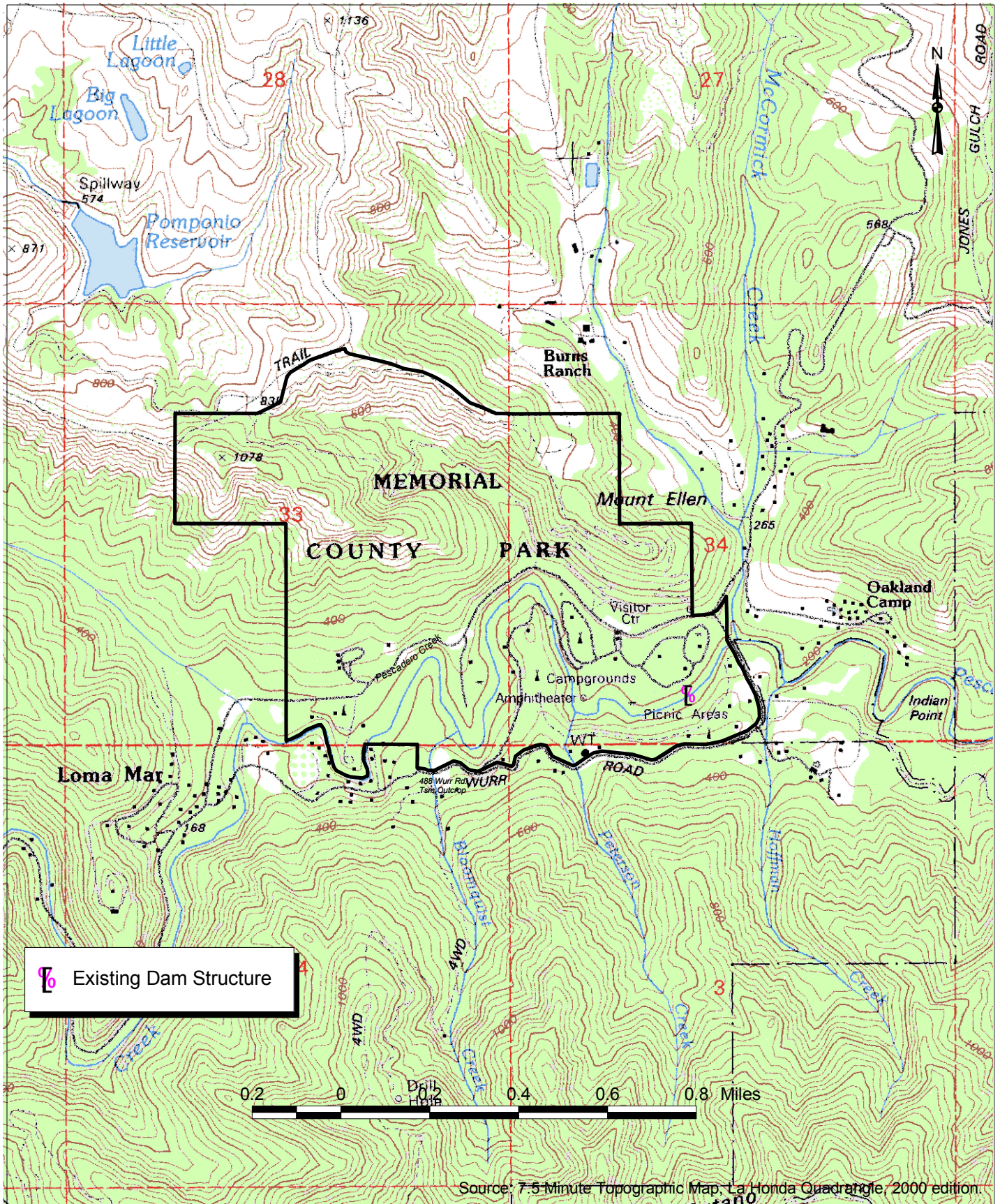
In the following order, please attach the following required items, as appropriate to the project type:

