FINAL REPORT:

COUNTY OF SANTA CRUZ STREAM CROSSING INVENTORY AND FISH PASSAGE EVALUATION

Prepared for the

County of Santa Cruz Public Works Department

By

Ross Taylor and Associates

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Ross Taylor and Associates
1254 Quail Run Court
McKinleyville, CA 95519
(707)-839-5022
rossntaylor@sbcglobal.net

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INTRODUCTION

The inventory and fish passage evaluation of county-maintained stream crossings within the County of Santa Cruz was conducted between September of 2002 and March of 2004. The primary objective was to assess passage of juvenile and adult salmonids and develop a project-scheduling document to prioritize corrective treatments to provide unimpeded fish passage at road/stream intersections. The inventory was focused primarily on county-maintained crossings within anadromous stream reaches within Santa Cruz County watersheds known to historically and/or currently support runs of coho salmon (*Oncorhynchus kisutch*) and/or steelhead (*O. mykiss irideus*).

Please note that for this report the term **stream crossing** is defined as any human-made structure, (used primarily for transportation purposes) that crosses over or through a stream channel, such as: a paved road, unpaved road, railroad track, biking or hiking trail, golf-cart path, or low-water ford. Stream crossings include culverts, bridges, and low-water crossings such as paved and unpaved fords. For the purpose of fish passage, the distinction between types of stream crossings is not as important as the effect the structure has on the form and function of the stream. A stream crossing encompasses the structure employed to pass stream flow as well as associated fill material within the crossing prism.

The inventory and assessment process included:

1. Locating stream crossings within anadromous stream reaches.
2. Visiting each crossing on an initial site visit to determine the type of crossing and assessment of stream channel as suitable fish habitat.
3. At crossings with culverts - collecting information regarding culvert specifications and surveying a longitudinal profile.
4. Assessing fish passage using culvert specifications and passage criteria for juvenile and adult salmonids (state and federal criteria) by employing a first-phase evaluation filter and then using a computer software program (FishXing) on a subset of sites defined as partial/temporal barriers by the filter.
5. Assessing quality and quantity of stream habitat above and below each culvert.

The prioritization process ranked sites by assigning numerical scores for the following criteria:

1. Presumed species diversity within stream reach of interest (and federal listing status).
2. Extent of barrier for each species and lifestage for range of estimated migration flows.
3. Quality and quantity of potential upstream habitat gains.
4. Sizing of current stream crossing (risk of fill failure).
5. Condition of current crossing (life expectancy).

The initial ranking was not intended to provide an exact order of priority, rather produce a first-cut rank in which sites could be grouped as high, medium, or low priority. Professional judgment was a vital component of the ranking process. On a site-specific basis, some or all of the following factors were considered in developing the final ranked list.

1. Streams that currently support runs of steelhead and/or coho salmon. Treating barriers in these watersheds should result in a high probability of immediate utilization of re-opened habitat.

2. Physical stress or danger to migrating salmonids. Recent studies have revealed numerous sites in California where concentrations of migrating salmonids were subjected to decades of predation by birds and mammals or poaching by humans (Taylor 2000 and 2001). Inability to enter cool-water tributaries to escape stressful/lethal mainstem water temperatures during summer months has also been observed. These factors should weigh heavily in priority ranking.

3. Amount of road fill. At stream crossings that were undersized and/or in poor condition, we assessed the volume of fill material within the road prism potentially deliverable to the stream channel if the culvert were to fail. Large, sudden contributions of sediment from road failures are often detrimental to salmonid spawning and rearing habitat located downstream of the crossing.

4. Presence or absence of other stream crossings and other types of barriers. In many cases, a single stream was crossed by multiple roads under a variety of management or ownership. In these situations, close communication with other road managers and watershed coordinators was important. When multiple stream crossings were identified as migration barriers, a coordinated effort will be required to identify and treat them in a logical manner – generally in an upstream direction starting with the lowermost crossing.

5. Remediation project cost. One should examine the range of treatment options and associated costs when determining the order in which to proceed and what should be implemented at specific sites. In cases where Federally listed fish species are present, costs must also be weighed against the consequences of failing to comply with the Endangered Species Act by not providing unimpeded passage.

6. Scheduling of other road maintenance and repair projects. Road managers should consider upgrading all migration barriers during other activities they may perform to the roadway, such as repaving, chip-sealing, or widening. When undersized or older crossings fail during storms, road managers should be prepared to install properly-sized crossings that provide unimpeded passage for all species and life-stages of fish.

7. Other factors impacting salmon and steelhead. In many cases, other limiting factors besides migration barriers exist that impair salmonid productivity. On a watershed or sub-basin level, restoration decisions must be made after carefully reviewing potential limiting factors, the source of the impacts, the range of restoration options available, and what restoration activities are actually feasible.

Additional physical, operational, social, and/or economic factors exist that may influence the final order of sites; but these are beyond the scope of this project.

Final Product of Stream Crossing Inventory

Final report includes:

1. A count and location of all stream crossings with culverts. Locations were identified by stream name; road name; road number; watershed name; mile marker or distance to nearest named crossroad; Santa Cruz County road map Sheet #; USGS Quad name; Township, Range and Section coordinates; and lat/long coordinates (NAD27 datum). Each evaluated crossing was provided a unique ID # by the County of Santa Cruz for GIS purposes. All location data were entered into a spreadsheet for potential database uses.

2. For each site, crossing specifications were collected, including: length, diameter, type, position relative to flow and stream gradient, amount of fill material, depth of jump pool below culvert, height of leap required to enter culvert, previous modifications (if any) to improve fish passage, and evaluate effectiveness of previous modifications. All site-specific data were entered into a spreadsheet for potential database uses.

3. Information regarding crossing age, wear, and performance was collected, including: overall condition of the pipe and rust line height. All crossing specifications were entered into a spreadsheet for potential database uses.

4. An evaluation of fish passage at each crossing location. Fish passage was evaluated by two methods. Initially, fish passage was assessed by employing a first-phase evaluation filter that was developed for Part 10 of the California Department of Fish and Game's (CDFG) *Salmonid Stream Habitat Restoration Manual* (Taylor and Love, 2003). The filter quickly determined if a culvert either met fish passage criteria for all species and life stages as defined by CDFG for the range of migration flows (**GREEN**); failed to meet passage criteria for all species and life stages (**RED**); or was a partial/temporal barrier (GRAY). Then FishXing (a computer software program) was used to conduct in-depth passage evaluations on the GRAY sites by modeling culvert hydraulics over the range of migration flows and comparing these values with leaping and swimming abilities of the species and life stages of interest.

5. Digital photo documentation of each crossing was taken to provide visual information regarding inlet and outlet configurations; as well as insertion in future reports, proposals, or presentations.

6. An evaluation of the quantity and quality of fish habitat above and below each crossing location. Most information was obtained from previously conducted habitat typing and fisheries surveys. The County of Santa Cruz assimilated most of the habitat and fisheries data that were available from CDFG. Where feasible, a first-hand inspection and evaluation of stream habitat occurred. Lengths of potential anadromous habitat were also estimated from USGS topographic maps. In situations where formal habitat typing surveys were not conducted and/or access to stream reaches was not permitted, professional judgment of biologists and/or watershed coordinators familiar with watershed conditions was utilized.

7. A ranked list of crossings that require treatment to provide unimpeded fish passage to spawning and rearing habitat. On a site-by-site basis, general recommendations for providing unimpeded fish passage were provided.

8. The County of Santa Cruz entered all stream crossing data and passage evaluations into their GIS database and developed maps that also include fish distribution.

Project Justification

Migration Barrier Impacts to Salmonids

Fish passage through culverts at stream crossings is an important factor in the recovery of depleted salmonid populations throughout the Pacific Northwest. Although most fish-bearing streams with culverts tend to be relatively small in size with only a couple of miles or less of upstream habitat, thousands of these exist and the cumulative effect of blocked habitat is probably quite significant. Recent research regarding watershed restoration considers the identification, prioritization, and treatment of migration barriers to restore ecological connectivity for salmonids a vital step towards recovering depressed populations (Roni et al. 2002). Culverts often create temporal, partial or complete barriers for anadromous salmonids on their spawning migrations (Table 1) (adapted from Robison et al. 2000).

Typical passage problems created by culverts are:

- Excessive drop at outlet (too high of entry leap required);
- Excessive velocities within culvert;
- Lack of depth within culvert;
- Excessive velocity and/or turbulence at culvert inlet; and
- Debris accumulation at culvert inlet and/or within culvert.

Table 1. Definitions of barrier types and their potential impacts.

Barrier Category	Definition	Potential Impacts
Temporal	Impassable to all fish some of the time	Delay in movement beyond the barrier for some period of time
Partial	Impassable to some fish at all times	Exclusion of certain species and life stages from portions of a watershed
Total	Impassable to all fish at all times	Exclusion of all species from portions of a watershed

Even if culverts are eventually negotiated, excess energy expended by fish may result in their death prior to spawning or reductions in viability of eggs and offspring. Migrating fish concentrated in pools and stream reaches below road crossings are also more vulnerable to predation by a variety of avian and mammalian species, as well as poaching by humans. Culverts which impede adult passage limit the distribution of spawning, often resulting in under seeded headwaters and superimposition of redds in lower stream reaches.

Current guidelines for new culvert installation aim to provide unimpeded passage for both adult and juvenile salmonids (CDFG 2002, NMFS 2001). However many existing culverts on federal, state, county, and private roads are barriers to anadromous adults, and more so to resident and juvenile salmonids whose smaller sizes significantly limit their leaping and swimming abilities to negotiate culverts. For decades, "legacy" culverts on established roads have effectively disrupted the spawning and rearing behavior of all four species of anadromous salmonids in California: Chinook salmon, coho salmon, coastal rainbow trout (steelhead are anadromous coastal rainbow trout), and coastal cutthroat trout (*Oncorhynchus clarki clarki*).

In recent years, there has been a growing awareness of the disruption of in-stream migrations of resident and juvenile salmonids caused at road/stream intersections. In-stream movements of juvenile and resident salmonids are highly variable and still poorly understood by biologists. Juvenile coho salmon spend approximately one year in freshwater before migrating to the ocean, and juvenile steelhead may rear in freshwater for up to four years prior to out-migration (one to two years is most common in California). Thus, juveniles of both species are highly dependent on stream habitat.

Many studies indicate that a common strategy for over-wintering juvenile coho is to migrate out of larger river systems into smaller streams during late-fall and early-winter storms to seek refuge from possibly higher flows and potentially higher turbidity levels in mainstem channels (Skeesick 1970; Cederholm and Scarlett 1981; Tripp and McCart 1983; Tschaplinski and Hartman 1983; Scarlett and Cederholm 1984; Sandercock 1991; Nickelson et al. 1992). Recent research conducted in coastal, northern California watersheds suggests that juvenile salmonids migrate into smaller tributaries in the fall and winter to feed on eggs deposited by spawning adults as well as flesh of spawned-out adults (Roelofs, pers. comm). Direct observation at numerous culverts in northern California confirmed similar upstream movements of three year-classes of juvenile steelhead (young-of-year, 1-year old and 2-year old) (Taylor 2001 and 2000).

The variable life history of resident coastal rainbow trout is exhibited by seasonal movements in and out of one or more tributaries within a watershed. These smaller tributaries are where most culverts are still located since larger channels tend to be spanned by bridges.

County Planning Efforts to Address Migration Barriers

In response to the 1996 and 1997 federal listings of coho salmon as threatened in northern California, six counties (Sonoma, Marin, Napa, San Mateo, Alameda, and Santa Cruz) formed FishNet 4C to examine various land-use programs and/or policies conducted or permitted under county jurisdiction that may impact coho salmon and steelhead habitat. Initial meetings identified causative factors of potential impacts, information gaps, and priority tasks required to

obtain missing information. A high-priority task included conducting stream crossing inventories on County-maintained roads to evaluate fish passage and prioritize treatments.

Anadromous salmonids will benefit from this planning effort because the final document provides the County of Santa Cruz's Public Works Department with a prioritized list of culvert locations to fix that will provide unimpeded passage for all species (and life stages) of salmonids. Report information will assist in proposal development to seek State and Federal money to implement treatments. The inventory also provides the County with a comprehensive status evaluation of the overall condition and sizing of culverts within fish-bearing stream reaches, providing vital information to assist the County's general planning and road's maintenance needs.

METHODS AND MATERIALS

Methods for conducting the culvert inventory and fish passage evaluation included seven tasks; accomplished generally in the following order:

1. Location of stream crossings.
2. Initial site visits and data collection.
3. Estimation of tributary-specific hydrology and design flows for presumed migration period.
4. Data entry and passage analyses. Passage was first evaluated with a first-phase evaluation filter referred to as the "Green-Gray-Red" filter. Sites determined to be "Gray" then required an in-depth evaluation with FishXing – a computer modeling software.
5. Collection and interpretation of existing habitat information.
6. Prioritization of sites for corrective treatment.
7. Site-specific recommendations for unimpeded passage of both juvenile and adult salmonids.

These methods were fairly consistent with the protocol recently developed for the CDFG *California Salmonid Stream Habitat Restoration Manual* (Taylor and Love, 2003). These methods were developed to be consistent with current state and federal fish passage criteria for anadromous salmonids (CDFG 2002, NMFS 2001).

Two modifications to the original CDFG protocol were made during the County of Santa Cruz fish passage assessment project:

- Use of more rigorous criteria (minimum water depths and swimming abilities) for assessing passage of adult salmonids (see page 19).
- A reduction of the weight of culvert sizing and condition in the ranking score (see page 27).

These modifications to the original CDFG protocol were initiated in response to results generated by the original methods in Five-Counties' assessments. All protocol changes were discussed with CDFG and NMFS personnel prior to their use in the Santa Cruz County assessment project. In-depth explanations to the rationale of modifying the methodology are provided at the appropriate places within the Methods and Materials section of this final report.

Location of Stream Crossings

Preliminary project scoping for stream crossings to survey was conducted by County of Santa Cruz personnel during the spring and summer of 2002. An initial inventory was conducted in which 209 sites were visited and briefly examined to determine the type of crossing, construction material, and estimated height of the perch (drop) at each culvert outlet. Locations were determined by road name, county plate number, and mileage marker. Where feasible, a GPS reading was also taken. The sites were then entered into the County of Santa Cruz's GIS database. To determine if the sites were within fish-bearing stream reaches, the County utilized data available from CDFG and local fisheries biologists. One hundred-fourteen county-maintained stream crossings with culverts were initially identified and approximately 85 sites were initially considered to be within anadromous stream reaches. Ninety-five sites were considered bridges that currently provided unimpeded access.

Initial Site Visits

The objective of the initial site visits was to collect physical measurements at stream crossings with culverts to utilize with the first-phase evaluation filter and with the FishXing passage evaluation software. Notes describing the type and condition of each culvert, as well as qualitative comments describing stream habitat immediately above and below each culvert were also included. Photographs, facing both upstream and downstream (outlet and inlet views at culverts), were taken at each site.

Stream Crossing Type

Potential sites were visited in the field and all crossings were first identified as either: culverts, bridges, or fords. The field measurements were only collected on culverts, however this included some crossings identified on County road maps as bridges because of the length of their span. Typically any structure with a combined span greater than 20 feet was defined by road managers as a bridge – yet from a fish passage perspective if these structures had a smooth concrete floor they were defined as concrete box culverts, surveyed, and evaluated for passage.

Culvert Location

The location of each culvert was described by: Santa Cruz County - California road system map Sheet # ; road name and number; stream name; watershed name; name of USGS quad map; Township, Range, and Section; latitude and longitude; and post mile (PM) or distance to nearest named cross-road. If more than one county road culvert crossed a single stream, a number was assigned to the stream name with the #1 culvert located farthest downstream (numbering then proceeded in an upstream direction). Lat/long coordinates were determined using Terrain Navigator (Version 3.01 by MapTech), a geo-referenced mapping software program; or in the field with a handheld GPS unit. For data entry and analyses purposes, all lat/long coordinates were provided in the North American 1927 datum (NAD27).

Longitudinal Survey

A longitudinal survey was shot at each culvert to provide accurate elevation data for FishXing passage analyses. We utilized an auto-level (Topcon AT-G7) with an accuracy of ± 2.5 mm, a domed-head surveyor's tripod, and a 25' leveling rod in 1/100' increments. All data and information were written on water-proof data sheets with a pencil. Data sheets were photocopied to provide back-ups in case of loss or destruction of originals.

Once a site was located in the field by the two-person survey crew, bright orange safety cones with signs marked "Survey Party" were placed to warn oncoming traffic from both directions. Bright orange vests were also worn by the survey crew to increase one's visibility to traffic. If sites were close to private residences, or the property was posted - we attempted to contact the property owners to inform them of our survey of the County-maintained stream crossing.

To start the survey, a 300-foot tape (in 1/10' increments) was placed down the approximate center of the stream channel. The tape was started on the upstream side of the culvert, usually in the riffle crest of the first pool or run habitat unit above the culvert. This pool or run was

considered the first available resting habitat for fish negotiating the culvert. The tape was set to follow any major changes in channel direction. The tape was set through the culvert and continued downstream to at least the riffle crest (or control) of the pool immediately downstream of the culvert outlet. If several "stair-stepped" pools led up to the culvert outlet, then the tape was set to the riffle crest of the lower-most pool. Extreme caution was used when wading through culverts. A hardhat and flashlight were standard items used during the surveys.

The tripod and mounted auto-level were set in a location to eliminate or minimize the number of turning points required to complete the survey. If possible, a location on the road surface was optimal, allowing a complete survey to be shot from one location. The leveling rod was placed at the thalweg (deepest point of channel cross-section at any given point along the center tape) at various stations along the center tape, generally capturing visually noticeable breaks in slope along the stream channel.

At all sites, a temporary benchmark (TBM) was established in order to allow county personnel to easily re-survey the site to either check the accuracy of our surveys or to conduct a survey prior to implementing a treatment. TBM's were typically established by spray-painting an "X" on a relatively permanent feature such as a concrete wing-wall or head-wall. The locations of all TBM's were clearly marked on the site sketches.

At all sites, a cross-section of the channel was surveyed at the outlet pool's tailwater control. Each cross-section was comprised of approximately eight elevations from the left bank-full channel margin to the right bank-full margin. These cross sections allowed for a more accurate modeling of changes in tailwater elevations over varying flows with the FishXing software.

At all sites, five required elevations were measured (Figures 1 and 2):

1. culvert inlet,
2. culvert outlet,
3. maximum pool depth within five feet of the outlet,
4. outlet pool control, and
5. active channel margin between the culvert outlet and the outlet pool control. An active channel discharge is less than a bank-full discharge and is often identified by several features, including (Figure 2):

- Edge of frequently scoured substrate.
- Break in rooted vegetation or moss growth on rocks along stream margins.
- Natural line impressed on the bank.
- Shelving.
- Changes in soil character.

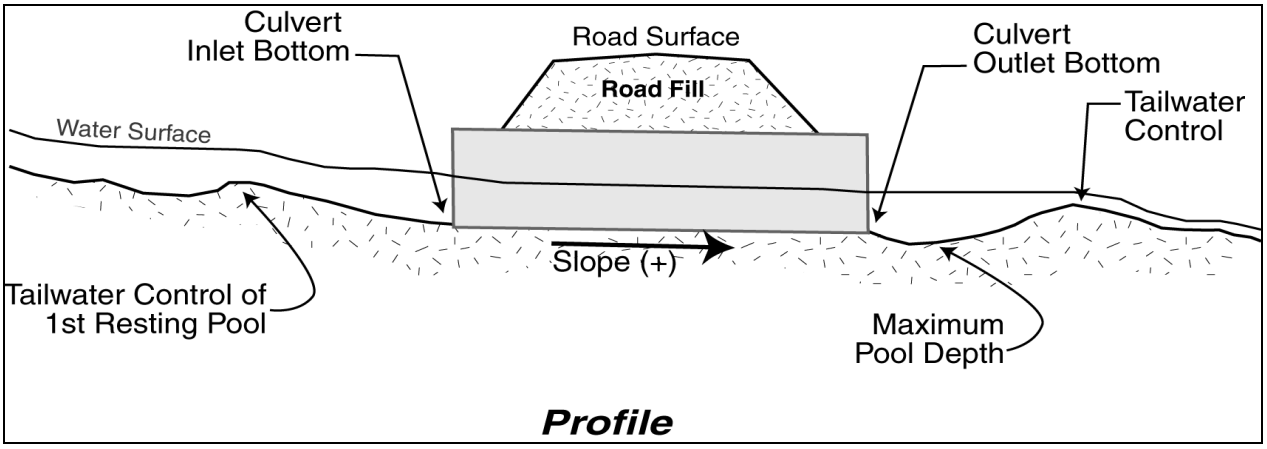

Figure 1. Diagram of required survey points though a culvert at a typical stream crossing.

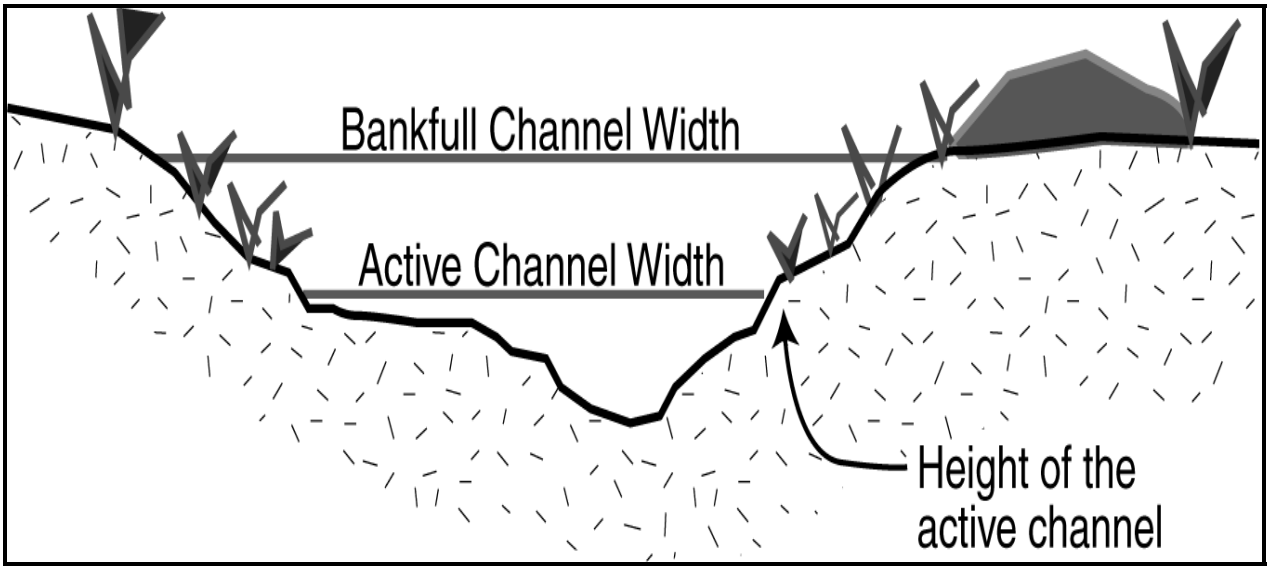

Figure 2. Active channel width versus bankfull channel width.

On a site-specific basis, the following additional survey points provided useful information for evaluating fish passage with FishXing:

- Apparent breaks-in-slope within the crossing. Older culverts often sag when road fills slump, creating steeper sections within a culvert. If only inlet and outlet elevations were measured, the overall slope would predict average velocities less than actual velocities within steeper sections. These breaks-in-slope may act as velocity barriers, which would be masked if only the overall slope of the culvert was measured. The tripod and auto-level were set within the culvert or channel to measure breaks-in-slope.

- Steep drops in the stream channel profile immediately upstream of the culvert inlet. We measured the elevation at the tail of the first upstream holding water (where the tape was set) to estimate the channel slope leading into the culvert. In some cases, a fish may negotiate the culvert only to fail at passing through a velocity chute upstream of the inlet entrance. Inlet drops often create highly turbulent conditions during elevated flows.

All elevations were measured to the nearest 1/100' and entered with a corresponding station location (distance along center tape) to the nearest 1/10'.

Channel Widths

Where feasible, at least five measurements of the active channel width above the culvert (visually beyond any influence the crossing may have on channel width) were taken. Active channel was defined as the portion of channel commonly wetted during and above winter base flows and is identified by a break in rooted vegetation or moss growth on rocks along stream margins. Some culvert design guidelines utilize active channel widths in determining the appropriate widths of new culvert installations (CDFG 2002; NMFS 2001; Robison et al 2000; Bates et al. 1999).

Fill Estimate:

At each culvert, the volume of road fill placed above the stream channel was estimated from field measurements. Fill volume estimates are incorporated into the ranking of sites for treatment and can assist in:

1. Calculating culvert flood capacity at HW/Fill =1 (water surface at top of fill prism).
2. Determining potential volume of sediment delivered to downstream habitat if the stream crossing failed.
3. Developing rough cost estimates for barrier removal by estimating equipment time required for fill removal and disposal site space needed.

Road fill volume is estimated using procedures outlined in Flannigan et al. (1998). The following measurements are taken to calculate the fill volume (Figure 3):

1. Upstream and downstream fill slope lengths (L_d and L_u).
2. Slope (%) of upstream and downstream fill slopes (S_d and S_u).
3. Width of road prism (W_r).
4. Top fill width (W_f).
5. Base fill width (W_c).

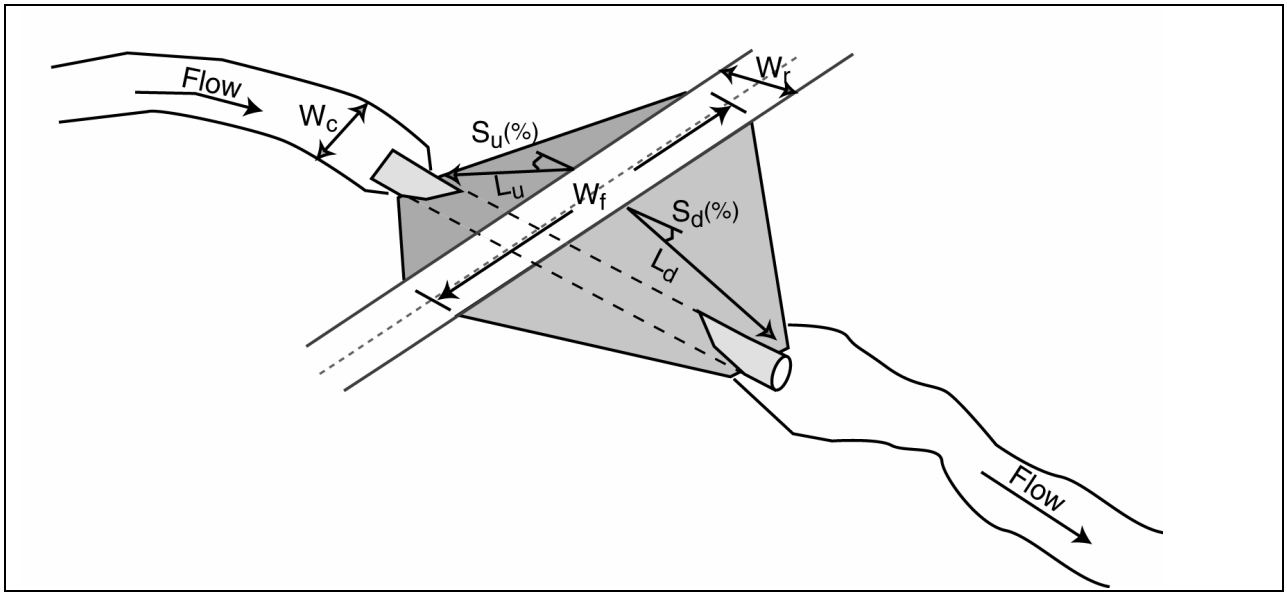

Figure 3. Road fill measurements.

Equations (1) through (4) were used calculate the fill volume.

(1) Upstream prism volume, V_u:

$$V_u = 0.25(W_f + W_c)(L_u \cos S_u)(L_u \sin S_u)$$

(2) Downstream prism volume, V_d:

$$V_d = 0.25(W_f + W_c)(L_d \cos S_d)(L_d \sin S_d)$$

(3) Volume below road surface, V_r:

$$V_r = 0.25(H_u + H_d)(W_f + W_c)\, W_r$$

where: $H_u = L_u \sin S_u$, and

$H_d = L_d \sin S_d$

(4) Total fill volume, V:

$$V = V_u + V_d + V_r$$

NOTE: The fill measurements used as part of this inventory protocol were meant to generate rough volumes for comparison between sites while minimizing the amount of time required to collect the information. These volume estimates can contain significant error and should not be used for designing replacement structures.

Other Site-specific Measurements

For each site, the following culvert specifications were collected:
1. Length (to nearest 1/10 of foot);
2. Dimensions: diameter (circular), or height and width (box culverts), or span and rise (pipe arches);
3. Type: corrugated metal pipe (CSP), structural steel plate (SSP), concrete pipe, concrete box, bottomless pipe arch, squashed pipe-arch, or a composite of materials;
4. Overall condition of pipe (good, fair, poor, extremely poor);
5. Height and width of rustline (if present);
6. Position relative to flow and stream gradient;
7. Depth of jump pool below culvert;
8. Height of jump required to enter culvert;
9. Previous modifications (if any) to improve fish passage; and
10. Condition of previous modifications.

Qualitative notes describing stream habitat immediately upstream and downstream of each culvert were taken. Where feasible, variable lengths of the stream channel above and below crossings were walked to detect presence of salmonids and provide additional information regarding habitat conditions.

Data Entry and Passage Analyses

All survey and site visit data were recorded on waterproof data sheets. Then data for each culvert were entered into a spreadsheet (Excel 97). A macro was created to calculate thalweg elevations of longitudinal profiles and compute culvert slopes.

First-phase Passage Evaluation Filter: GREEN-GRAY-RED

A filtering process was used to assist in identifying sites which either meet, or fail to meet, state and federal fish passage criteria for all fish species and lifestages (CDFG 2002; NMFS 2001). Using the field inventory data, calculate: average active channel width, culvert slope, residual inlet depth and drop at outlet (Figure 4). The first-phase passage evaluation filter was employed to reduce the number of crossings which required an in-depth passage evaluation with FishXing. The filter criteria were designed to quickly classify crossings into one of three categories:

- **GREEN**: Conditions assumed adequate for passage of all salmonids, including the weakest swimming lifestage.

- **GRAY**: Conditions may not be adequate for all salmonid species or lifestages presumed present. Additional analyses required to determine extent of barrier for each species and lifestage.

- **RED**: Conditions do not meet passage criteria at all flows for strongest swimming species presumed present. Assume "no passage" and move to analysis of habitat quantity and quality upstream of the barrier.

Follow the flowchart to determine a stream crossing's status as Green, Gray, or Red (Figure 5). Depending on geographic location within California, species of interest will vary. Within anadromous-bearing watersheds, CDFG has determined that culverts classified as "Green" must meet upstream passage criteria for both adult and over-wintering juvenile salmonids at all expected migration flows.

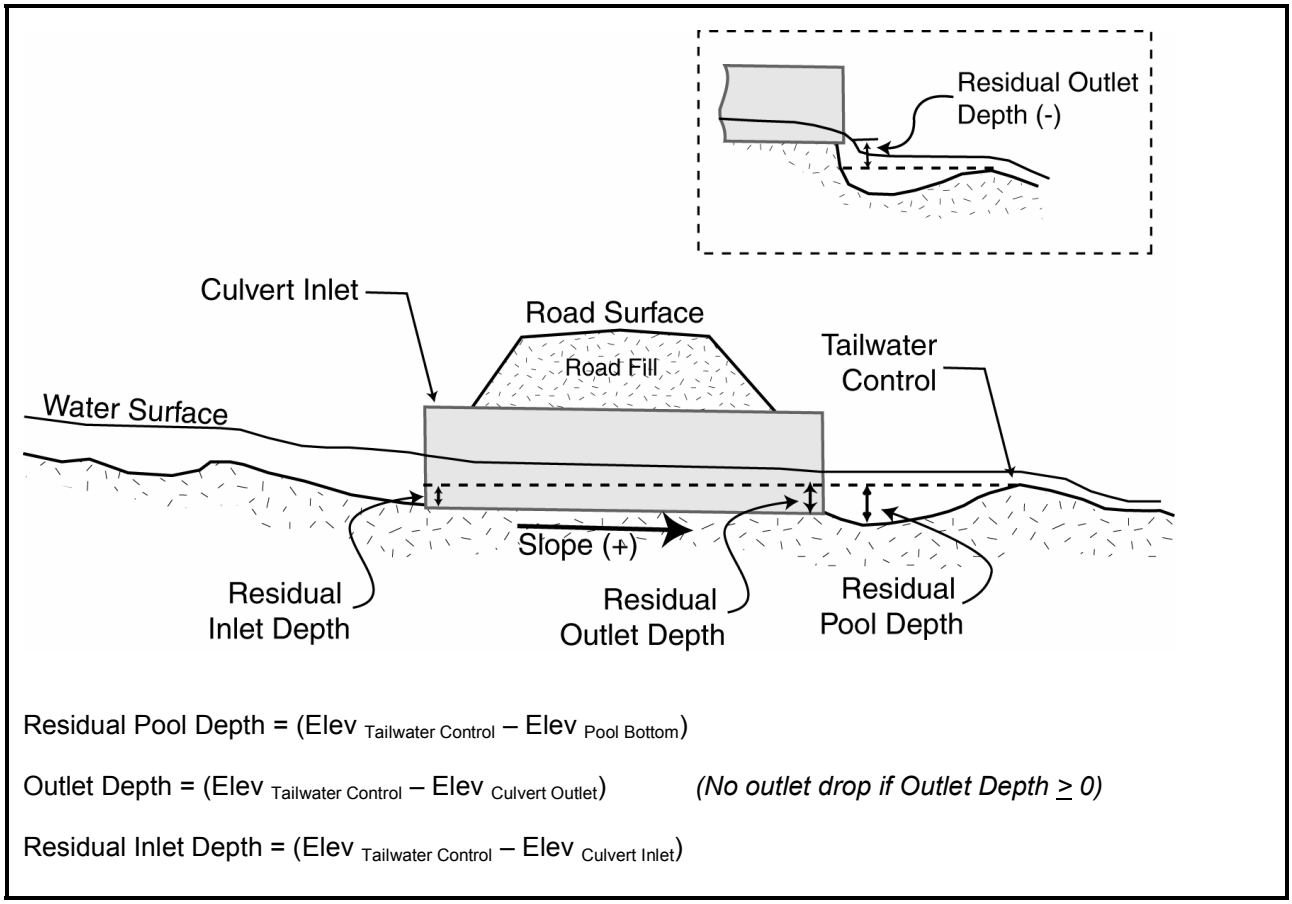

Figure 4. Measurements used in Green-Grey-Red filtering criteria.

Many stream crossings have unique characteristics which may hinder fish passage, yet they are not recognized in the filtering process. For culverts meeting the "Green" criteria, a review of the inventory data and field notes was necessary to ensure no unique passage problems existed before classifying the stream crossings as "100% passable".

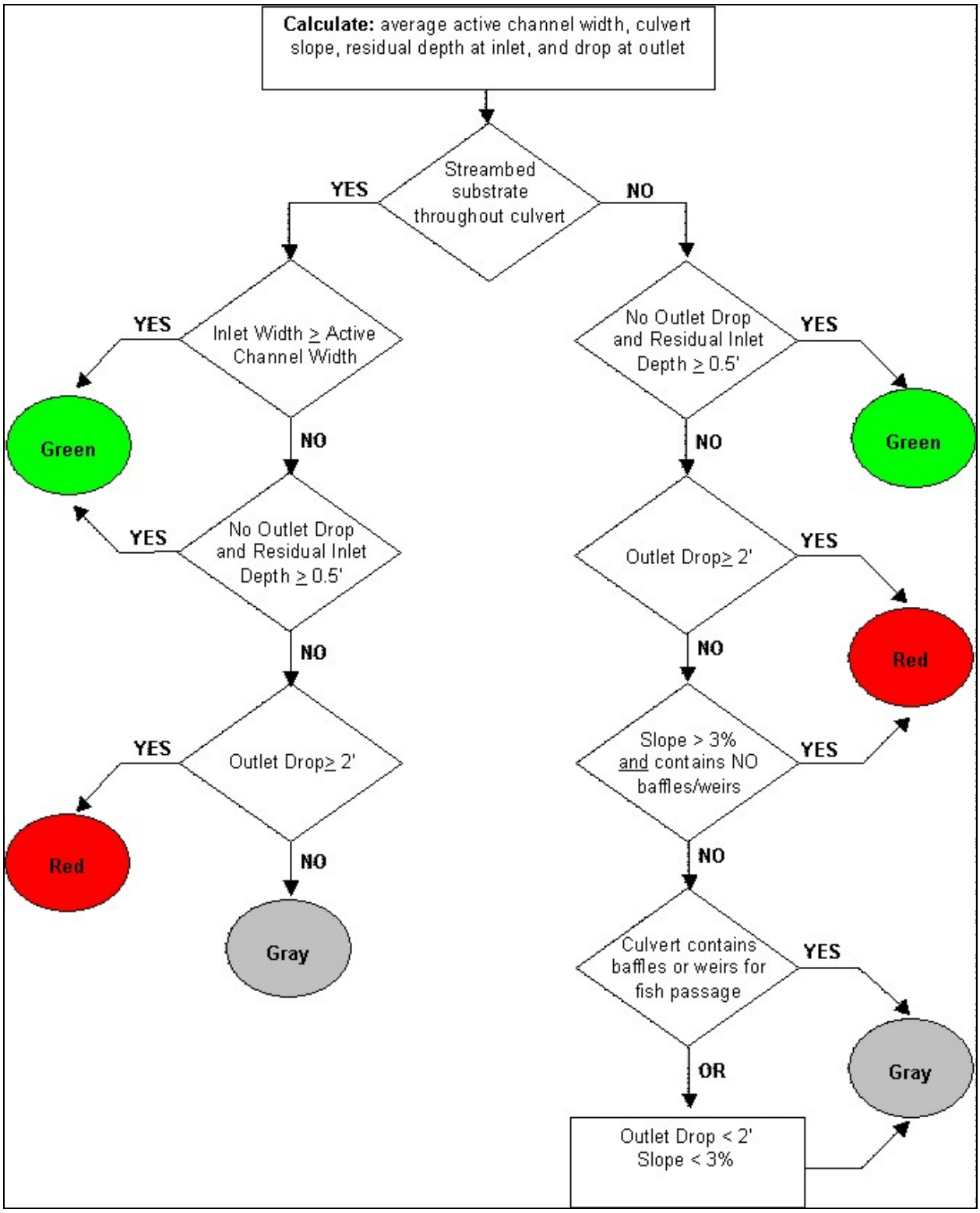

Figure 5. GREEN-GRAY-RED first-phase passage evaluation filter.

NOTE: FishXing Overview, Hydrology and Design Flow, Peak Flow Capacity, and Fish Passage Flows sections were written by Michael Love under a separate contract administered by CDFG (Taylor and Love, 2003).

FishXing Overview

FishXing is a computer software program developed by Six Rivers National Forest's Watershed Interactions Team - a group of scientists with diverse backgrounds in engineering, hydrology, geomorphology, geology and fisheries biology. Mike Furniss, a Forest Service hydrologist for Six Rivers, managed program development. A CD-ROM final version of FishXing was released in March, 2000. In-depth information regarding FishXing (or a copy of the most recent version of the program) may be obtained at the FishXing homepage at (www.stream.fs.fed.us/fishxing).

FishXing is an interactive software package that integrates a culvert design and assessment model for fish passage nested within a multimedia educational setting. Culvert hydraulics are well understood and model output closely resembles reality. FishXing successfully models (predicts) hydraulic conditions throughout the culvert over a wide range of flows for numerous culvert shapes and sizes. The model incorporates fisheries inputs including fish species, life stages, body lengths, and leaping and swimming abilities. FishXing uses the swimming abilities to determine whether the culvert installation (current or proposed) will accommodate fish passage over the desired range of migration flows, and identify specific locations within the culvert that impede or prevent passage. Software outputs include water surface profiles and hydraulic variables such as water depths and average velocities displayed in both tabular and graphical formats.

Fish Passage Criteria – First Deviation from CDFG Protocol

FishXing used the survey elevation and culvert specifications to evaluate passage at sites defined as "GRAY" by the first-phase evaluation filter for each species and life-stages of salmonids known to currently or historically reside in the County of Santa Cruz tributaries of interest. The swimming abilities and passage criteria recommended in the original CDFG fish-passage protocol and the alternate values used in the County of Santa Cruz project for each species and life-stage are listed Table 2.