- 1. Project budget according to the sample in the Solicitation. See examples and instructions on pages B10-B16. (ALL)
- 2. Plan view diagram. See example on page B9.  
(CC, CF, FL, HB, HI, HR, HS, HU, MO, PM, SC, TW, WC, WD)
- 3. Project location topo map, 7.5 minute. See example on page B8.  
(CC, CF, FL, HA, HB, HI, HR, HS, HU, MD, MO, PM, RE, SC, TE, TW, WC, WD, WP)
- 4. Watershed map. See Section III. (HU, MD, MO, OR, PI, PL, WP)
- 5. Landowner access agreements. See examples on pages B2-B7.  
(All projects with on-the-ground work)
- 6. Project 10-year maintenance agreement. See examples on pages B3-B5. (HR, HU)
- 7. Written eligibility certification from CDF. See Section III. (CF)
- 8. Evaluation plan. See Section III. (ED, TE)
- 9. Land acquisition/easement information. See pages 8-9, Section III. (HA)
- 10. Water purchase information. See pages 11-12, Section III. (WP)
- 11. Status report. See Section III. (OR, PI)
- 12. 5-year management plan. See page 10, Section III. (RE)
- 13. Environmental project questionnaire. See form on pages B17-B19.  
(CC, CF, FL, HA, HB, HI, HR, HS, HU, MD, MO, PM, RE, SC, TW, WC, WD, WP)

### Supplemental Information Checklist By Project Type

(Please refer to the item numbers above)

Project Type	Item Number
AC	1
CC	1, 2, 3, 5, 13
CF	1, 2, 3, 5, 7, 13
ED	1, 5, 8
FL	1, 2, 3, 5, 13
HA	1, 3, 5, 9, 13
HB	1, 2, 3, 5, 13
HI	1, 2, 3, 5, 13
HR	1, 2, 3, 5, 6, 13
HS	1, 2, 3, 5, 13
HU	1, 2, 3, 4, 5, 6, 13
MD	1, 3, 4, 5, 13
MO	1, 2, 3, 4, 5, 13
OR	1, 4, 5, 11
PI	1, 4, 5, 11
PL	1, 4, 5
PM	1, 2, 3, 5, 13
RE	1, 3, 5, 12, 13
SC	1, 2, 3, 5, 13
TE	1, 3, 5, 8
TW	1, 2, 3, 5, 13
WC	1, 2, 3, 5, 13
WD	1, 2, 3, 5, 13
WP	1, 3, 4, 5, 10, 13