The CDFG fish-passage protocol recommended using conservative values for assessment under the assumption that although many individual fish will have swimming abilities surpassing those listed, swim speeds and minimum water depths were selected to ensure stream crossings accommodated passage of weaker individuals within each age class. This assumption is better suited for the *design* of new crossings where being conservative hopefully allows for the passage of all fish. However, for *assessment* purposes, the use of conservative swimming values and minimum water depths generated many "RED" sites that, in fact, were allowing the passage of adult salmonids. This discrepancy was first noticed during Taylor and Associates' assessment project in Marin County where extensive spawning survey data confirmed adult coho salmon and steelhead consistently spawning upstream of crossings initially assessed as "RED".

If the objective of the passage assessment is to identify crossings that are truly barriers (or at least serious impediments) to adult migration, as well as, accurately estimate the percentage of temporal passage to allow a gradation in the scoring matrix; then using conservative values is not appropriate. For example, in Marin County, 90 stream crossings were initially assessed with the conservative criteria and 62 sites (or 69%) were identified as "RED" and received a maximum "extent of barrier" score of 15 points in the ranking matrix. When the more rigorous criteria were utilized, the number of "RED" sites dropped to 46 (or 51%) and a wider range of "extent of barrier" scores were generated for the "GRAY" sites.

FishXing and other hydraulic models report the average cross-sectional water velocity, not accounting for spatial variations. Stream crossings with natural substrate or corrugations will have regions of reduced velocities that can be utilized by migrating fish. These areas are often too small for larger fish to use, but can enhance juvenile passage success. The software allows the use of reduction factors that decrease the calculated water velocities proportionally. As shown in Table 2, velocity reduction factors were used in the passage analysis of resident fish and juveniles with specific types of stream crossing structures.

Using the FishXing program, the range of flows that meet the depth, velocity, and leaping criteria for each lifestage were identified. The range of flows meeting the passage requirements were then compared to the lower and upper fish passage flows to determine "percent passable".

Table 2. Fish species and lifestages used in the passage assessment along with associated swimming abilities and passage criteria. Values in parentheses are the conservative values recommended in the CDFG protocol. Passage flows are based on current adult salmonid criteria combined with observational data from northern California coastal streams.

Fish Species/Age Class	Adult Coho Salmon and Steelhead	Resident Trout and 2+ Juvenile Steelhead	Young-of-year and 1+ Juvenile Salmonids
Fish Length	>500mm (≈ 20")	200mm (≈ 8")	80mm (≈ 3")
Prolonged Mode Swim Speed Time to Exhaustion	 (6 ft/sec) **8 ft/sec** 30 min	 4 ft/sec 30 min	 1.5 ft/sec 30 min
Burst Mode Swim Speed Time to Exhaustion	 (10 ft/sec) **16 ft/sec** 5 sec	 5.0 ft/s 5 sec	 3.0 ft/s 5 sec
Maximum Leaping Speed	(12.0 ft/sec) **16 ft/sec**	6 ft/sec	3 ft/sec
Velocity Reduction Factors for Corrugated Metal Culverts **	Inlet = 1.0 Barrel = 1.0 Outlet = 1.0	Inlet = 0.8 Barrel = 0.6 Outlet = 0.8	Inlet = 0.8 Barrel = 0.6 Outlet = 0.8
Minimum Required Water Depth	(1 ft) **0.5 ft**	(0.5 ft) 0.4 ft	0.3 ft
Minimum Passage Flow *(Use the larger of the two flows)*	50% exceedance flow or 3 cfs	90% exceedance flow or 2 cfs	95% exceedance flow or 1 cfs
Maximum Passage Flow	1% exceedance flow	5% exceedance flow	10% exceedance flow

** Velocity reduction factors only apply to culverts with corrugated walls, baffles, or natural substrate. All other culverts had reduction factors of 1.0 for all age classes.

Hydrology and Design Flow

When examining stream crossings that require fish passage, three specific flows are considered: peak flow capacity of the stream crossing, the upper fish passage flow, and the lower fish passage flow. Because flow is not gauged on most small streams, it must be estimated using techniques that required hydrologic information about the stream crossing's contributing watershed, including:

- Drainage area;
- Mean annual precipitation;
- Mean annual potential evapotranspiration; and
- Average basin elevation.

Drainage area and basin elevations were calculated from a 1:24,000 USGS topographic map. For most projects, mean annual precipitation (MAP) and potential evapotranspiration (PET) are estimated from regional maps produced by Rantz (1968).

Peak Flow Capacity

Peak flows are typically defined in terms of a recurrence interval, but reported as a quantity; often as cubic feet per second (c.f.s.). Current guidelines recommend all stream crossings pass the flow associated with the 100-year flood without damage to the stream crossing (NMFS, 2001). Additionally, infrequently maintained culverted crossings should accommodate the 100-year flood without overtopping the culvert's inlet.

Determination of a crossing's flood capacity assisted in ranking sites for remediation. Undersized crossings have a higher risk of catastrophic failure, which often results in the immediate delivery of sediment from the road-fill into the downstream channel. Depending on the amount of road-fill, this pulse of sediment may have a minor-to-catastrophic impact on downstream rearing and spawning habitat. Undersized crossings can also adversely affect sediment transport and downstream channel stability, creating conditions that hinder fish passage, degrade habitat, and cause damage to other stream crossings and/or private property.

The first step was to estimate hydraulic capacity of each inventoried stream crossing. Capacity is generally a function of the shape and cross-sectional area of the inlet. Capacity was calculated for two different headwater elevations: water ponded to the top of the culvert inlet (HW/D = 1) and water ponded to the top of the road surface (HW/F=1). Nomograph equations developed by Piehl et. al (1988) were used to calculate capacity of circular culverts. Federal Highways nomographs presented in Norman et. al (1995) were used for pipe-arches, open bottom arches, oval pipes and box culverts. Capacities of embedded culverts were determined using two hydraulic computer models, FishXing and HydroCulv.

The second step was to estimate peak flows at each crossing. This required estimating the 2-year, 5-year, 10-year, 25-year, 50-year, and 100-year peak flows. Regional flood estimation equations developed by Waananen and Crippen (1977) were used to estimate peak flows for the various recurrence intervals (Figure 6). The equations incorporate drainage area, MAP, and mean basin elevation as variables to predict peak flow in Central Coast region California streams.

The third step was to compare the stream crossing's capacity to peak flow estimates. Risk of failure was assessed by comparing a stream crossing's hydraulic capacity with the estimated peak flow for each recurrence interval. Each crossing was placed into one of six "sizing" categories:

1. equal to or greater than the 100-year flow,
2. between the 50-year and 100-year flows,
3. between the 25-year and 50-year flows,
4. between the 10-year and 25-year flows,
5. between the 10-year and 5-year flows.
6. less than the 5-year storm flow.

These six categories were utilized in the ranking matrix.

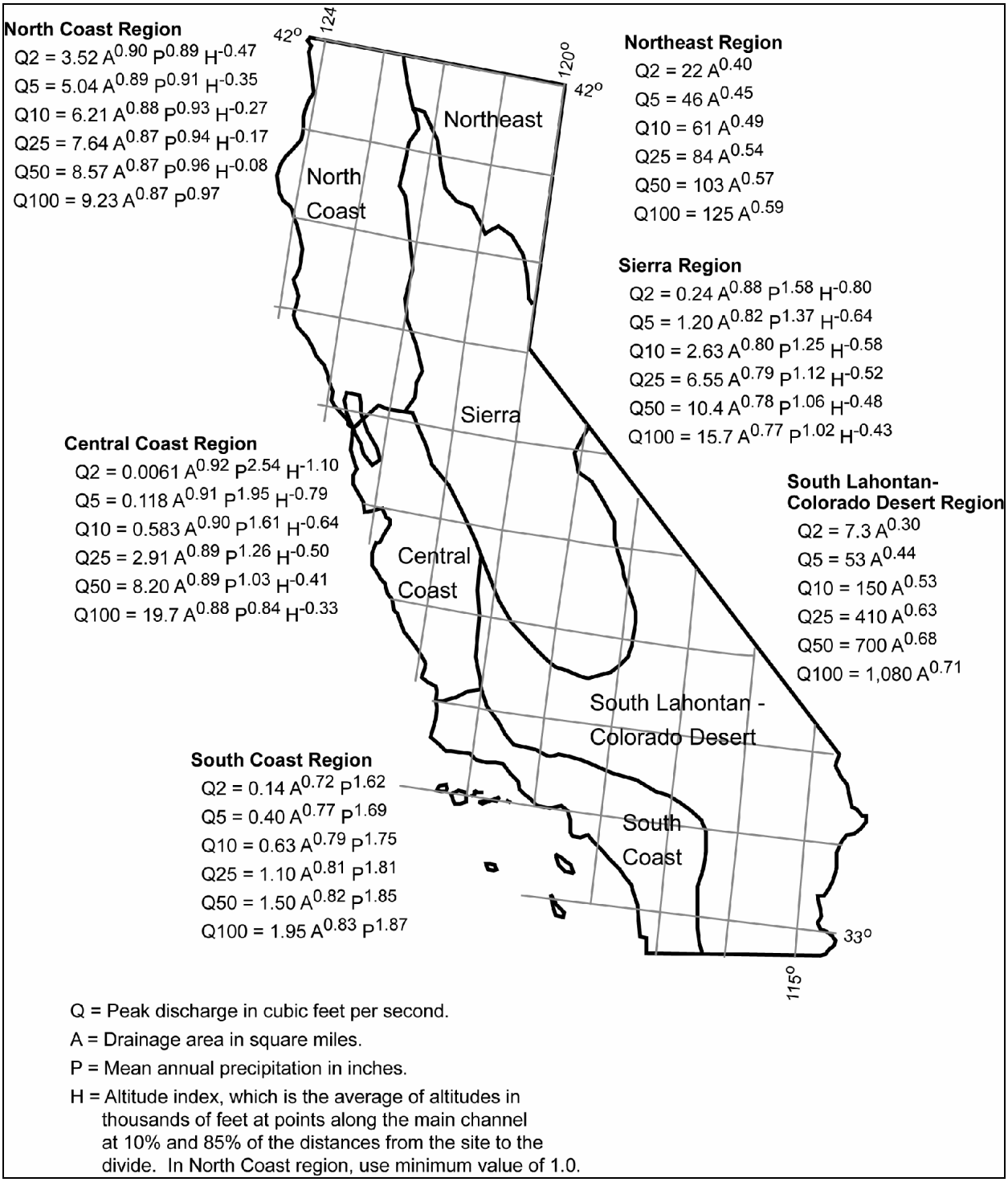

Figure 6. California regional regression equations for estimating peak flows associated with a 2-year, 5-year, 10-year, 25-year, 50-year, and 100-year recurrence interval (Waananen and Crippen, 1977).

Fish Passage Flows

It is widely agreed that designing stream crossings to pass fish at all flows is impractical (CDFG 2002; NMFS 2001; Robison et al. 2000; SSHEAR 1998). Although anadromous salmonids typically migrate upstream during higher flows triggered by hydrologic events, it is presumed that migration is naturally delayed during larger flood events. Conversely, during low flow periods on many smaller streams water depths within the channel can become impassable for both adult and juvenile salmonids. To identify the range of flows that stream crossings should accommodate for fish passage, lower and upper flow limits have been defined specifically for streams within California (CDFG 2002; NMFS 2001).

To evaluate the extent to which a crossing is a barrier, passage was assessed between the lower and upper passage flows for each fish species and life-stage of concern. Identifying the exceedence flows required obtaining average daily stream flow data from gauged streams. Daily average flow data for small streams in Santa Cruz County were available from the USGS.

The following steps were followed to estimate upper and lower passage flows:

1. Obtained flow records from local stream gauges that met the following requirements:
   - At least five years of recorded daily average flows (do not need to be consecutive years);
   - A drainage area less than 100 square miles, and preferably less than 10 square miles; and,
   - Unregulated flows (no upstream impoundments or water diversions) during the migration season is desired.

2. Divided the flows (Q) for each gauged stream by its drainage area (A), resulting in units of cfs/mi^2.

3. Created regional flow duration curve by taking the average of the exceedence flows (Q/A) of the gauged streams (Appendix C).

4. Determined the upper and lower passage flows for each stream crossing using the regional flow duration curve and the drainage area of the stream crossing.

When analyzing fish passage with FishXing, these flows were used to determine the extent to which the crossing is a barrier. The stream crossing must meet the more rigorous water velocity and depth criteria between Q_{lp} and Q_{hp} to be considered 100% passable. For the ranking matrix, at each stream crossing, the extent of the migration barrier was determined for each salmonid species and life-stage presumed present.

Habitat Information

Because this project addressed fish passage in numerous streams throughout Santa Cruz County, plan development was based both on prior assessment and evaluation; and on conducting habitat assessment and evaluation as part of the project. Habitat conditions upstream and downstream of culvert locations relied on previously conducted habitat typing or fisheries surveys. Habitat information and fish distribution data for some streams were available from reports on file at CDFG office in Santa Cruz and from survey notes compiled during fish passage assessments completed by the County of Santa Cruz Planning department between 1985-86 (Hope, unpublished field notes and maps). The habitat typing reports also provided information on past, present, and future land uses within watersheds that flow through culverts on the County of Santa Cruz road systems.

The completed habitat typing reports provided information to:

- Assess the quantity and quality of stream habitat associated with the crossings.
- Determine salmonid species-diversity and distribution data.
- Identify the number, location, and status of additional stream crossings and other types of potential migration impediments – such as flashboard dams.
- Assess past, present, and future land uses within sub-watersheds of interest.

Professional judgment from on-site inspection of the stream habitat adjacent to each crossing also aided habitat assessment and evaluation – especially for streams that had not been recently surveyed. In some cases, with landowner permission, longer reaches of stream were walked by Taylor and Associates field crew to better assess quality of habitat above and below the crossings. County of Santa Cruz and CDFG personnel also walked reaches of stream after the crossings were surveyed to better assess habitat conditions and other types of impediments to salmonid migration.

Habitat Quantity

Lengths of potential anadromous salmonid habitat upstream of each crossing were estimated by several methods:

1. Lengths measured in the field with a hip-chain during the CDFG habitat typing surveys. If access was permitted, these surveys were terminated where the field crew thought the limit of anadromy was located. The surveys were often terminated at obvious features such as natural waterfalls, extremely steep-sloped boulder cascades, or at permanent human-made structures such as dams.

2. Measured off of digitized USGS 7.5 Minute Series topographic maps (Terrain Navigator, Version 3.01by MapTech). The upper limit of anadromous habitat was considered when the channel exceeded an eight percent slope for at least a 300-foot channel reach.

3. The County of Santa Cruz Planning Department in conjunction with CDFG fisheries biologists have been drafting and refining fisheries distribution information into the County's GIS layer (Schroeder and Nelson, pers. comm.). Data sources include the previously

mentioned reports and habitat surveys, as well as recent field surveys to document fish presence and upper limits of distribution.

The habitat quantity value used in the ranking matrix varied, but if the habitat typing survey or the County's fisheries distribution map identified an obvious feature where anadromy was terminated – this was the value used. In other instances, the eight-percent slope was used only if on-the-ground survey information was unavailable.

Additional Crossings and other Human-related Impediments to Migration

The presence of additional stream crossings, above and below each county-maintained site, was also considered when evaluating potential habitat gains. In many cases, additional stream crossings existed that were either private, city, state, or federal. The completed CDFG habitat typing reports also identified the number, location, and status of stream crossings and flashboard dams located on private property. The on-the-ground habitat typing surveys were more accurate than attempting to determine the status of these additional features off of USGS topographic maps and/or the County road maps.

Initial Ranking of Stream Crossings for Treatment

The ranking objective was to arrange the sites in an order from high to low priority using a suite of site-specific information. However, the "scores" generated were not intended to be absolute in deciding the exact order of scheduling treatments. Once the first-cut ranking was completed, professional judgment played an important part in deciding the order of treatment. As noted by Robison et al. (2000), numerous social and economic factors influenced the exact order of treated sites.

Because the County of Santa Cruz intends on treating stream crossings identified as "high-priority" by submitting proposals to various fisheries restoration funding sources, additional opportunities for re-evaluating the biological merit of potential projects will occur through proposal review committees composed of biologists from CDFG and other agencies. The stream crossing assessment protocol developed for the CDFG *Restoration Manual* acknowledged that the methods for ranking stream crossing locations was a developing process and would undoubtedly require refinement as additional information was obtained (Taylor and Love, 2003).

This report also acknowledges (but makes no attempt to quantify or prioritize) that other potentially high-priority restoration projects exist throughout California, and these must all be considered when deciding where and how to best spend limited restoration funds. However, recent research regarding watershed restoration considers the identification, prioritization, and treatment of human-made migration barriers to restore ecological connectivity for salmonids a vital (and often initial) step towards recovering depressed populations (Roni et al. 2002).

Ranking Criteria

The criteria and scoring for ranking stream crossings were mostly consistent with those developed for Part 10 of CDFG's *Salmonid Stream Habitat Restoration Manual* (Taylor and Love, 2003). The CDFG method assigns a score or value for the following criteria at each culvert location and the total score is the sum of five criteria: species diversity, extent of barrier, sizing, current condition, and habitat score.

The second deviation from the CDFG protocol entailed reducing the weight of the current crossing's sizing and condition scores on the site's total score. Again, this modification to the CDFG protocol resulted from carefully analyzing data sets from previously completed assessment projects. The ranking matrix developed for the *Restoration Manual* can generate a maximum possible score of 39 points, with a maximum of 10 points (25.6%) associated with crossing condition and sizing. In some instances, crossings with very little upstream habitat (<1,000') and/or met the adult passage criteria on nearly 100% of the range of migration flows were ranking near the top due primarily to poor condition and under-sizing.

Undersized crossings that are in poor condition should be of concern to County of Santa Cruz's road managers. However, if the primary purpose of the ranking matrix is to identify sites to treat with fisheries restoration funding, then more weight should be put on the biological-related criteria so that crossings which are serious impediments to migration with significant reaches of potential upstream habitat rank higher.

Thus, for the County of Santa Cruz, Russian River, Marin County, and the Morro Bay watershed fish passage assessment project, Taylor and Associates has reduced the weight of the sizing and condition criteria by utilizing the average of the two values. This resulted in a maximum possible total score of 34 points, with sizing and condition criteria comprising a weight of 14.7% of the maximum total score.

The method utilized for the Santa Cruz County fish passage assessment assigned a score or value for the following criteria at each crossing location. The total score was the sum of four criteria: species diversity, extent of barrier, average value of crossing sizing and current condition, and total habitat score.

1. **Species diversity:** number of salmonid species known to occur within the stream reach at the crossing location. **Score:** Because of ESA listing status as threatened coho salmon = **2** points and steelhead = **2** points. **Maximum score = 4 points.**

2. **Extent of barrier:** for three age classes of salmonids (adults, resident trout/2+, and 1+/young-of-year), over the range of estimated migration flows, assign one of the following values. **Score: 0** = meets passage criteria on 80-100% of migration flows; **1** = meets passage criteria on 60-80% of migration flows; **2** = meets passage criteria on 40-60% of migration flows; **3** = meets passage criteria on 20-40% of migration flows; **4** = meets passage criteria on less than 20% of migration flows; **5** = fails to meet passage criteria (RED by first-phase evaluation filter). For a total score, sum scores given for each age-class of salmonids. **Maximum score = 15 points.**

3. **Sizing (risk of failure):** for each culvert, assign one of the following values as related to flow capacity. **Score: 0 =** sized to NMFS standards of passing 100-year flow at less than inlet height. **1** = sized for at least a 50-year flow, low risk. **2** = sized for at least a 25-year flow, moderate risk. **3** = sized for less than a 25-year flow, moderate to high risk of failure. **4** = sized for less than a 10-year event, high risk of failure. **5** = sized for less than a five-year event, high risk of failure.

4. **Current condition:** for each culvert, assign one of the following values. **Score: 0** = good condition. **1** = fair, showing signs of wear. **3** = poor, floor rusting through, crushed by roadbase, etc. **5** = extremely poor, floor rotted-out, severely crushed, damaged inlets, collapsing wingwalls, slumping roadbase, etc.

5. **Crossing Score:** for each crossing, combine the sizing and condition values and compute the average value. **Maximum score = 5 points.**

6. **Habitat quantity:** above each crossing, length of anadromy was estimated (in feet) up to a channel slope with a sustained 8% gradient. **Score:** Starting at a 500' minimum; 0.5 points for each 500' length class (**example**: **0** points for <500'; **1** point for 1,000'; **2** points for 2,000'; **3.5** points for 3,500'; and so on). **Maximum score = 10 points.**

7. **Habitat quality:** for each stream, assign a "multiplier" of quality (relative to other streams in inventory) after reviewing available habitat information.

- **Score: 1.0 = Excellent-** Relatively undeveloped, "pristine" watershed conditions. Habitat features include dense riparian zones with mix of mature native species, frequent pools, high-quality spawning areas, cool summer water temperatures, complex in-channel habitat, and/or channel floodplain relatively intact. High likelihood of no future human development. Presence of migration barrier(s) is obviously the watershed's limiting factor.

- **0.75 = Good-** Habitat is fairly intact, but human activities have altered the watershed with likelihood of continued activities. Habitat still includes dense riparian zones of native species, frequent pools, spawning gravels, cool summer water temperatures, complex in-channel habitat, and/or channel floodplain relatively intact. Presence of migration barrier(s) is most likely one of the watershed's primary limiting factor.

- **0.5 = Fair-** Human activities have altered the watershed with likelihood of continued (or increased) activities, with apparent effects to watershed processes and features. Habitat impacts include riparian zone present but lack of mature conifers and/or presence of non-native species, infrequent pools, sedimentation evident in spawning areas (pool tails and riffle crests), summer stream flow (quantity and quality) compromised by diversions, summer water temperatures periodically exceed stressful levels for salmonids, sparse in-channel complex habitat, floodplain intact or slightly modified. Presence of migration barrier(s) may be one of the watershed's limiting factor (out of several factors).

- **0.25 = Poor-** Human activities have drastically altered the watershed with high likelihood of continued (or increased) activities, with apparent effects to watershed processes. Habitat impacts include riparian zones absent or severely degraded, little or no pool formations, excessive sedimentation evident in spawning areas (pool tails and riffle crests), summer stream flow (quantity and quality) severely compromised by diversions, summer water temperatures periodically exceed stressful levels for salmonids, sparse stressful to lethal summer water temperatures common, lack of in-channel habitat, floodplain severely modified with levees, riprap, and/or residential or commercial development. Other limiting factors within watershed are most likely of a higher priority for restoration than remediation of migration barriers. Please note that in some instances, poor quality habitat also encompassed reaches of stream not necessarily impacted by human activities. These stream reaches were either very small in size, or were steeply-sloped and provided limited spawning and rearing habitat for anadromous salmonids.

8. **Total habitat score:** Multiply #5 by #6 for habitat "score". A multiplier assigned for habitat quality, weighs the final score more on quality than sheer quantity of upstream habitat. **Maximum score = 10 points.**

For each culvert location, the five ranking criteria were entered into a spreadsheet and total scores computed. Then the list was sorted by "Total Score" in a descending order to determine an initial ranking. On closer review of the rank, some professional judgment was used to adjust the rank of several sites. The list was then divided subjectively into groups defined as "high", "medium", or "low" priority.

The high-priority sites were generally characterized as serious impediments to migration with significant amounts of upstream habitat for anadromous salmonids. Medium-priority sites were characterized as limited in upstream habitat gains, limited species diversity, and/or were only significant impediments to juvenile migration. Low-priority sites were either limited in upstream habitat, habitat condition was poor, and/or the sites allowed passage of adults and most juveniles.

Remediation of culvert sites identified as "high-priority" should be accomplished by submitting proposals to various fisheries restoration funding sources. The information provided in this report should be used to document the logical process employed to identify, evaluate, and rank these migration barriers.

The County of Santa Cruz Planning and Public Works Departments should consider ranking medium and low-priority sites a second time focusing mainly on culvert condition, sizing, and amount of fill material within the road prism. A risk assessment may be conducted to determine the consequence of potential sediment delivery to the downstream channel if or when a crossing failed. Most medium and low-priority sites should not be considered candidates for treatment via limited restoration funding sources, unless an imminent site failure would deliver a significant amount of sediment to high-quality downstream salmonid habitat.

However, this information will provide the County of Santa Cruz Planning and Public Works a list of sites in need of future replacement with county road maintenance funds. When these replacements are implemented, this report should provide guidance on treatments with properly-sized crossings conducive to adequate flow conveyance and unimpeded fish passage.

Additional Considerations for Final Ranking

On a site-specific basis, some or all of these factors were considered in rearranging the first-cut ranking to develop a final list for project scheduling:

1. Amount of road fill. At stream crossings that were undersized and/or in poor condition, we examined the volume of fill material within the road prism potentially deliverable to the stream channel if the culvert were to fail.

2. Presence, location, and barrier status of other stream crossings. In many cases, an individual stream was crossed by multiple roads under a variety of management or ownership. In these situations, close communication with other road managers was important. If multiple crossings are migration barriers a coordinated effort is required to identify and treat them in a logical manner – generally in an upstream direction starting with the lowermost crossing. In some cases the lowermost crossing was County-maintained and these sites were raised slightly in the final ranking. Conversely, the County of Santa Cruz also maintains crossings above private, city, state or federal-maintained crossings that are currently impeding and/or blocking fish migration – these county sites were lowered in the final ranking.

3. Remediation project cost. With the assistance of the County of Santa Cruz Planning and Public Works Departments, the range of treatment options and associated costs were examined when determining the order in which to proceed and the type of treatment to implement at specific sites. In cases where Federally-listed fish species were present, costs should be weighed against the consequences of failing to comply with the Endangered Species Act by not providing unimpeded passage.

4. Scheduling of other road maintenance and improvement projects. With the assistance of the County of Santa Cruz Planning and Public Works Departments, the upgrading of migration barriers during other scheduled maintenance and/or improvement activities was considered. When undersized or older crossings fail during storms, the County should be prepared to install properly-sized crossings that provide unimpeded passage for all species and life stages of fish.

RESULTS

Initial Site Visits

Initial site visits were conducted at 209 stream crossings and 80 sites with culverts were surveyed and included in the evaluation and ranking process (Appendix A). Two of these crossings had two pipes, and another crossing was a two-bay concrete box culvert, bringing the survey total up to 83 barrels. The reasons for excluding 132 crossings in the evaluation included: the stream crossing was a bridge and provided unimpeded passage; the stream crossing was a culvert (but not County-maintained); and/or the stream crossing was a County-maintained culvert (but located in a non-fish bearing stream reach – either too steep or too small).

The 80 surveyed sites were each given a unique ID number that was determined in an upstream direction starting in watersheds at the northern Santa Cruz County line and moving in generally a north to south direction (Table 3). Post Mile values (PM) were also provided for each site since this is a unique site-identifier that may have more utility to road managers (Table 3). A table of the 80 crossings inventoried and their location information is provided in Appendix A. Data generated from the longitudinal profile surveys are also located in Appendix A.

The location information, site-specific characteristics, site photographs, maps, and habitat descriptions for the 80 County of Santa Cruz stream crossings with culverts were assembled in a separate document, titled "*Catalog of Santa Cruz County Stream Crossings with Culverts Located Primarily within Fish-bearing Stream Reaches*". The following list is an overview of the crossing inventory and assessment:

1. A wide variety of crossing configurations and materials were discovered.

2. Some crossings were in poor condition (19 sites or 25%) and are due for replacement. Another 24 crossings (or 31%) were described as in "fair" condition, and starting to show signs of deterioration.

3. Thirteen of 80 crossings (or 16.25% of the sites) were property sized when compared to recently released NMFS guidelines that recommend stream crossings pass the 100-year storm flow at less than 100% of inlet height. Another nine crossings (or 11.25% of the sites) were sized to pass greater than a 25-year storm flow.

4. Forty of the 80 crossings (or 50% of the sites) were extremely undersized, overtopping on less than a ten-year storm flow (Table 4). Of these 40 sites, 20 crossings (or 25% of the sites) had culverts that overtopped on less than a five-year storm flow – these sites should be of concern from a road's maintenance and safety point of view (high-lighted with "red" font in Table 4).

A GIS map produced by the County of Santa Cruz that visually displays the stream crossing locations, type of crossing, passage status, and fisheries distribution information is provided in Appendix B. Synthesis of the fisheries distribution information was a significant task completed by the County with input from CDFG biologists and other fisheries experts familiar with watersheds located in Santa Cruz County.

Table 3. Site ID numbers and mile posts for 80 County of Santa Cruz stream crossings with culverts.

SITE ID #	POST MILE	STREAM NAME	ROAD NAME
SC-001	**1.32**	Queseria Creek	Swanton Road
SC-002	**2.17**	Archibald Creek	Swanton Road
SC-003	**3.45**	Unnamed tributary #1 to Scott Creek	Swanton Road
SC-004	**4.05**	Unnamed tributary #2 to Scott Creek	Swanton Road
SC-005	**0.71**	Molino Creek	Swanton Road
SC-006	**0.69**	West Liddell Creek #1	Bonny Doon Road
SC-007	**0.71**	West Liddell Creek #2	Bonny Doon Road
SC-008	**0.94**	West Liddell Creek #3	Bonny Doon Road
SC-009	**1.02**	Redwood Creek #1	Glen Canyon Road
SC-010	**0.10**	Redwood Creek #2	Redwood Drive
SC-011	**0.20**	Redwood Creek #3	Redwood Drive
SC-012	**1.34**	Redwood Creek #4	Redwood Drive
SC-013	**1.45**	Redwood Creek #5	Redwood Drive
SC-014	**1.48**	Redwood Creek #6	Redwood Drive
SC-015	**1.67**	Redwood Creek #7	Redwood Drive
SC-016	**0.55**	Granite Creek	Granite Road
SC-017	**2.02**	Crystal Creek #1	Branciforte Drive
SC-018	**0.09**	Crystal Creek #2	Happy Valley Road
SC-019	**0.18**	Crystal Creek #3	Happy Valley Road
SC-020	**4.20**	Branciforte Creek #1	Branciforte Drive
SC-021	**0.38**	Tie Gulch	Branciforte Drive
SC-022	**5.00**	Branciforte Creek #2	Branciforte Drive
SC-023	**0.00**	Mountain View Creek #1	Vine Hill Road
SC-024	**0.76**	Mountain View Creek #2	Mountain View Road
SC-025	**0.31**	Blackburn Gulch	Vine Hill Road
SC-026	**1.30**	Unnamed tributary to Carbonera Creek	La Madrona Drive
SC-027	**at Willow Way**	Gold Gulch	Brookside Way
SC-028	**at Oak Drive**	Shingle Mill Creek	Redwood Drive
SC-029	**1.8**	Bean Creek #1	Mt. Hermon Road
SC-030	**0.60**	Lockhart Gulch	Lockhart Gulch Road
SC-031	**3.0**	Bean Creek #2	Bean Creek Road
SC-032	**0.4**	Lompico Creek #1	Lompico Road
SC-033	**0.5**	Lompico Creek #2	Lompico Road
SC-034	**2.0**	Lompico Creek #3	Lompico Road
SC-035	**4.58**	Cobble Creek	East Zayante Road
SC-036	**5.21**	Mountain Charlie Gulch	East Zayante Road
SC-037	**6.22**	Unnamed tributary to Zayante Creek	East Zayante Road
SC-038	**1.28**	South Fall Creek #1	Felton Empire Road
SC-039	**0.73**	South Fall Creek #2	Felton Empire Road
SC-040	**0.4**	Love Creek #1	Love Creek Road
SC-041	**0.9**	Love Creek #2	Love Creek Road

Table 3 (continued). Site ID numbers for 80 County of Santa Cruz stream crossings with culverts.

SITE ID #	MILE POST	STREAM NAME	ROAD NAME
SC-042	**1.3**	Love Creek #3	Love Creek Road
SC-043	**0.37**	Hubbard Gulch	Hubbard Gulch Road
SC-044	**0.40**	Marshall Creek	Hubbard Gulch Road
SC-045	**0.05**	Clear Creek	Clear Creek Road
SC-046	**2.49**	Unnamed tributary to Jamison Creek	Jamison Creek Road
SC-047	**0.20**	Hare Creek	Hare Way
SC-048	**1.5**	Hopkins Gulch	Bear Creek Road
SC-049	**0.63**	Two Bar Creek #1	Two Bar Road
SC-050	**0.86**	Two Bar Creek #2	Two Bar Road
SC-051	**2.7**	Two Bar Creek #3	Two Bar Road
SC-052	**2.65**	Logan Creek	Kings Creek Road
SC-053	**2.82**	Debris Flow Creek	Kings Creek Road
SC-054	**0.1 miles to Soquel Ave**	Arana Gulch #1 – 2 pipes	Capitola Road
SC-055	**0.1 miles to Capitola Road**	Arana Gulch #2	Soquel Avenue
SC-056	**0.20**	Arana Gulch #3 – 2 pipes	Brookwood Drive
SC-057	**1.30**	Arana Gulch #4	Paul Sweet Road
SC-058	**0.60**	Bates Creek	Main Street
SC-059	**3.10**	Moores Gulch	Soquel San Jose Road
SC-060	**5.3**	Hester Creek	Soquel San Jose Road
SC-061	**1.88**	West Branch Soquel Creek	Redwood Lodge Road
SC-062	**0.85**	Laurel Creek #1	Morrell Road
SC-063	**11.00**	Laurel Creek #2	Soquel San Jose Road
SC-064	**6.20**	Valencia Creek #1	Soquel Drive
SC-065	**2.29**	Valencia Creek #2	Valencia Road
SC-066	**3.3**	Browns Creek #1	Browns Valley Road
SC-067	**3.4**	Browns Creek #2	Browns Valley Road
SC-068	**3.3**	Gamecock Canyon	Hazel Dell Road
SC-069	**0.29**	Rider Creek	Rider Road
SC-070	**2.95**	Corralitos Creek	Eureka Canyon Road
SC-071	**4.8**	Shingle Mill Gulch #1	Eureka Canyon Road
SC-072	**5.24**	Shingle Mill Gulch #2	Eureka Canyon Road
SC-073	**1.50**	Casserly Creek #1	Casserly Road
SC-074	**1.0**	Casserly Creek #2	Mt. Madonna Road
SC-075	**0.20**	Green Valley Creek #1 – 2 bays	Casserly Road
SC-076	**4.03**	Green Valley Creek #2	Green Valley Road
SC-077	**3.25**	Green Valley Creek #3	Green Valley Road
SC-078	**1.98**	Green Valley Creek #4	Green Valley Road
SC-079	**0.89**	Green Valley Creek #5	Green Valley Road
SC-080	**0.69**	Green Valley Creek #6	Green Valley Road

Table 4. Hydraulic capacity of 80 Santa Cruz County stream crossings. Capacity is expressed as both a discharge (cfs) and a return-interval (years) for flows overtopping culvert inlet (HW/D=1) and overtopping road prism (HW/F=1).

Site ID #	Post Mile	Stream Name	Road Name	Capacity at HW/D=1 (cfs)	Capacity at HW/F=1 (cfs)	Return Interval to Overtop Culvert (years)	Return Interval to Overtop Road Prism (years)
SC-001	1.32	Queseria Creek	Swanton Road	23.8	55.3	2	3
SC-002	2.17	Archibald Creek	Swanton Road	77.2	123.0	0	1
SC-003	3.45	Unnamed tributary #1 to Scott Creek	Swanton Road	64.1	123.2	>250	>250
SC-004	4.05	Unnamed tributary #2 to Scott Creek	Swanton Road	64.1	111.7	9	120
SC-005	0.71	Molino Creek	Swanton Road	355.2	888.0	11	>250
SC-006	0.69	West Liddell Creek #1	Bonny Doon Road	115	N/A	<5	N/A
SC-007	0.71	West Liddell Creek #2	Bonny Doon Road	112	N/A	<5	N/A
SC-008	0.94	West Liddell Creek #3	Bonny Doon Road	166	N/A	<5	N/A
SC-009	1.02	Redwood Creek #1	Glen Canyon Road	165.0	660.0	6	>250
SC-010	0.10	Redwood Creek #2	Redwood Drive	165.0	340.0	6	50
SC-011	0.20	Redwood Creek #3	Redwood Drive	176.6	291.9	7	30
SC-012	1.34	Redwood Creek #4	Redwood Drive	77.2	115.3	7	19
SC-013	1.45	Redwood Creek #5	Redwood Drive	37.6	92.4	3	24
SC-014	1.48	Redwood Creek #6	Redwood Drive	77.2	147.0	23	>250
SC-015	1.67	Redwood Creek #7	Redwood Drive	37.6	132.2	6	>250
SC-016	0.55	Granite Creek	Granite Road	165.0	255.0	2	4
SC-017	2.02	Crystal Creek #1	Branciforte Drive	165.0	340.0	3	19
SC-018	0.09	Crystal Creek #2	Happy Valley Road	212.7	326.9	5	18

Table 4 (continued). Hydraulic capacity of 80 Santa Cruz County stream crossings. Capacity is expressed as both a discharge (cfs) and a return-interval (years) for flows overtopping culvert inlet (HW/D=1) and overtopping road prism (HW/F=1).

Site ID #	Post Mile	Stream Name	Road Name	Capacity at HW/D=1 (cfs)	Capacity at HW/F=1 (cfs)	Return Interval to Overtop Culvert (years)	Return Interval to Overtop Road Prism (years)
SC-019	0.18	Crystal Creek #3	Happy Valley Road	212.7	355.0	5	26
SC-020	4.20	Branciforte Creek #1	Branciforte Drive	1,224.0	1,890.0	69	>250
SC-021	0.38	Tie Gulch	Branciforte Drive	138.0	318.0	36	>250
SC-022	5.00	Branciforte Creek #2	Branciforte Drive	930.0	1,250.0	59	>250
SC-023	0.00	Mountain View Creek #1	Vine Hill Road	220.0	410.0	16	>250
SC-024	0.76	Mountain View Creek #2	Mountain View Road	110.0	205.0	>250	>250
SC-025	0.31	Blackburn Gulch	Vine Hill Road	800.0	1,050.0	>250	>250
SC-026	1.30	Unnamed trib to Carbonera Creek	La Madrona Drive	77.2	235.4	57	>250
SC-027	at Willow Way	Gold Gulch	Brookside Way	259.8	652.5	5	54
SC-028	at Oak Drive	Shingle Mill Creek	Redwood Drive	55.3	100.0	7	28
SC-029	1.8	Bean Creek #1	Mt. Hermon Road	4,000.0	6,500.0	182	>250
SC-030	0.60	Lockhart Gulch	Lockhart Gulch Road	270.0	516.0	2	7
SC-031	3.0	Bean Creek #2	Bean Creek Road	1,200.0	1,800.0	51	>250
SC-032	0.4	Lompico Creek #1	Lompico Road	486.9	1,020.1	3	44
SC-033	0.5	Lompico Creek #2	Lompico Road	586.2	740.3	6	12
SC-034	2.0	Lompico Creek #3	Lompico Road	782.0	851.0	15	27
SC-035	4.58	Cobble Creek	East Zayante Road	80.0	148.0	8	49
SC-036	5.21	Mountain Charlie Gulch	East Zayante Road	560.0	820.0	10	31

Table 4 (continued). Hydraulic capacity of 80 Santa Cruz County stream crossings. Capacity is expressed as both a discharge (cfs) and a return-interval (years) for flows overtopping culvert inlet (HW/D=1) and overtopping road prism (HW/F=1).

Site ID #	Post Mile	Stream Name	Road Name	Capacity at HW/D=1 (cfs)	Capacity at HW/F=1 (cfs)	Return Interval to Overtop Culvert (years)	Return Interval to Overtop Road Prism (years)
SC-037	6.22	Unnamed tributary to Zayante Creek	East Zayante Road	77.2	184.9	2	10
SC-038	1.28	South Fall Creek #1	Felton Empire Road	23.8	70.5	2	5
SC-039	0.73	South Fall Creek #2	Felton Empire Road	11.3	27.4	3	6
SC-040	0.4	Love Creek #1	Love Creek Road	850.5	1,575.0	10	>250
SC-041	0.9	Love Creek #2	Love Creek Road	537.2	711.0	4	10
SC-042	1.3	Love Creek #3	Love Creek Road	1,203.1	1,970.0	>250	>250
SC-043	0.37	Hubbard Gulch	Hubbard Gulch Road	170.9	416.9	19	>250
SC-044	0.40	Marshall Creek	Hubbard Gulch Road	37.6	85.6	1	2
SC-045	0.05	Clear Creek	Clear Creek Road	270.0	405.0	7	19
SC-046	2.49	Unnamed tributary to Jamison Creek	Jamison Creek Road	39.0	102.0	1	6
SC-047	0.20	Hare Creek	Hare Way	212.7	275.9	2	4
SC-048	1.5	Hopkins Gulch	Bear Creek Road	212.7	806.7	7	>250
SC-049	0.63	Two Bar Creek #1	Two Bar Road	1,000.0	1,400.0	38	>250
SC-050	0.86	Two Bar Creek #2	Two Bar Road	1,768.9	2,789.9	>250	>250
SC-051	2.7	Two Bar Creek #3	Two Bar Road	1,395.7	2,303.5	>250	>250
SC-052	2.65	Logan Creek	Kings Creek Road	420.0	640.0	16	107
SC-053	2.82	Debris Flow Creek	Kings Creek Road	19.8	76.4	3	>250

Table 4 (continued). Hydraulic capacity of 80 Santa Cruz County stream crossings. Capacity is expressed as both a discharge (cfs) and a return-interval (years) for flows overtopping culvert inlet (HW/D=1) and overtopping road prism (HW/F=1).