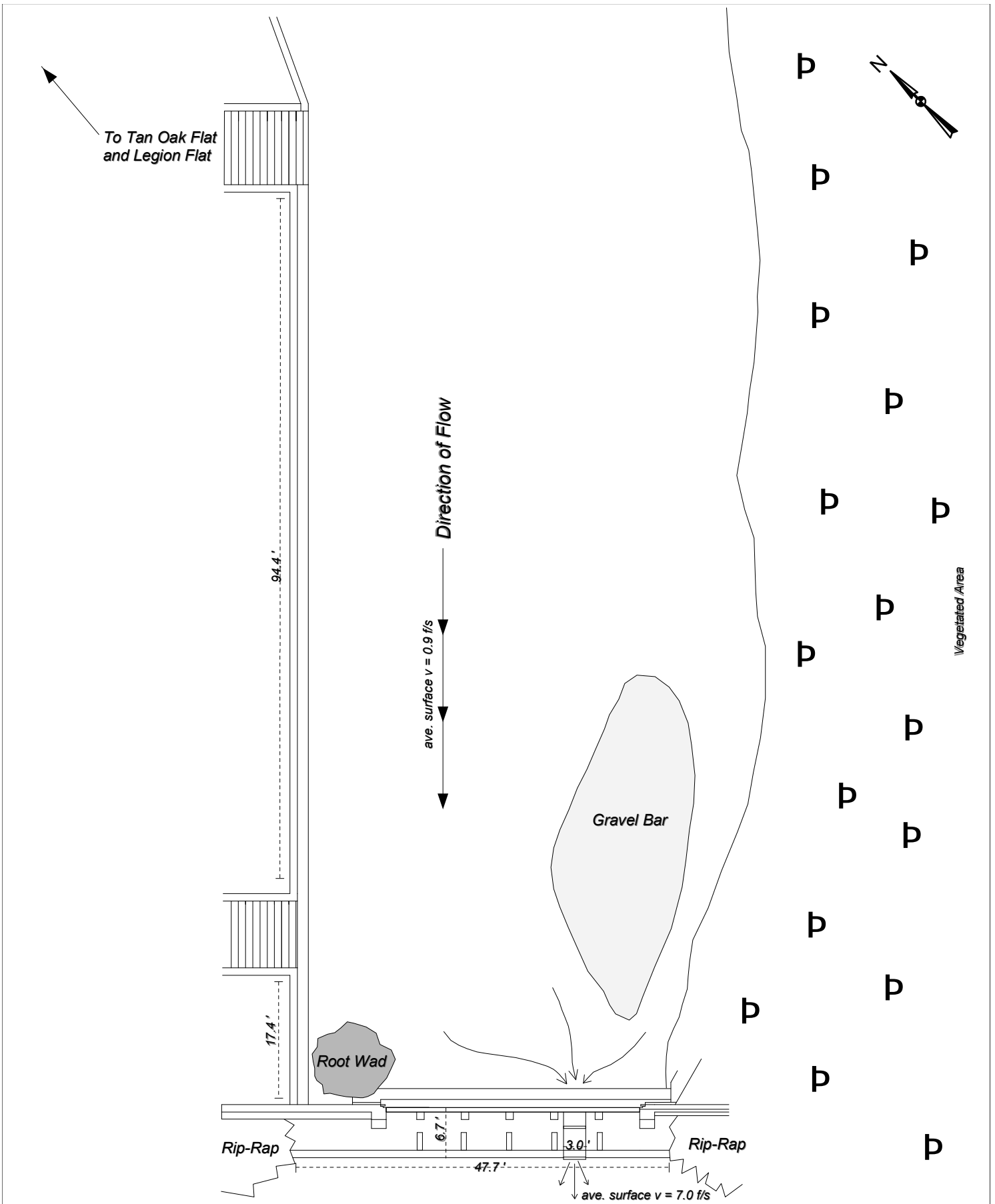
**Figure 1. Project Location Map.**

Pescadero Creek at Memorial County Park,  
Loma Mar, California.



**Balance  
Hydrologics, Inc.**

d:\gis\smcol\memorial park.apr



**Balance  
Hydrologics, Inc.**

**Figure 2. Plan View of Existing Dam Structure**  
Pescadero Creek at Memorial County Park,  
Loma Mar, California.

**Table 1.** Estimated costs associated with dam removal and ground-water well development, Memorial County Park, San Mateo County, California.  
Memorial County Park

Project Tasks		Design Professionals					Construction Sub Contractor						Drilling/E-Log		CEQA Firm					Cost Totals		
		Principal	Senior Professional	Project Professional	Staff Professional	Assistant Professional	Park Staff	Excavator	Loader	Dump Truck	Labor	Recycling	Equipment	Containment	Principal	Senior Professional	Senior Technical	Technical Staff	Support Staff	Total Labor	Direct Costs	Total Costs
Number	Task Description																					
	Hourly Rate	\$165	\$130	\$115	\$90	\$80	\$30	\$150	\$50	\$75	\$35	\$225	\$360	\$80	\$160	\$150	\$125	\$90	\$75			
	<b>Task 1 Project Administration</b>						20													\$600		\$600
	<b>Task 2 Siting, Drilling, and Well Completion</b>																					
	2.1 Obtain access to alternate sites						10						33							\$300	\$12	\$312
	2.2 Mobilize, drill and log well			30									3							\$15,330	\$613	\$15,943
	2.3 E-logging (gamma)			4																\$1,540	\$62	\$1,602
	2.4 Well design and completion (included in 2b.)			2	8															\$950	\$38	\$988
	2.5 Well development and water containment					7.5							17							\$6,720	\$269	\$6,989
	2.6 Waste containment and disposal								10			10	1	2						\$3,520	\$141	\$3,661
	2.7 Aquifer test and water quality analysis	10	15	20									15	9						\$10,945	\$438	\$11,383
	2.8 Connections to existing distribution system				10		10						3							\$2,280	\$91	\$2,371
	<b>Task 3 Removal of Dam Structure</b>																					
	3.1 Contracting and supervision						40													\$1,200	\$480	\$1,680
	3.2 Temporary coffer dam and bypass								15		10									\$5,000	\$2,000	\$7,000
	3.3 Concrete breaking							20			20									\$3,700	\$1,480	\$5,180
	3.4 Excavation of bank channel							15	10		10									\$3,100	\$1,240	\$4,340
	3.5 Rubble removal							15	5		20									\$3,200	\$1,280	\$4,480
	3.6 Haul rubble								4											\$200	\$80	\$280
	3.7 Clean-up and restoration								4		20									\$900	\$360	\$1,260
	3.8 Erosion control							15			20									\$2,950	\$1,180	\$4,130
	3.9 Recycling fees																					
	<b>Task 4 Permitting</b>																					
	4.1 Well Drilling Permit				4															\$435	\$17	\$452
	4.2 Public Water Supply Permit				4															\$500	\$20	\$520
	4.3 CWA 401 Permit, RWQCB				4															\$500	\$20	\$520
	4.4 Streambed Alteration Agreement,1601				4															\$770	\$31	\$801
	4.5 NOAA Fisheries (ESA)				4															\$500	\$20	\$520
	<b>Task 5 CEQA Compliance</b>																					
	5.1 Application for Negative Declaration															16				\$2,000	\$80	\$2,080
	<b>Total Hours</b>	10	51	58	7.5		80	65	38	10	100	10	72	11			16					
	<b>Total Costs</b>	\$1,300	\$5,865	\$5,220	\$600		\$2,400	\$9,750	\$1,900	\$750	\$3,500	\$2,250	\$25,920	\$880			\$2,000			\$60,335	\$9,952	\$77,092