Site ID #	Post Mile	Stream Name	Road Name	Capacity at HW/D=1 (cfs)	Capacity at HW/F=1 (cfs)	Return Interval to Overtop Culvert (years)	Return Interval to Overtop Road Prism (years)
SC-054	0.1 mi. to Soquel Ave	Arana Gulch #1	Capitola Road	625.2	1,049.1	6	32
SC-055	0.1 mi. to Capitola Road	Arana Gulch #2	Soquel Avenue	762.7	966.0	11	26
SC-056	0.20	Arana Gulch #3	Brookwood Drive	300.0	540.0	3	9
SC-057	1.30	Arana Gulch #4	Paul Sweet Road	60.0	140.0	1	3
SC-058	0.60	Bates Creek	Main Street	436.6	938.4	4	28
SC-059	3.10	Moores Gulch	Soquel San Jose Road	508.3	1,859.6	9	>250
SC-060	5.3	Hester Creek	Soquel San Jose Road	1,020.0	2,600.0	139	>250
SC-061	1.88	West Branch Soquel Creek	Redwood Lodge Road	1,203.1	2,828.7	27	>250
SC-062	0.85	Laurel Creek #1	Morrell Road	696.9	1,595.8	>250	>250
SC-063	11.00	Laurel Creek #2	Soquel San Jose Road	436.6	1,405.3	>250	>250
SC-064	6.20	Valencia Creek #1	Soquel Drive	1,476.0	5,280.0	7	>250
SC-065	2.29	Valencia Creek #2	Valencia Road	762.7	1,555.9	17	>250
SC-066	3.3	Browns Creek #1	Browns Valley Road	816.0	1,560.0	15	116
SC-067	3.4	Browns Creek #2	Browns Valley Road	816.0	1,320.0	20	95
SC-068	3.3	Gamecock Canyon	Hazel Dell Road	350.0	660.0	15	97
SC-069	0.29	Rider Creek	Rider Road	212.7	413.3	7	30
SC-070	2.95	Corralitos Creek	Eureka Canyon Road	1,512.0	3,480.0	36	>250
SC-071	4.8	Shingle Mill Gulch #1	Eureka Canyon Road	280.0	520.0	13	53

Table 4 (continued). Hydraulic capacity of 80 Santa Cruz County stream crossings. Capacity is expressed as both a discharge (cfs) and a return-interval (years) for flows overtopping culvert inlet (HW/D=1) and overtopping road prism (HW/F=1).

Site ID #	Post Mile	Stream Name	Road Name	Capacity at HW/D=1 (cfs)	Capacity at HW/F=1 (cfs)	Return Interval to Overtop Culvert (years)	Return Interval to Overtop Road Prism (years)
SC-072	**5.24**	Shingle Mill Gulch #2	Eureka Canyon Road	**212.7**	**303.9**	**10**	**19**
SC-073	**1.50**	Casserly Creek #1	Casserly Road	**340.0**	**800.0**	**14**	**168**
SC-074	**1.0**	Casserly Creek #2	Mt. Madonna Road	**176.6**	**376.5**	**9**	**35**
SC-075	**0.20**	Green Valley Creek #1	Casserly Road	**2,952.0**	**3,600.0**	**>250**	**>250**
SC-076	**4.03**	Green Valley Creek #2	Green Valley Road	**1,600.0**	**2,400.0**	**34**	**171**
SC-077	**3.25**	Green Valley Creek #3	Green Valley Road	**1,200.0**	**1,700.0**	**23**	**68**
SC-078	**1.98**	Green Valley Creek #4	Green Valley Road	**4,550.0**	**6,000.0**	**>250**	**>250**
SC-079	**0.89**	Green Valley Creek #5	Green Valley Road	**999.6**	**1,383.3**	**129**	**>250**
SC-080	**0.69**	Green Valley Creek #6	Green Valley Road	**436.6**	**609.0**	**14**	**29**

Passage Analyses

The **GREEN**-**GRAY**-**RED** first-phase evaluation filter reduced the number of sites requiring in-depth analyses with FishXing. The initial use of the first-phase filter was followed by FishXing evaluations utilizing the conservative swimming abilities and minimum depth requirement as recommended in the CDFG assessment protocol. This initial analysis resulted in 49 of 80 surveyed crossings (or 61.25% of the sites) were defined as **RED**, or failing to meet CDFG's fish passage criteria for adult and juvenile salmonids throughout the entire range of migration flows (CDFG 2002). Examination of the site photos and fish observations during recent surveys suggested adult steelhead were migrating through many of these **RED** crossings.

When the more rigorous swimming abilities of 8-16-16 ft/sec and a minimum water depth of 0.5 feet were used in a second round of FishXing analyses, the number of **RED** crossings dropped to 31 sites (or 38.75% of the sites). The range of migration values for **GRAY** sites also increased and resulted in a wider distribution of the ranking scores.

It is important to note that crossings which failed to meet the more rigorous criteria may still actually provide partial or temporal passage during certain flow conditions, especially if FishXing identified the only violation of the passage criteria as a lack-of-depth. However, all **RED** sites were given a "total barrier" score in the ranking matrix.

Twelve stream crossings (15% of the sites) were defined as **GREEN** with the first-phase evaluation filter and were assumed to provide unimpeded passage for all age classes of anadromous salmonids. These crossings were typically culverts that spanned at least the average active channel width and were fully embedded with streambed substrate. Due to natural variations in channel morphology, it is recommended that these sites are still periodically inspected to ensure they remain embedded with substrate.

FishXing proved an extremely useful tool in estimating the extent of passage at the 67 **GRAY** and **RED** sites and identifying the probable causes of blockages. However, like most models which attempt to predict complex physical and biological processes with mathematics, there were limitations and assumptions that must be acknowledged.

Over the past six winters, repeated visits to numerous culverts in northern California during migration flows revealed some confounding results generated by FishXing:

1. Adult salmonids having great difficulties entering perched culverts which FishXing suggested were easily within the species' leaping and swimming capabilities.

2. Adult salmonids successfully migrating through water depths defined as "too shallow" by current fish passage criteria.

3. The behavior and abilities of fish are too varied and complex to be summed up with an equation or number taken from a published article. Even a single fishes' leaping and swimming abilities at a culvert may change as numerous attempts are made. Extensive winter-time observations at culverts in northern California have documented individual fish

become fatigued over repetitive attempts, and conversely documented other fish gaining access to culverts after numerous failed attempts (Taylor 2000 and 2001; Love pers. comm.).

Due to these factors, passage evaluation results generated by FishXing were used conservatively in the ranking matrix by lumping "percent passable" into large (20%) categories. Adult steelhead and coho salmon were lumped as the "adult" run, resident coastal rainbow trout and two-year old (2+) steelhead were grouped as the "resident trout" run, and one-year old (1+) and young-of-the-year (y-o-y) steelhead and coho salmon were grouped as the "juvenile" run.

Passage results generated by FishXing are displayed as "percent passable" for the range of migration flows calculated for each stream crossing location within the five sub-watershed categories or areas (Figures 6-10). For each site, by species and lifestage, FishXing evaluation results are provided in Appendix C. The "Comments" column in Appendix C lists assumptions made concerning specific sites while running FishXing. Passage evaluation scores are provided in the Stream Crossing Ranking Matrix (Appendix D).

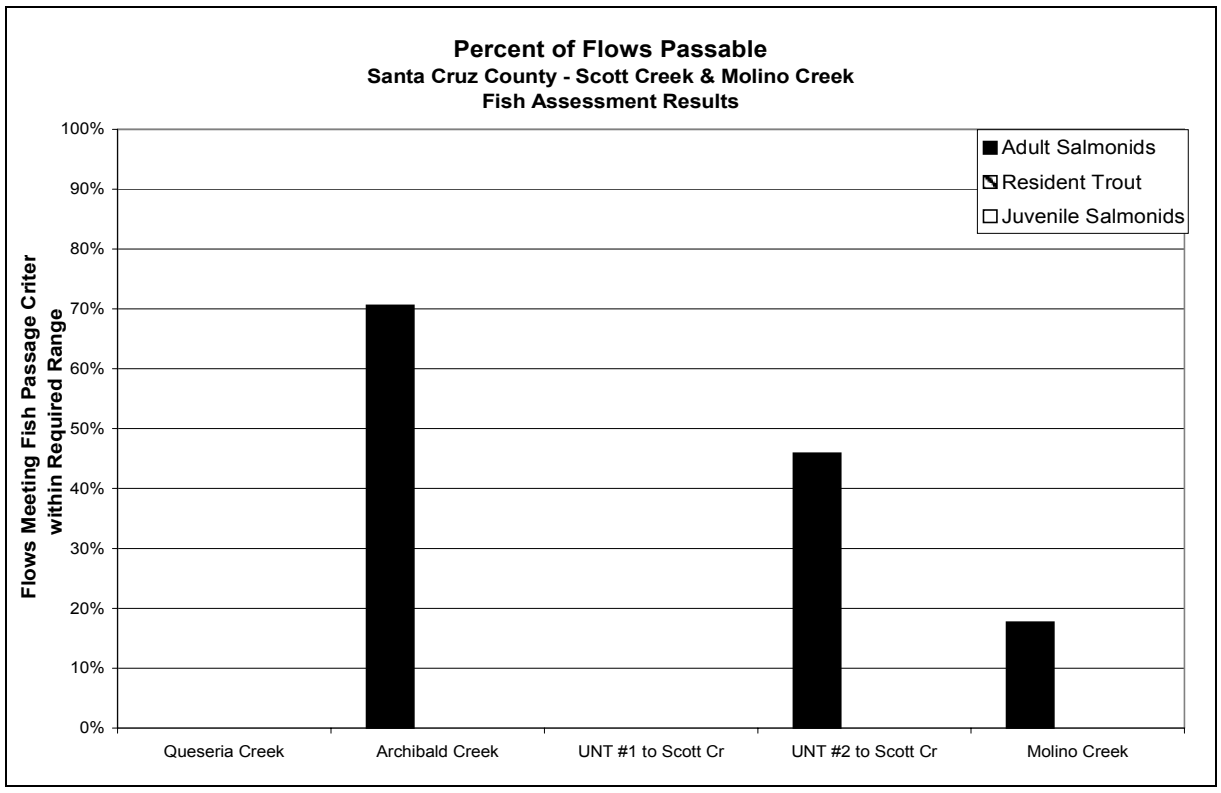

Figure 6. Percent passable as estimated by the Green-Gray-Red evaluation filter and FishXing for five County of Santa Cruz stream crossings within the Scott Creek sub-watershed, by life stages.

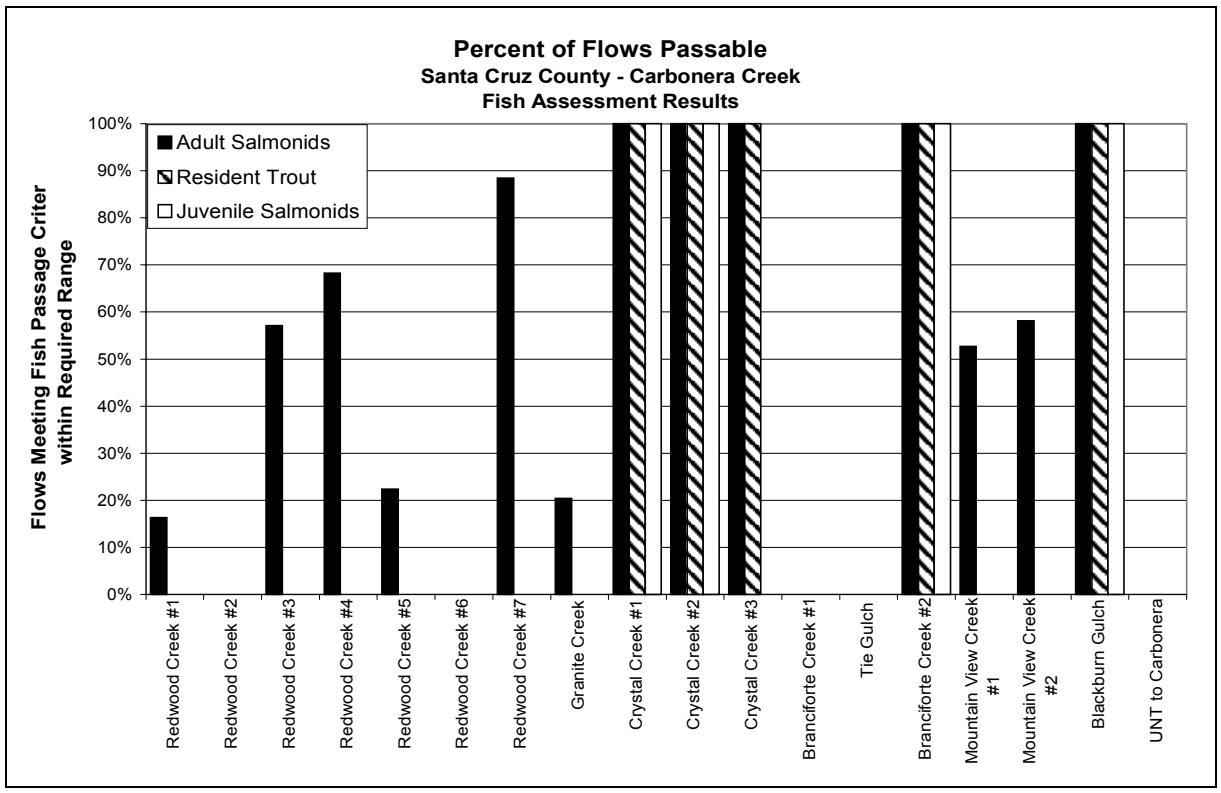

Figure 7. **Percent passable as estimated by the Green-Gray-Red evaluation filter and FishXing for 18 County of Santa Cruz stream crossings within the Branciforte Creek sub-watershed, by life stages.**

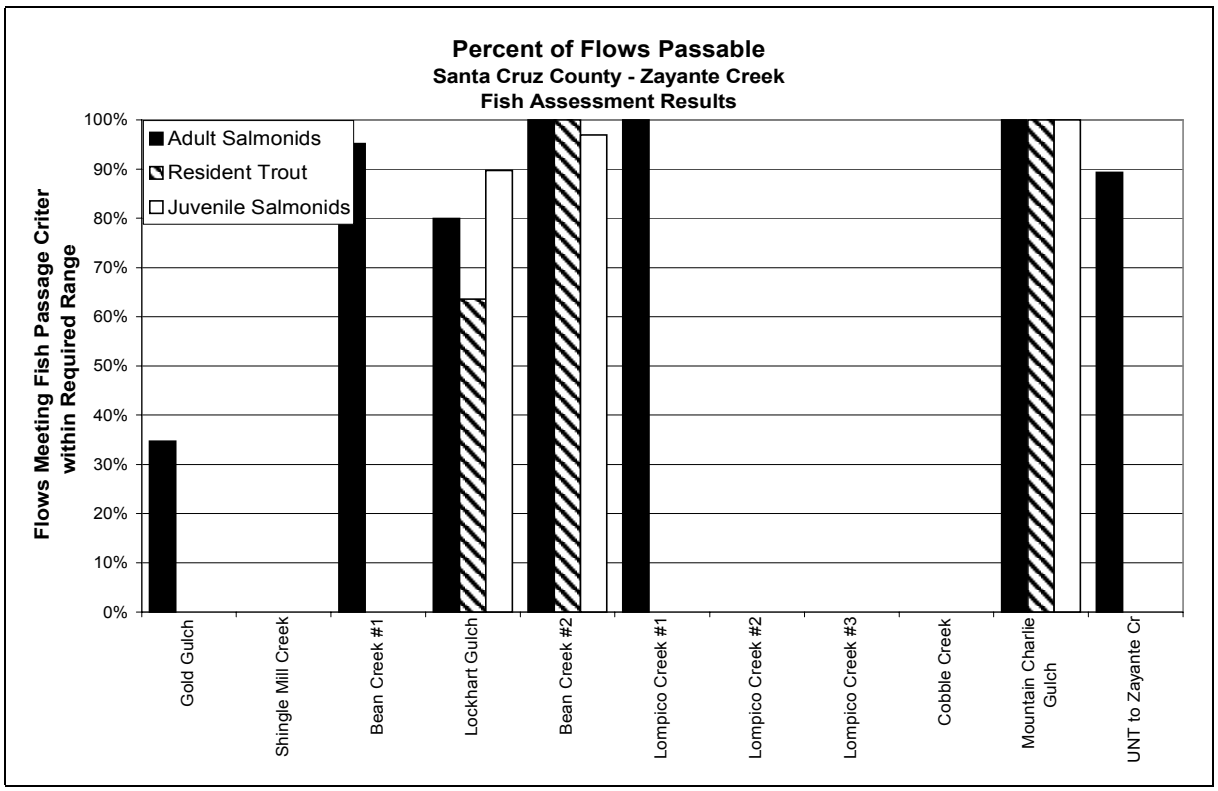

Figure 8. **Percent passable as estimated by FishXing for 11 County of Santa Cruz stream crossings within the Zayante Creek sub-watershed, by life stages.**

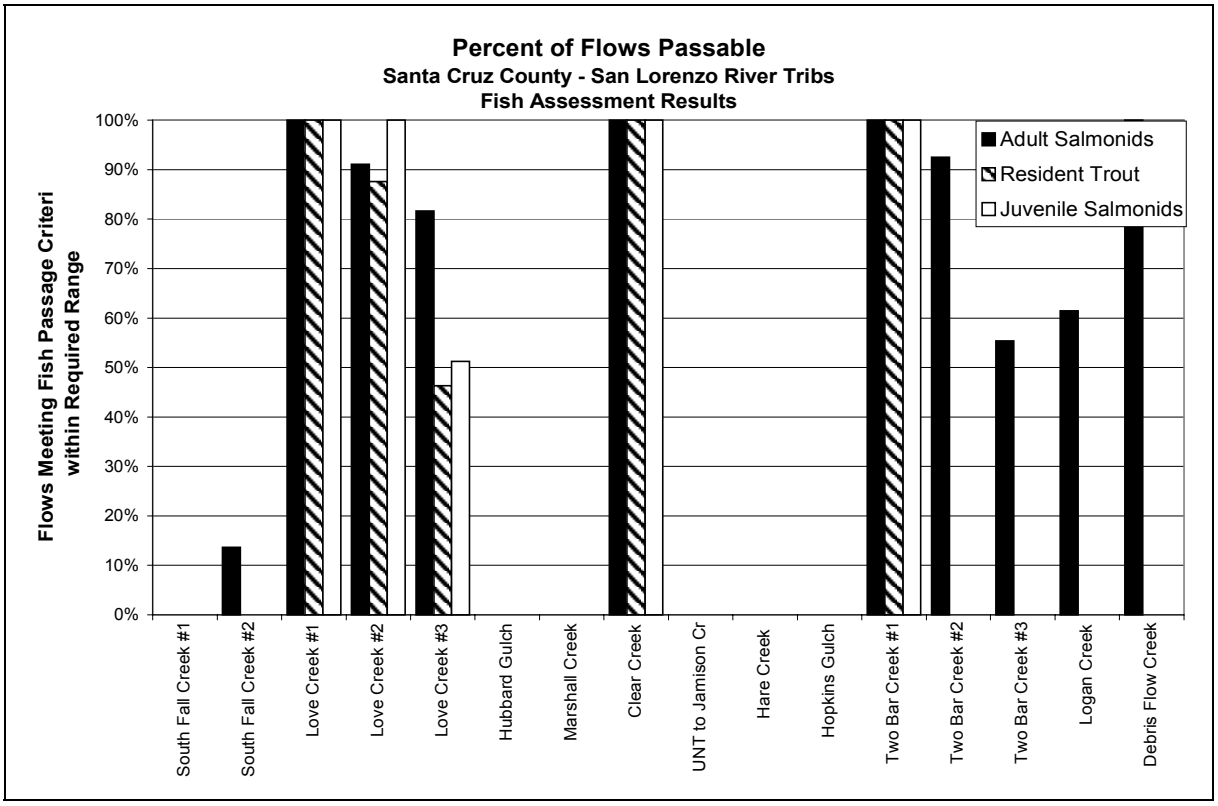

Figure 9. **Percent passable as estimated by FishXing for 16 County of Santa Cruz stream crossings within the San Lorenzo River watershed, by life stages.**

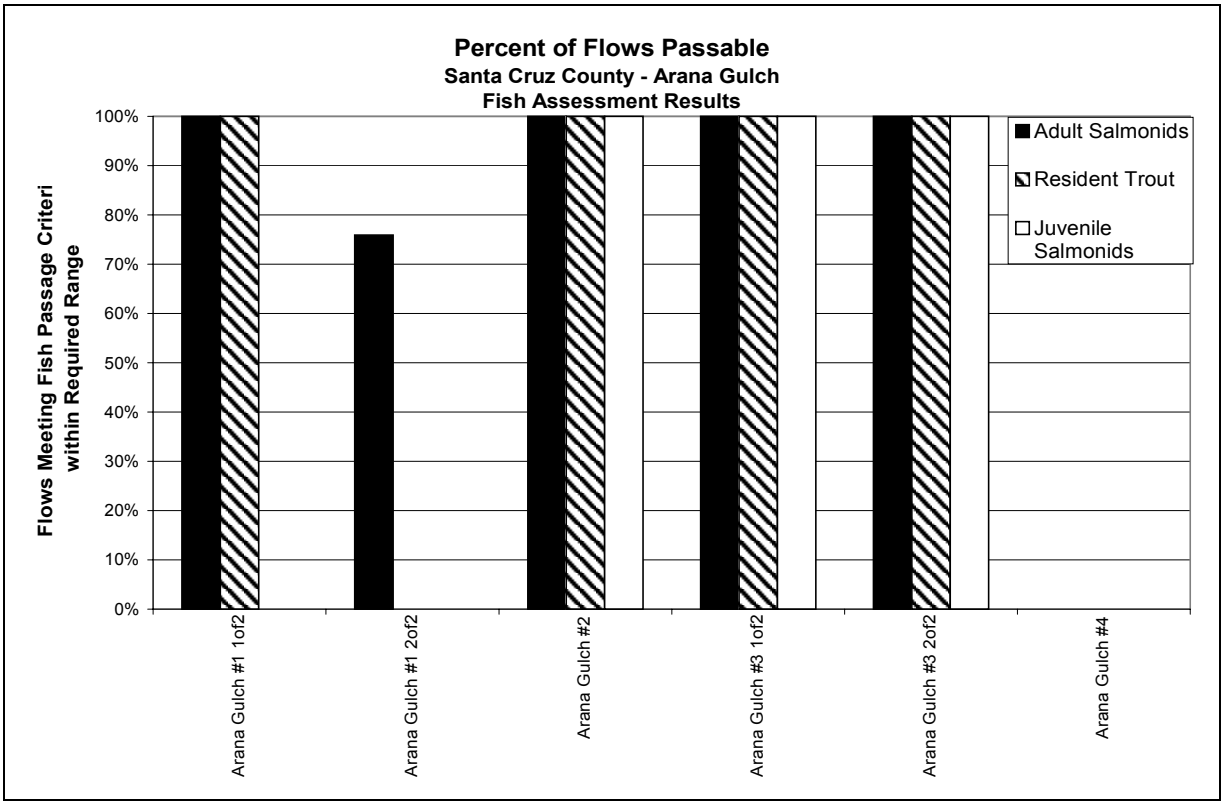

Figure 10. **Percent passable as estimated by FishXing for six County of Santa Cruz stream crossings within the Arana Creek sub-watershed, by life stages.**

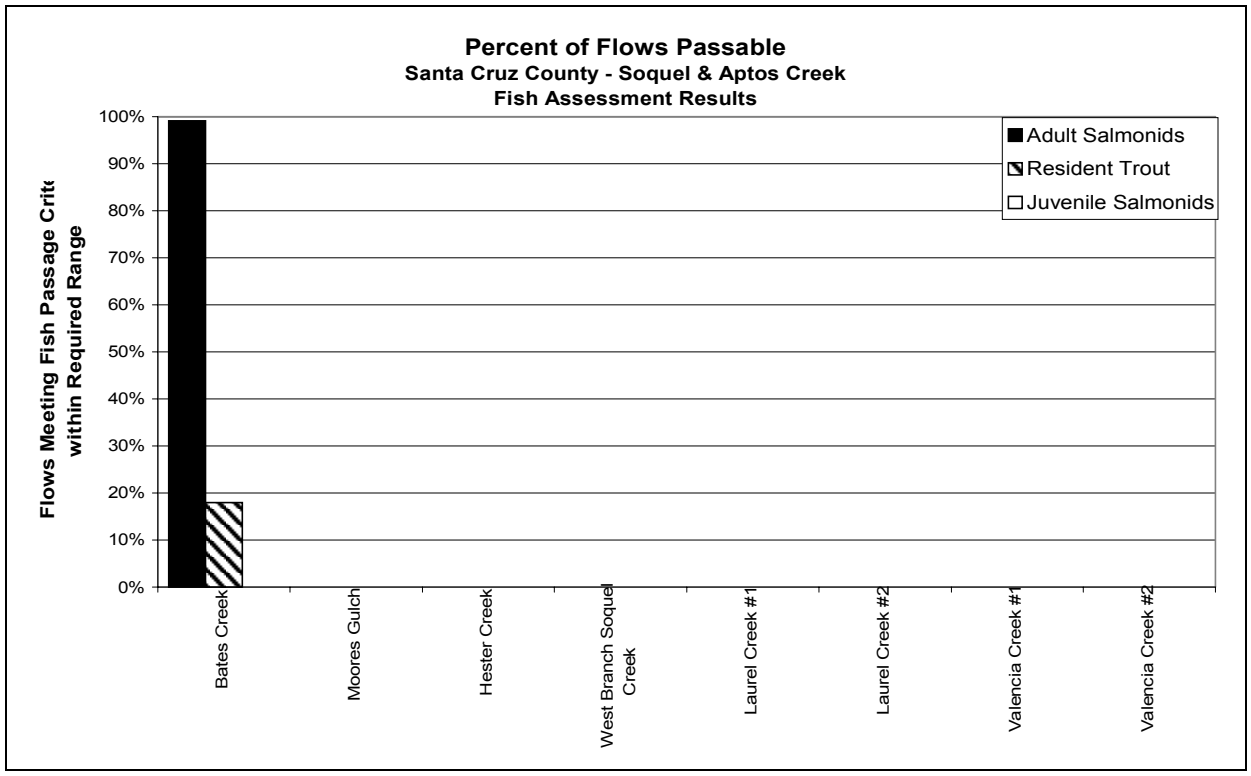

Figure 11. **Percent passable as estimated by FishXing for eight County of Santa Cruz stream crossings within the Soquel Creek and Aptos Creek watersheds, by life stages.**

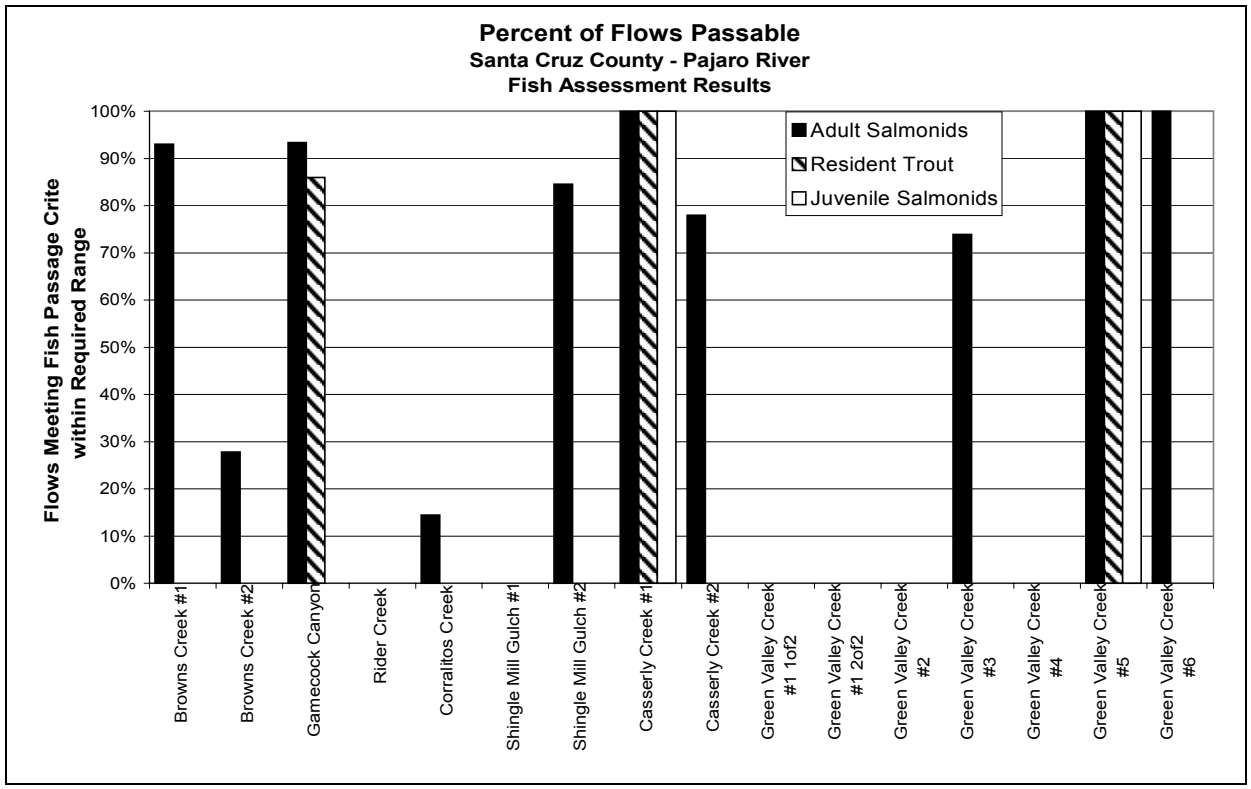

Figure 12. **Percent passable as estimated by FishXing for 16 County of Santa Cruz stream crossings within the Pajaro River watersheds, by life stages.**

Ranking Matrix

The 80 County of Santa Cruz stream crossing locations were sorted in a descending order by "Total Score", the sum of the four ranking criteria (Appendix D). The final ranked list of sites reflects changes made due to professional judgment that included the input of Taylor and Associates, CDFG, and County of Santa Cruz Planning Department (Table 6).

The sites were divided into groups of high, medium, and low priority based on initial ranking and habitat quality. Within each group, the sites are presented in geographic order (from north to south and in an upstream direction) with no attempt to prioritize the exact rank of each site within a sub-group. The development of a treatment schedule is an on-going process with the County and is highly dependant on the future availability of restoration funding.

The final ranked list includes 65 of the 80 sites that were surveyed and initially ranked. Fifteen sites were dropped from the final ranking because information collected suggested that these crossings were not located within fish-bearing stream reaches – due primarily to lack of in-stream salmonid habitat, the steepness of the channel slope, or there was a known migration barrier located downstream of the crossing.

Please note that these 15 sites are still included in the "*Catalog of Santa Cruz County Stream Crossings with Culverts Located Primarily within Fish-bearing Stream Reaches*". The County of Santa Cruz should examine the sizing and condition of the culverts at these crossings, which may assist in scheduling treatments based on road maintenance and repair needs. Many of these crossings are located relatively close to fish-bearing stream reaches and have the potential to impact downstream salmonid habitat – especially if a failure were to occur, resulting in an episodic introduction of sediment.

<u>List of 15 sites dropped from the final ranking were:</u>

1. Unnamed tributary #1 to Scott Creek.
2. Unnamed tributary #2 to Scott Creek.
3. Archibald Creek.
4. South Fall Creek #1.
5. South Fall Creek #2.
6. Marshall Creek.
7. Hubbard Gulch.
8. Debris Flow Creek.
9. Hopkins Gulch.
10. Cobble Creek.
11. Redwood Creek #4.
12. Redwood Creek#5.
13. Redwood Creek #6.
14. Redwood Creek #7.
15. Unnamed tributary to Carbonera Creek.

Summary of the Final Ranking for the County of Santa Cruz's Stream Crossing Inventory

HIGH-PRIORITY LOCATIONS – 13 SITES

Quesaria Creek/Swanton Road (PM 1.32) – *replaced with arch culvert in Fall of 2003.*

West Liddell Creek #1/Bonny Doon Road (PM 0.69) - *passage improvement at Highway 1 should be implemented before treatment of County culverts. Recommend an evaluation of the potential upstream habitat.*

West Liddell Creek #2/Bonny Doon Road (PM 0.74) – *due to poor condition culvert was replaced in Fall of 2003.*

West Liddell Creek #3/Boony Doon Road (PM 0.94) - *passage improvement at Highway 1 should be implemented before treatment of County culverts. Recommend an evaluation of the potential upstream habitat.*

Gold Gulch/Brookside Way (PM = at Willow Way) – *culvert is in poor condition and needs replacement. Project should include channel restoration. Site is funded for design of replacement and permitting.*

Lompico Creek #2/Lompico Road (PM 0.50) – *existing retrofit of sacrete weirs and baffles.*

Lompico Creek #3/Lompico Road (PM 2.00) – *may be eligible for bridge funding.*

Valencia Creek #1/Soquel Drive (PM 6.20) – *funding obtained for fish ladder retrofit design and permitting.*

Valencia Creek #2/Valencia Road (PM 2.29) – *funding obtained for retrofit design and permitting.*

Corralitos Creek/Eureka Canyon Road (PM 2.95) – *existing retrofit of downstream boulder and log weirs and a low-flow channel with baffles is failing. In need of extensive repair/retrofit or replacement. Retrofit designed in March of 2004.*

Shingle Mill Gulch #1/Eureka Canyon Road (PM 4.80) – *habitat assessment is recommended, including ability of steelhead to migrate through steeper sections located downstream of County crossing.*

Browns Creek #1/Browns Valley Road (PM 3.30) – *low flow stem wall needs repair. Floor near outlet needs repair due to scour and under-mining. Retrofit designed in March of 2004.*

Browns Creek #2/Browns Valley Road (PM 3.40) – *failed wing-wall on downstream, right-bank side. Retrofit designed in March of 2004.*

MODERATE-PRIORITY LOCATIONS – 13 SITES

Molino Creek/Swanton Road (PM 0.71) – *approximately 2,700' of available habitat up to dam/impoundment.*

Two Bar Creek #2/Two Bar Road (PM 0.86) – *culvert outlet to be improved in summer of 2004.*

Lompico Creek #1/Lompico Road (PM 0.40) – *passage for adults; existing retrofits could be improved.*

Bean Creek #1/Mount Hermon Road (PM 1.80) – *meets criteria for adults, not juveniles.*

Tie Gulch/Branciforte Drive (PM 0.38) - *habitat assessment is recommended.*

Granite Creek/Granite Road (PM 0.55) – *need to check possible barriers down-stream.*

MODERATE-PRIORITY LOCATIONS (continued)

Branciforte Creek #1/Branciforte Drive (PM 1.03) – *downstream weir is located on private property.*

Arana Gulch #4/Paul Sweet Road (PM 1.30) – *upstream passage barriers should be considered.*

West Branch Soquel Creek/Redwood Lodge Road (PM 1.88) – *located in resident trout reach above a 100% barrier, but culvert is in poor condition and has significant impact on watershed's geomorphic processes. funded for replacement or retrofit design (IWRP).*

Bates Creek/Main Street (PM 0.60) – *funded for bridge design by the Integrated Watershed Restoration Program (IWRP).*

Hester Creek/Soquel-San Jose Road (PM 5.30) – *funded for replacement or retrofit design (IWRP).*

Shingle Mill Gulch #2/Eureka Canyon Road (PM 5.24) – *current culvert is under-sized, in poor condition, and due for a full replacement.*

Green Valley Creek #6/Green Valley Road (PM 0.69) – *current culvert sized for less than a five-year storm flow and should be replaced to provide improved passage for resident coastal rainbow trout.*

LOW-PRIORITY LOCATIONS – 27 SITES

Shingle Mill Creek/Redwood Drive (PM at Oak Drive) – *dropped in ranking due barrier upstream and poor habitat quality.*

Hare Creek/Hare Way (PM 0.20)– *dropped in ranking due to poor habitat quality.*

Unnamed tributary to Jamison Creek/Jamison Creek Road (PM 2.49) – *dropped in ranking due to poor habitat quality.*

Two Bar Creek #3/Two Bar Road (PM 2.70) – *although "RED" there is limited habitat upstream.*

Logan Creek/Kings Creek Road (PM 2.65) – *arch culvert installed in 1999 was assessed as "RED", yet there is limited upstream habitat (<1000').*

Love Creek #2/Love Creek Road (PM 0.90) - *meets most passage criteria for adults and juveniles.*

Love Creek #3/Love Creek Road (PM 1.30) - *meets most of passage criteria for adults and juveniles*.

Bean Creek #2/Bean Creek Road (PM 3.00) – *meets passage criteria for adults and 2+ juveniles; most for other juveniles.*

Lockhart Gulch/Lockhart Gulch Road (PM 0.60) – *provides adequate passage opportunities; however culvert is sized for only a two-year storm flow.*

Unnamed tributary to Zayante Creek/East Zayante Road (PM 6.22) - *meets passage criteria for adults.*

Redwood Creek #1/Glen Canyon Road (PM 1.02) – *dropped in rank due to small stream size and habitat quality.*

Redwood Creek #2/Redwood Drive (PM 0.10) - *dropped in ranking due to small stream size and habitat quality.*

Redwood Creek #3/Redwood Drive (PM 0.20) - *dropped in ranking due to small stream size and habitat quality*.

Mountain View Creek #1/Vine Hill Road (PM 0.00) – *dropped in ranking due to poor habitat quality.*

LOW-PRIORITY LOCATIONS (continued)

Mountain View Creek #2/Mountain View Road (PM 0.76) – *dropped in ranking due to poor habitat quality.*

Crystal Creek #3/Happy Valley Road (PM 0.18) – *dropped in ranking due to small stream size limited reach of upstream habitat.*

Arana Gulch #1/Capitola Road (PM 0.01 to Soquel Ave) – *meets passage criteria for adults and 2+ juveniles.*

Moores Gulch/Soquel-San Jose Road (PM 3.10) – *performance of fish ladder at culvert is un known and should be further assessed. Site would be an expensive culvert replacement project.*

Laurel Creek #1/Morrell Road (PM 0.85) – *located upstream of two complete passage barriers.*

Laurel Creek #2/Soquel-San Jose Road (PM 11.00) – *located upstream of two complete passage barriers.*

Rider Creek/Rider Road (PM 0.29) – *dropped in ranking due to poor habitat quality.*

Gamecock Canyon/Hazel Dell (PM 3.30) – *provides nearly 100% passage for adults and 2+ juveniles.*

Green Valley Creek #1/Casserly Road (PM 0.20) - *need to consider policy to preserve genetic integrity of native resident coastal rainbow trout located in upper reaches of Green Valley Creek.*

Green Valley Creek #2, #3, #4/Green Valley Road (PM 4.03, 3.25, 1.98) – *need to consider policy to preserve genetic integrity of native resident coastal rainbow trout located in upper reaches of Green Valley Creek.*

Casserly Creek #2/Mount Madonna Road (PM 1.00) – *small stream size and limited reach of potential habitat.*

LOW-PRIORITY LOCATIONS: PASSAGE = GREEN – 12 SITES

Two Bar Creek #1/Two Bar Road (PM 0.63) – *properly-sized (>250-year discharge).*

Love Creek #1/Love Creek Road (PM 0.40) – *under-sized (<10-year discharge).*

Mountain Charlie Gulch/East Zayante Road (PM 5.21) – *under-sized (≈ 10-year discharge).*

Branciforte Creek #2/Branciforte Drive (PM 5.00) – *adequately-sized (≈60-year discharge).*

Crystal Creek #1/Branciforte Drive (PM 2.02) – *extremely under-sized (< 5-year discharge).*

Crystal Creek #2/Happy Valley Road (PM 0.09) – *under-sized (≈5-year discharge).*

Clear Creek/Clear Creek Road (PM 0.05) – *under-sized (≈7-year discharge).*

Blackburn Gulch/Vine Hill Road (PM 0.31) – *properly-sized (>250-year discharge).*

Arana Gulch #2/Soquel Avenue (PM 0.1 to Capitola Road) – *under-sized (≈11-year discharge).*

Arana Gulch #3/Brookwood Drive (PM 0.20) – *extremely under-sized (≈3-year discharge).*

Green Valley Creek #5/Green Valley Road (PM 0.89) – *properly-sized (≈130-year discharge).*

Casserly Creek #1/Casserly Road (PM 1.50) – *under-sized (≈14-year discharge).*

Table 6. Final ranking of 65 stream crossing locations on the County of Santa Cruz road system.