*Notes:*  
This itemized budget was submitted for the fisheries grant

## **APPENDIX G**

List of certified well drillers and certified pumpers,  
County of San Mateo, Health Services Agency

## **Certified Well Drillers**

ASE Drilling  
468 Franklin Lane  
Livermore, CA 94550  
(925) 606-9060

Bayland Drilling  
811 Hamilton Avenue  
Menlo Park, CA 94550  
(650) 322-2900  
FAX (650) 322-2919

Bruce Drilling  
P.O. Box 2101  
El Granada, CA 94018  
(650) 726-4060

Earth Flow Drilling  
2600 Smith Grade  
Santa Cruz, CA 94019  
(831) 429-3288  
FAX (831) 429-9238

Garcia Well & Pump Co.  
1045 Weeks Street  
East Palo Alto, CA 94303  
(650) 322-2803

HEW Drilling  
1045 Weeks Street  
East Palo Alto, CA 94303  
(650) 322-2851

Landino Drilling  
P.O. Box 419  
Davenport, CA 95017  
(831) 426-4129  
FAX (831) 426-0526

Maggiora Bros. Drilling, Inc.  
595 Airport Blvd  
Watsonville, CA 95076  
(831) 724-1338

Wilkinson Enterprises  
890 Sonora Avenue  
Half Moon Bay, CA 94019  
(650) 726-4212

## **Certified Pumpers**

Aaron's Septic Tank Service  
P.O. Box 24662  
San Jose, CA 95124  
(408) 371-2350

National Construction Rentals  
15319 Chetworth Street  
Mission Hill, CA 91345  
(818) 221-6000

Pioneer Liquid Transport Inc.  
Attention: Mitch  
251 E. Empire Street  
San Jose, CA 95112  
(408) 287-5800

Portoscan Co, LLC  
945 Teal Drive  
Benicia, CA 94510  
(707) 747-2800

A-1 Septic Tank Service  
1111 Industrial Parkway West  
Hayward, CA 94544

Ajax Portable Services  
Attention: Veronica  
1601 Lana Way  
Hollister, CA 95023-2533  
(800) 345-3353

Pete's Outflow Technicians  
P.O. Box 1066  
Soquel, CA 95073  
(831) 475-0959

R & D Grease Trap  
P.O. Box 2085  
Guerneville, CA 95446  
(707) 632-5827

Acme & Sons Sanitation Inc.  
1880 South 7th Street  
San Jose, CA 95112  
(408) 295-2263

Contractors Potables  
P.O. Box 1341  
Windsor, CA 95492  
(707) 838-0978

updated 7/30/03