Final Rank	Stream Name	Road Name	Comments to Final Ranking
High	Queseria Creek (PM = 1.32)	Swanton Road	High-priority due to: severity of barrier = "RED" for all species and life stages and 3,200' of upstream habitat. Only County-maintained site located on a stream that potentially supports both coho salmon and steelhead. Upstream habitat was rated as "poor" by CDFG biologist, due to small stream size. A more in-depth field reconnaissance of this stream is recommended prior to developing a proposal for acquiring treatment funds. The current culvert is extremely undersized and overtops on less than a five-year storm flow.
High	West Liddell Creek #1 (PM = 0.69)	Bonny Doon Road	High-priority site due to: severity of barrier = "RED" for both adult and juvenile steelhead, quantity and quality of upstream habitat (approximately 1.8 miles), and sizing and condition of current crossing. The culvert has a perched outlet that probably impedes most migration attempts. The habitat is in good condition and there is little potential for future development within the watershed that would degrade habitat quality. A full replacement of the current concrete box culvert is recommended because it is severely under-sized and past high flows through the culvert have damaged stream-banks and County road prism. Grade control weirs must be incorporated into the replacement's design because of the proximity of West Liddell Creek#2. The crossing at West Liddell Creek #3 should be treated soon after this project to open up the entire reach of potential habitat. Passage through the crossing located underneath Highway 1 and the railroad should be evaluated (and if needed, treated) prior to treating the County-maintained sites on Bonny Doon Road.
High	West Liddell Creek #2 (PM = 0.74)	Bonny Doon Road	High-priority due to: although "GRAY" for adult and juvenile steelhead and allows for partial passage, the culvert is extremely undersized, poorly aligned with the stream channel and in extremely poor condition. The habitat is in good condition and there is little potential for future development within the watershed that would degrade habitat quality. If feasible, the County should consider treating sites #1 and #2 as a single project to minimize impacts to the channel and aquatic biota, reduce traffic delays, and reduce costs by developing a single set of project permits. Passage through the crossing located underneath Highway 1 and the railroad should be evaluated (and if needed, treated) prior to treating the County-maintained sites on Bonny Doon Road.
High	West Liddell Creek #3 (PM = 0.94)	Bonny Doon Road	High-priority due to: severity of the barrier = "RED" for all steelhead life stages and a significant length of upstream habitat gain (≈ 1.3 miles). The habitat is in good condition and there is little potential for future development within the watershed that would degrade habitat quality. Current culvert is undersized and overtops on less than a 10-year storm flow. This site should be treated after passage is restored at the two lower sites = West Liddell Creek #1 and #2.

Table 6 (continued). Final ranking of 65 stream crossing locations on the County of Santa Cruz road system.

Final Rank	Stream Name	Road Name	Comments to Final Ranking
High	Gold Gulch (PM = at Willow Way)	Brookside Way	High-priority due to: severity of the barrier = 35% passable for adult steelhead, severely undersized, in extremely poor condition and has a moderate length (3,700') of low-gradient upstream habitat and one of first tributaries to San Lorenzo River. The culvert has several sharp breaks-in-slope within the road prism where sections of the culvert have separated. Large sections of the culvert floor are rusted through and have been torn by flows and storm debris. The culvert is also extremely undersized and overtops on less than a five-year storm flow. If this crossing were to fail, nearly 2,000 cubic yards of fill material would be introduced to the downstream channel. Hope (1986) identified this crossing and the box culvert located downstream at Hwy 9 as migration barriers.
High	Lompico Creek #2 (PM = 0.50)	Lompico Road	High-priority due to: severity of barrier = "RED" for all steelhead life stages and significant length of upstream habitat (approximately 3.7 miles). The culvert is baffled and has a series of downstream weirs that allows partial passage of adult steelhead. The current culvert is undersized and overtops on less than a 10-year storm flow – thus a full replacement with either a bridge or an open-bottom arch set on footings is the best long-term solution for treating this crossing.
High	Lompico Creek #3 (PM = 2.0)	Lompico Road	High-priority due to: severity of barrier = "RED" for all steelhead life stages and significant length of upstream habitat gain (approximately 2.4 miles). The current culvert is undersized and overtops on approximately a 15-year storm flow – thus a full replacement with either a bridge or an open-bottom arch set on footings is the best long-term solution for treating this crossing.
High	Valencia Creek #1 (PM = 6.20)	Soquel Drive	High-priority due to: severity of the barrier = "RED" for all steelhead life stages and significant length of upstream habitat gain (more than 10 miles). Current box culvert is undersized and overtops on less than a 10-year storm flow. Because of the large amount of upstream habitat, the best long-term treatment is a full replacement with a bridge. However, the 10,000+ cubic yards of road fill makes this a very expensive replacement project. The current culvert has been modified with a low-flow divider and offset baffles, but its effectiveness is probably limited by the nearly 4-foot drop that remains at the outlet. A treatment should focus on raising the downstream tail-water elevation. The active channel width of nearly 20 feet and large storm discharges would make a series of boulder weirs an expensive treatment. An engineered fish ladder may be a feasible alternative. Treat concurrently with the upstream crossing at Valencia Creek #2/Valencia Road.
High	Valencia Creek #2 (PM = 2.29)	Valencia Road	High-priority due to severity of the barrier = "RED" for all steelhead life stages and significant length of upstream habitat gain (≈ 2.2 miles). Treatment should occur concurrently with Valencia Creek #1. The habitat above this site was rated as "fair". Current culvert was modified with a set of five steel ramp baffles, however further modifications are required to improve fish passage. A series of downstream weirs is needed to raise the tail-water elevation and the concrete apron at the inlet should be either removed or made rougher.

Table 6 (continued). Final ranking of 65 stream crossing locations on the County of Santa Cruz road system.

Final Rank	Stream Name	Road Name	Comments to Final Ranking
High	Corralitos Creek (PM = 2.95)	Eureka Canyon Road	High-priority due to: severity of barrier = "RED" for all species and life stages and potential habitat gain of nearly five miles of good-quality spawning and rearing habitat. The current box culvert could be modified with corner baffles and several downstream boulder weirs (or a roughened riffle) to improve the passage of adult steelhead. A full replacement with a bridge or an open-bottom arch is the best long-term treatment to allow for unimpeded migration of both adult and juvenile steelhead, however the nearly 5,000 cubic yards of road fill makes this an expensive project. Adult steelhead were observed making numerous, unsuccessful leap attempts at the outlet in February, 2004 (Schroeder, pers. comm.).
High	Shingle Mill Gulch #1 (PM = 4.80)	Eureka Canyon Road	High-priority – "RED" for adult and juvenile steelhead. 5.400' of potential upstream habitat, but needs additional habitat assessment. The downstream channel is quite steep, with several reaches of eight to 10% slopes. Culvert is undersized and overtops on less than a 10-year storm flow. When needed, replace with a properly-sized crossing.
High	Browns Creek #1 (PM = 3.3)	Browns Valley Road	High-priority due to: severity of barrier = "RED" for all steelhead life stages and the quantity and quality of upstream habitat (approximately 3 miles). The culvert has a low-flow partition that probably allows for partial passage even though it fails to meet state and federal passage criteria. The current box culvert could be cost-effectively re-modified with corner baffles and several downstream boulder weirs to improve fish passage at a relatively low cost. If feasible, correct the poor channel alignment on the upstream side of the crossing. A full replacement with a bridge is the best long-term treatment to allow for unimpeded migration of both adult and juvenile steelhead. Treat concurrently with Browns Creek #2.
High	Browns Creek #2 (PM = 3.40)	Browns Valley Road	High-priority due to: severity of barrier = "RED" for all steelhead life stages and the quantity and quality of upstream habitat (approximately 2.1 miles). The culvert has a low-flow partition that probably allows for temporal/partial passage beyond the level of passage estimated by FishXing. The current box culvert could be cost-effectively re-modified with corner baffles and several downstream boulder weirs to improve fish passage at a relatively low cost. A full replacement with a bridge is the best long-term treatment to allow for unimpeded migration of both adult and juvenile steelhead. Treat concurrently with Browns Creek #1.
Mod	Molino Creek (PM = 0.71)	Swanton Road	Moderate-priority due to: although "RED" for adult and juvenile steelhead there is a limited reach of available upstream habitat, approximately 2,700' up to a dam and small reservoir. The upstream habitat was rated as "fair" by CDFG. The current concrete box culvert is undersized and over tops on approximately an 11-year storm flow and is in poor condition. The crossing is probably due for a replacement and should be replaced with a properly-sized open-bottomed arch or a bridge.

Table 6 (continued). Final ranking of 65 stream crossing locations on the County of Santa Cruz road system.

Final Rank	Stream Name	Road Name	Comments to Final Ranking
Mod	Two Bar Creek #2 (PM = 0.86)	Two Bar Road	Moderate-priority due to: nearly 100% passage for adult steelhead and "RED" for juvenile steelhead. There is a significant reach of upstream habitat (≈ 2.4 miles), but habitat quality is rated as "fair" and Public Works lined the bottom of the culvert and improved outlet conditions in summer 2003. When needed, replace with a properly-sized crossing.
Mod	Lompico Creek #1 (PM = 0.40)	Lompico Road	Moderate-priority due to: current crossing is "GREEN" for adults and "RED" for juveniles; however the site was retrofitted with baffles and downstream weirs that were difficult to accurately evaluate with FishXing. Restoring unimpeded passage through this site is vital if the upper two county –maintained sites are treated. The crossing is extremely undersized and without accounting for the baffles conveys only a three-year storm flow. The culvert is also in poor condition. Replace with a properly-sized open-bottomed arch or a bridge.
Mod	Bean Creek #1 (PM = 1.80)	Mount Hermon Road	Moderate-priority due to: although "GRAY" for adult and "RED" for juvenile steelhead passage criteria, the previous modifications probably allow for a range of both adult and juvenile passage. There is more than five miles of upstream habitat. Site should be periodically inspected for cleaning of baffles. Current culvert is properly- sized and is in good condition. Fish passage could be cost-effectively improved by constructing a series of three to four downstream concrete weirs to raise the tail-water elevation and back-flood the culvert.
Mod	Tie Gulch (PM = 0.38)	Branciforte Drive	Moderate-priority due to: although "RED" for adult and juvenile steelhead and with a moderate length of upstream habitat (≈ 3,700'), little information was available to assess habitat quality and fish distribution. Site should be periodically inspected for condition. Culvert is moderately-sized and conveys approximately a 36-year storm flow. When needed, replace with a properly-sized crossing.
Mod	Granite Creek (PM = 0.55)	Granite Road	Moderate-priority due to: although the crossing is "RED" for adult and juvenile steelhead with a substantial length of potential upstream habitat (nearly 5,000'), there are three potential migration barriers on private property downstream of Granite Road that should be evaluated. The first site is a six-foot diameter culvert just above Granite Creek's confluence with Branciforte Creek. The second site is a crossing constructed of concrete and wood. The third site is a four-foot high dam. The concrete box culvert at Granite Road is extremely undersized and overtops on less than a five-year storm flow. A full replacement with a properly-sized bridge or open-bottom arch is recommended after any downstream barrier impediments are treated.

Table 6 (continued). Final ranking of 65 stream crossing locations on the County of Santa Cruz road system.

Final Rank	Stream Name	Road Name	Comments to Final Ranking
Mod	Branciforte Creek #1 (PM = 4.20)	Branciforte Drive	Moderate-priority due to: although the crossing is "RED" for adult and juvenile steelhead and there is a substantial length of potential upstream habitat (nearly three miles), the crossing probably provides at least partial passage for adults due to concrete weir below the outlet. However, there appears to be a lack-of-depth in the pool below the weir for fish to leap out of. It is recommended that the performance of the weir be evaluated during winter migration flows. If warranted, passage could be cost-effectively improved by re-modifying the downstream weir. Approximately 9,000 feet of the potential habitat is located upstream of a significant partial barrier in Blackburn Gulch (dam on bedrock) that some adult steelhead may pass on certain flows.
Mod	Arana Gulch #4 (PM = 1.30)	Paul Sweet Road	Moderate-priority due to: although "RED" for adult and juvenile steelhead there is a limited reach of upstream habitat (≈ 1,900'). No information was available to assess fisheries or habitat value. Culvert is extremely undersized and overtops on less than a five-year storm flow. When needed, replace with a properly-sized crossing.
Mod	West Branch Soquel Creek (PM = 1.88)	Redwood Lodge Road	Moderate-priority due to: although "RED" for adult and juvenile steelhead and located above the limit of anadromy, there is nearly two miles of resident coastal rainbow trout upstream habitat that was rated as "good" by CDFG. The current culvert is also in poor condition and has a significant impact on geomorphic processes to the West Branch of Soquel Creek. The best long-term solution is a replacement with a bridge. CDFG should investigate the feasibility of restoring passage over the downstream dam.
Mod	Bates Creek (PM = 0.60)	Main Street	Moderate-priority due to: "GRAY" for adult steelhead and "RED" for juveniles with a significant reach of good-quality upstream habitat (more than five miles). Culvert is extremely undersized, overtops on less than a five-year storm flow, and is in extremely poor condition. Thus, a full replacement with either a bridge or an open-bottom arch set on footings is the best long-term solution for treating this crossing.
Mod	Hester Creek (PM = 5.30)	Soquel-San Jose Road	Moderate-priority due to: although "RED" for both adult and juvenile steelhead there is a limited amount of upstream habitat (≈ 3,800') due to numerous four-to-six foot drops over debris jams of large wood and an auto body. Culvert's steep slope creates a velocity barrier for migrating steelhead. Because the culvert is properly-sized, passage could be cost-effectively improved by installing a series of downstream boulder weirs downstream of the culvert and concrete weirs within the box culvert.
Mod	Shingle Mill Gulch #2 (PM =5.24)	Eureka Canyon Road	**Moved up in final ranking** because of potential good quality habitat upstream. However, needs more habitat assessment. The current culvert is extremely undersized (overtops on less than a 10-year storm flow) and is in poor condition. This crossing is due for an upgrade and the replacement should be properly-sized to convey additional storm flow.

Table 6 (continued). Final ranking of 65 stream crossing locations on the County of Santa Cruz road system.

Final Rank	Stream Name	Road Name	Comments to Final Ranking
Mod	Green Valley Creek #6 (PM = 0.69)	Green Valley Road	**Moved up in final ranking** because recent research (Smith) indicates that this reach supports a genetically unique population of resident rainbow trout. Moderate priority: "RED" for adult and juvenile steelhead. Culvert is extremely undersized and overtops on less than a five-year storm flow. When needed, replace with a properly-sized crossing.
Low	Shingle Mill Creek	Redwood Drive	**Dropped in ranking** because limited habitat upstream of culvert, including a barrier immediately upstream. The channel slope increases quickly upstream of Redwood Drive. Low-priority due to: although "RED" for adult and juvenile steelhead there is a limited amount of upstream habitat, plus no current information exists documenting salmonid distribution.
Low	Hare Creek (PM = 0.20)	Hare Way	**Dropped in ranking** because of poor habitat quality in Hare Creek. The current culvert is extremely undersized (overtops on less than a 5-year storm flow) and is in poor condition. The entire culvert invert is rusted-through and there is a break-in-slope within the culvert. This crossing is due for an upgrade and the replacement should be properly-sized to convey additional storm flow.
Low	Unnamed tributary to Jamison Creek (PM = 2.49)	Jamison Creek Road	**Moved down in final ranking**: although "RED" for adult and juvenile steelhead, there is a very limited length of potential upstream habitat (≈ 400'). No information was available to assess fisheries or habitat value. Culvert is extremely undersized and overtops on less than a five-year storm flow. When needed, replace with a properly-sized crossing.
Low	Two Bar Creek #3 (PM = 2.70)	Two Bar Road	Low-priority due to although "RED" for adult and juvenile steelhead, there is a limited reach of suitable upstream habitat (≈ 1,200'). Site should be periodically inspected for condition. Current culvert is properly-sized and is in fair condition. When needed, replace with a properly-sized crossing.
Low	Logan Creek (PM = 2.65)	Kings Creek Road	Low-priority due to: although "RED" for adult and juvenile steelhead and with a very limited length of upstream habitat (<1,000'). Site should be periodically inspected for condition. Culvert is extremely undersized and overtops on less than a five-year storm flow. When needed, replace with a properly-sized crossing.
Low	Love Creek #2 (PM = 0.90)	Love Creek Road	Low-priority due to: current crossing is "GRAY" but meets most of CDFG passage criteria over the entire range of estimated migration flows. Site should be periodically inspected for condition. Culvert is undersized and overtops on less than a five-year storm flow. When needed, replace with a properly-sized crossing.
Low	Love Creek #3 (PM = 1.30)	Love Creek Road	Low-priority due to: passes adults on most flows and juvenile steelhead with a very limited length of upstream habitat (<1,000'). There is limited information available to assess fisheries or habitat value. Site should be periodically inspected for condition. Culvert is undersized and overtops on less than a 10-year storm flow. When needed, replace with a properly-sized crossing.

Table 6 (continued). Final ranking of 65 stream crossing locations on the County of Santa Cruz road system.

Final Rank	Stream Name	Road Name	Comments to Final Ranking
Low	Bean Creek #2 (PM = 3.00)	Bean Creek Road	Low-priority due to: current crossing is "GRAY", culvert meets passage criteria for adults and 2+ juveniles and passes 1+ and young-of-the-year juveniles on most flows. Culvert is adequately sized and is in fair condition.
Low	Lockhart Gulch (PM = 0.60)	Lockhart Gulch Road	Low-priority due to: although "GRAY" for adult and juvenile steelhead, this crossing provides an ample window of suitable conditions for migration. Site should be periodically inspected for condition. Culvert is extremely undersized and overtops on approximately a two-year storm flow. When needed, replace with a properly-sized crossing.
Low	Unnamed trib to Zayante Creek	East Zayante Rd.	Low-priority due to: passes adults on most flows but fails passage criteria for juveniles. There is limited information available to assess fisheries or habitat value. Site should be periodically inspected for condition. Culvert is extremely undersized and overtops on approximately a two-year storm flow. When needed, replace with a properly-sized crossing.
Low	Redwood Creek #1 (PM = 1.02)	Glen Canyon Road	**Moved down in final ranking** due to small stream size. Low priority even though the crossing is "RED" for adult and juvenile steelhead. Needs additional information on steelhead access and upstream habitat quality and quantity. While Redwood Creek #2 scored higher, this site should be treated first or in concert with treating Redwood Creek #2 and #3. Current crossing is undersized and overtops on approximately a six-year storm flow. Because of its poor sizing, a retrofit of this box culvert is not recommended due to increased likelihood of flooding.
Low	Redwood Creek #2 (PM = 0.10)	Redwood Drive	**Moved down in final ranking** due to small stream size Low-priority due to: although the crossing is "RED" for adult and juvenile steelhead, there is a passage barrier 4,600' upstream and little is known about habitat quality or fish distribution in Redwood Creek. Current crossing is undersized and overtops on approximately a six-year storm flow. Because of its poor sizing, a retrofit of this box culvert is not recommended due to increased likelihood of flooding. A full replacement with either a bridge or an open-bottom arch set on footings is the best long-term solution for treating this crossing.
Low	Redwood Creek #3 (PM = 0.20)	Redwood Drive	**Dropped slightly in final ranking** due to small stream size and because there are two county-maintained sites to treat downstream of Redwood Creek #3 in order to re-establish stream connectivity in a logical fashion. Low-priority due to: although the crossing is "RED" for adult and juvenile steelhead, there is a passage barrier 4,600' upstream and little is known about habitat quality or fish distribution in Redwood Creek. Current culvert is undersized and overtops on approximately a seven-year storm flow and is in poor condition with a rusted-through invert. The current culvert is also poorly aligned with the stream channel. A full replacement with either a bridge or an open-bottom arch set on footings is the best long-term solution for treating this crossing.

Table 6 (continued). Final ranking of 65 stream crossing locations on the County of Santa Cruz road system.

Final Rank	Stream Name	Road Name	Comments to Final Ranking
Low	Mountain View Creek #1 (PM = 0.00)	Vine Hill Road	Low-priority due to: although "GRAY" for adults and "RED" juvenile steelhead, there is a limited length of upstream habitat (≈3,400'). This is a small, fish-bearing stream, but no information was available to assess fisheries or habitat value. Site should be periodically inspected for condition. Culvert is moderately sized and overtops on approximately a 16-year storm flow. When needed, replace with a properly-sized crossing.
Low	Mountain View Creek #2 (PM = 0.76)	Mountain View Road	Low-priority due to: although "RED" for adult and juvenile steelhead and with a limited length of potential upstream habitat (≈ 900'). This is a small, fish-bearing stream, but no information was available to assess fisheries or habitat value. Culvert is properly- sized, but is in poor condition When needed, replace with a properly-sized crossing that meets fish passage criteria.
Low	Crystal Creek #3 (PM = 0.18)	Happy Valley Road	Low-priority due to: although "GRAY" for adult and juvenile steelhead and with a limited length of potential upstream habitat (≈ 1,800'). This is a small, fish-bearing stream, but no information was available to assess fisheries or habitat value. Culvert is extremely undersized and overtops on less than a five-year storm flow. When needed, replace with a properly-sized crossing.
Low	Arana Gulch #1 (PM = 0.1 miles to Soquel Ave.)	Capitola Road	Low-priority due to: current crossing is "GRAY", but meets CDFG's passage criteria for adult and 2+ juveniles but fails to meet passage criteria for 1+ and young-of-the-year juveniles. Site should be periodically inspected for condition. Culvert is under- sized and overtops on approximately a six year storm flow. When needed, replace with a properly-sized crossing.
Low	Moores Gulch (PM = 3.10)	Soquel–San Jose Road	Low-priority due to: although "RED" for adult and juvenile steelhead and with nearly one mile of upstream habitat, the culvert probably passes adult steelhead on some migration flows. The crossing was difficult to assess passage due to the complex fish ladder constructed at the culvert outlet. Field visits are recommended to confirm whether this structure passes fish or captures storm debris and is rendered ineffective during fish migration flows. Culvert is undersized and overtops on less than a 10-year storm flow. When needed, replace with a properly-sized crossing.
Low	Laurel Creek #1 (PM = 0.85)	Morrell Road	Low-priority due to: although "RED" for adult and juvenile steelhead, site is upstream of two complete passage barriers. If passage is provided at the downstream sites, more information on fisheries and habitat quality should be collected. Site should be periodically inspected for condition. Culvert is extremely undersized and overtops on less than a five-year storm flow. When needed, replace with a properly-sized crossing.

Table 6 (continued). Final ranking of 65 stream crossing locations on the County of Santa Cruz road system.

Final Rank	Stream Name	Road Name	Comments to Final Ranking
Low	Laurel Creek #2 (PM = 11.00)	Soquel-San Jose Road	Low-priority due to: although "RED" for adult and juvenile steelhead, site is upstream of two complete passage barriers. If passage is provided at the downstream sites, more information on fisheries and habitat quality should be collected. No information was available to assess fisheries or habitat value. Culvert is extremely undersized and overtops on less than a five-year storm flow. When needed, replace with a properly-sized crossing.
Low	Rider Creek (PM = 0.29)	Rider Road	Low-priority due to: although "RED" for adult and juvenile steelhead, there is a limited length of poor quality potential upstream habitat (≈ 1,200'). Culvert is undersized and overtops on less than a 10-year storm flow. When needed, replace with a properly-sized crossing.
Low	Gamecock Canyon (PM = 3.30)	Hazel Dell Road	Low-priority due to: meets CDFG passage criteria for adult and 2+ juvenile steelhead on over 80% of expected migration flows. The crossing's natural bottom probably allows partial passage of 1+ and y-o-y age juvenile age classes too. There is a significant reach of good-quality upstream habitat (≈ 5,700'). The crossing overtops on approximately a 15-year storm flow and is in good condition. When needed, replace with a properly-sized crossing that meets CDFG passage criteria.
Low	Green Valley Creek #1 (PM = 0.20)	Casserly Road	**Moved down in final ranking** because current research indicates that Green Valley Creek possibly supports a population of genetically unique resident rainbow trout (Smith, pers. comm.). Low-priority due to: although the crossing is "RED" for adult and juvenile steelhead and there is a substantial length of potential upstream habitat, little is known about the quality of the habitat or the current distribution and relative abundance of steelhead within Green Valley Creek. The current two-bay box culvert could be modified with a series of downstream boulder weirs to raise tail-water elevation and concrete weirs within both bays to increase depths and reduce velocities.
Low	Green Valley Creek #2 (PM = 4.03)	Green Valley Road	**Moved down in final ranking** because current research indicates that Green Valley Creek possibly supports a population of genetically unique resident rainbow trout (Smith, pers. comm.). Low-priority due to: although the crossing is "RED" for adult and juvenile steelhead and there is a substantial length of potential upstream habitat, current research (Smith) indicates that Green Valley Creek supports a population of genetically unique resident rainbow trout. The current pipe-arch could be modified with a series of downstream boulder weirs to raise tail-water elevation and concrete weirs within the culvert to increase depths and reduce velocities.
Low	Green Valley Creek #3 (PM = 3.25)	Green Valley Road	Low-priority due to: although the crossing is "RED" for adult and juvenile steelhead and there is a substantial length of potential upstream habitat, current research (Smith) indicates that Green Valley Creek supports a population of genetically unique resident rainbow trout. Passage could be improved through the current concrete arch culvert with a series of downstream boulder weirs to raise tail-water elevation.

Table 6 (continued). Final ranking of 65 stream crossing locations on the County of Santa Cruz road system.

Final Rank	Stream Name	Road Name	Comments to Final Ranking
Low	Green Valley Creek #4 (PM = 1.98)	Green Valley Road	Low-priority due to: although the crossing is "RED" for adult and juvenile steelhead and there is a substantial length of potential upstream habitat (more than five miles), current research (Smith, pers. comm.) indicates that Green Valley Creek supports a population of genetically unique resident rainbow trout. Current crossing is properly sized and conveys more than a 250-year storm flow. A series of downstream weirs is needed to improve fish passage, however passage must first be improved through the county-maintained sites at Green Valley Creek #1 - #3.
Low	Casserly Creek #2 (PM = 1.00)	Mount Madonna Road	Low-priority due to: although the crossing is "RED" for adult and juvenile steelhead, there is a limited length of potential upstream habitat (≈ 1,200'). The current crossing is undersized (conveys less than a 10-year storm flow) and is in poor condition. When needed, replace with a properly-sized crossing.
Low **Green**	Two Bar Creek #1 (PM = 0.63)	Two Bar Road	Low-priority due to: current crossing is "GREEN", thus meets CDFG's passage criteria for adult and juvenile passage on entire range of estimated migration flows.
Low **Green**	Love Creek #1 (PM = 0.40)	Love Creek Road	Low-priority due to: current crossing is "GREEN", thus meets CDFG's passage criteria for adult and juvenile passage on entire range of estimated migration flows. Site should be periodically inspected for condition. Culvert is undersized and overtops on approximately a 10-year storm flow. When needed, replace with a properly-sized crossing.
Low **Green**	Mountain Charlie Gulch (PM = 5.21)	East Zayante Road	Low-priority due to: current crossing is "GREEN" and meets CDFG's passage criteria over the entire range of estimated migration flows. Site should be periodically inspected for condition. Culvert is undersized and overtops on less than a 10-year storm flow. When needed, replace with a properly-sized crossing.
Low **Green**	Branciforte Creek #2 (PM = 5.00)	Branciforte Drive	Low-priority due to: current crossing is "GREEN", thus meets CDFG's passage criteria for adult and juvenile passage on entire range of estimated migration flows. Current culvert conveys nearly the 60-year storm flow and is in good condition.
Low **Green**	Crystal Creek #1 (PM = 2.02)	Branciforte Drive	Low-priority due to: current crossing is "GREEN", thus meets CDFG's passage criteria for adult and juvenile passage on entire range of estimated migration flows. The crossing should be periodically inspected for condition. The culvert is extremely undersized and should be replaced with a properly-sized crossing when needed.
Low **Green**	Crystal Creek #2 (PM = 0.09)	Happy Valley Road	Low-priority due to: current crossing is "GREEN", thus meets CDFG's passage criteria for adult and juvenile passage on entire range of estimated migration flows.

Table 6 (continued). Final ranking of 65 stream crossing locations on the County of Santa Cruz road system.

Final Rank	Stream Name	Road Name	Comments to Final Ranking
Low **Green**	Clear Creek	Clear Creek Road	Low-priority due to: current crossing is "GREEN", thus meets CDFG's passage criteria for adult and juvenile passage. Culvert under-sized and overtops on approximately a seven year storm flow. When needed, replace with a properly-sized crossing.
Low **Green**	Blackburn Gulch (PM =0.31)	Vine Hill Road	Low-priority due to: current crossing is "GREEN", thus meets CDFG's passage criteria for adult and juvenile passage on entire range of estimated migration flows. Culvert is properly-sized for greater than a 250-year storm flow.
Low **Green**	Arana Gulch #2 (PM = 0.1 miles to Capitola Road)	Soquel Avenue	Low-priority due to: Low-priority due to: current crossing is "GREEN", thus meets CDFG's passage criteria for adult and juvenile passage on entire range of estimated migration flows Site should be periodically inspected for condition. Culvert under-sized and overtops on approximately an 11- year storm flow. When needed, replace with a properly-sized crossing.
Low **Green**	Arana Gulch #3 (PM = 0.20)	Brookwood Drive	Low-priority due to: current crossing is "GREEN", thus meets CDFG's passage criteria for adult and juvenile passage on entire range of estimated migration flows. Site should be periodically inspected for condition. Culvert is extremely under-sized and overtops on approximately a three- year storm flow. When needed, replace with a properly-sized crossing.
Low **Green**	Green Valley Creek #5 (PM = 0.89)	Green Valley Road	Low-priority due to: current crossing is "GREEN", thus meets CDFG's passage criteria for adult and juvenile passage on entire range of estimated migration flows.
Low **Green**	Casserly Creek #1 (PM = 1.50)	Casserly Road	Low-priority due to: current crossing is "GREEN", thus meets CDFG's passage criteria for adult and juvenile passage on entire range of estimated migration flows. Culvert is undersized and overtops on approximately a 14-year storm flow. When needed, replace with a properly-sized crossing.

Site-Specific Treatments and Scheduling

High-Priority Sites

During the past few years, several sources of restorations funds have been available for treating priority culverts – SB271, California Coastal Salmon Recovery Program (CCSRP), Proposition 13 (Clean Water Bond), as well as Coastal Conservancy funds. As of March, 2004 the County of Santa Cruz's Planning Department has:

- Quesaria Creek/Swanton Road (PM 1.32) – replaced in Fall of 2003.
- West Liddell Creek #2/Bonny Doon Road - replaced the failing culvert in 2003.
- As part of the CDFG contract to complete this assessment – hired a consulting engineering firm to design treatments for Brown's Creek #1 and #2/Brown's Valley Road, and Corralitos Creek/Eureka Canyon Road.
- Valencia Creek #1 and #2/Soquel Drive (PM 6.20 and 2.29) – funding obtained for fish ladder retrofit design and permitting.
- Gold Gulch/Brookside Way – funded for design and permitting of replacement.
- Hester Creek/Soquel-San Jose Road – funded for treatment design and permitting.
- Bates Creek/Main Street – funded for treatment design and permitting.
- West Branch Soquel Creek/Redwood Lodge Road – funded for design and permitting.

All replacements should follow recently developed state criteria and federal guidelines for facilitating adult and juvenile fish passage (CDFG 2002; NMFS 2001). However, site-specific characteristics of the crossing's location should always be carefully reviewed prior to selecting the type of crossing to install. These characteristics include local geology, natural channel slope, channel confinement, and extent of channel incision likely from removal of a perched culvert.

For additional information, Bates et al. (1999) is recommended as an excellent reference to use when considering fish-friendly culvert installation options and Robinson et al. (2000) provides a comprehensive review of the advantages and disadvantages of the various treatment alternatives as related to site-specific conditions.

CDFG Allowable Design Options

Active Channel Design Option is a simplified design method that is intended to size a crossing sufficiently large and embedded deep enough into the channel to allow the natural movement of bed load and formation of a stable bed inside the culvert. Determination of the high and low fish passage design flows, water velocity, and water depth is not required for this option since the stream hydraulic characteristics within the culvert are intended to mimic the stream conditions upstream and downstream of the crossing.

The Active Channel Design Option is suitable for the following conditions:

- New and replacement culvert installations
- Simple installations with channel slopes of less than 3%.
- Short culvert lengths (less than 100 feet).
- Passage is required for all fish species and lifestages.

Culvert Setting and Dimensions

- Culvert Width – the minimum culvert width shall be equal to, or greater than, 1.5 times the active channel width.

- Culvert Slope – the culvert shall be placed level (0% slope).

- Embedment – the bottom of the culvert shall be buried into the streambed not less than 20% of the culvert height at the outlet and not more than 40% of the culvert height at the inlet. Embedment does not apply to bottomless culverts.

Stream Simulation Design Option

The Stream Simulation Design Option is a design process that is intended to mimic the natural stream processes within a culvert. Fish passage, sediment transport, flood and debris conveyance within the crossing are intended to function as they would in a natural channel. Determination of the high and low fish passage flows, water velocity, and water depth is not required for this option since the stream hydraulic characteristics within the culvert are designed to mimic the stream conditions upstream and downstream of the culvert.

Stream simulation crossings are sized as wide, or wider than, the bankfull channel and the bed inside the culvert is sloped at a gradient similar to that of the adjacent stream reach. These crossings are filled with a streambed mixture that is resistant to erosion and is unlikely to change grade, unless specifically designed to do so. Stream simulation crossings require a greater level of information on hydrology and topography and a higher level of engineering expertise than the Active Channel Design Option.

The Stream Simulation Design Option is suitable for the following conditions:

- New and replacement culvert installations.
- Complex installations with channel slopes less than 6%.
- Moderate to long culvert length (greater than 100 feet).
- Passage required for all fish species and lifestages.
- Ecological connectivity is required.

Culvert Setting and Dimensions

- Culvert Width – the minimum culvert width shall be equal to, or greater than, the bankfull channel width. The minimum culvert width shall not be less than six feet.

- Culvert Slope - the culvert slope shall approximate the slope of the stream through the reach in which it is being placed. The maximum slope shall not exceed 6%.

- Embedment – the bottom of the culvert shall be buried into the streambed, not less than 30% and not more than 50% of the culvert height. Embedment does not apply to bottomless culverts.

Substrate Configuration and Stability

- Culverts with slopes greater than 3% shall have the bed inside the culvert arranged into a series of step-pools with the drop at each step not exceeding 0.5 feet for juvenile salmonids.

- Smooth walled culverts with slopes greater than 3% may require bed retention sills within the culvert to maintain the bed stability under elevated flows.

- The gradation of the native streambed material or engineered fill within the culvert shall address stability at high flows and shall be well graded to minimize interstitial flow through it.

Hydraulic Design Option

The Hydraulic Design Option is a design process that matches the hydraulic performance of a culvert with the swimming abilities of a target species and age class of fish. The method targets specific species of fish and therefore does not account for ecosystem requirements of non-target species. There can be significant errors associated with estimation of hydrology and fish swimming speeds that are mitigated by making conservative assumptions in the design process. Determination of the high and low fish passage design flows, water velocity, and water depth are required for this option.

The Hydraulic Design Option requires hydrologic data analysis, open channel flow hydraulic calculations and information on the swimming ability and behavior of the target group of fish. This design option can be applied to the design of new and replacement culverts, and can be used to evaluate the effectiveness of retrofits for existing culverts.

The Hydraulic Design option is suitable for the following conditions:

- New, replacement, and retrofit culvert installations.
- Low to moderate channel slopes (less than 3%).
- Situation where either Active Channel Design or Stream Simulation Options are not physically feasible.
- Swimming ability and behavior of target fish species is known.
- Ecological connectivity is not required.
- Evaluation of proposed improvements to existing culverts.

For more information regarding the Hydraulic Design option, or to obtain the most recent copy of the CDFG *Culvert Criteria for Fish Passage*, contact George Heise, CDFG's hydraulic engineer, at GHEISE@dfg.ca.gov .

NMFS Order of Preferred Alternatives

1. *No crossing* - relocate or decommission the road.

2. *Bridge* - spanning the stream to allow for long-term dynamic channel stability.

3. *Streambed simulation strategies* – bottomless arch, embedded culvert design, or ford.

4. *Non-embedded culvert* – this often referred to as a hydraulic design, associated with more traditional culvert design approaches limited to low slopes for fish passage.

5. *Baffled culvert, or structure designed with a fish way* – for steeper slopes.

For more information, or to obtain a copy of the NMFS *Guidelines for Salmonid Passage at Stream Crossings* go to the Southwest Region website at: http://swr.nmfs.noaa.gov

Moderate-Priority Sites

The exact scheduling for treating of the 13 "moderate-priority" sites is unknown at the time because:

1. Santa Cruz County has a large task of completing the scheduling, contracting, permitting, and implementation required to treat the first 13 locations proposed in the tentative long-term scheduling. The County should focus on completing these higher priority projects with properly designed and constructed treatments before addressing the next tier of sites.

2. Santa Cruz County is a participant in the FishNet 4C Salmon Group, which plans to acquire treatment funds for passage problems in all six counties (Sonoma, Marin, Napa, San Mateo, Alameda, and Santa Cruz). Thus, the remaining "moderate-priority" tier of Santa Cruz County culverts should be ranked and evaluated with respect to priority crossings located in the other five counties.

3. When addressing the "moderate-priority" tier of crossings, the current biological condition and/or importance (such as quantity) of the streams starts to diminish. Thus, these sites may not rank well compared to other types of projects proposed to state and federal funding sources. However, other sources of funding, such as urban stream programs should be considered. Sites in poor condition and/or undersized should be eventually treated with county maintenance and repair funds.

Low-Priority Sites

Thirty-nine stream crossing locations were classified as "low-priority". Twelve of these sites were "GREEN" and currently provide passage for all age classes of salmonids. The other 27 "low-priority" sites have minimal biological benefit if treated. However, these sites should be examined for "consequence-of-risk" as to current condition, sizing, and fill amount. All future replacements with county maintenance funds should include properly sized crossings that permit unimpeded passage of adult and juvenile salmonids.

The four most common activities impacting these Santa Cruz County streams are timber harvesting, agriculture, unfenced grazing, and residential development. Some of these low-priority creeks generally exhibited some or all of the following characteristics:

1. Lack of pools and habitat complexity;
2. Denuded or non-existent riparian zones;
3. Extensive straightening, berming, and diking of channel;
4. High volumes of fine sediment; and
5. Warm summer water temperatures.

Limited fisheries restoration dollars should probably not be spent on improving fish passage in these streams, unless significant improvements occur to impacts caused by other land management activities. However, the County of Santa Cruz should carefully examine this list and determine which locations may be treated with existing maintenance funds.

For example, the County of Santa Cruz Public Works Department may have a general plan for improvements to specific traffic corridors or routes. Also, when low-priority culverts fail during winter storms, planners should examine the hydraulic capacity of the failed structure and budget for properly-sized replacements. When applying for FEMA funds, the County of Santa Cruz Public Works should utilize this report to explain why the replacement should be a larger and higher-quality crossing (for both ESA-listed fish species and future-flood benefits).

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PERSONAL COMMUNICATIONS

Love, Michael. Michael Love and Associates, McKinleyville, CA. (707)-839-7867.

Roelofs, Terry D. Professor, Fisheries Department, Humboldt State University, Arcata, CA. (707)-826-3344.

Schroeder, Kristen. County of Santa Cruz Planning Dept., Santa Cruz, CA. (831)-454-3154.

Smith, Jerry. Fishery Ecologist, San Jose State University, San Jose, CA.

APPENDIX A:

COUNTY OF SANTA CRUZ STREAM CROSSING INVENTORY AND FISH PASSAGE EVALUATION PROJECT –

INVENTORY AND SURVEY DATA

SANTA CRUZ COUNTY STREAM CROSSING LOCATIONS AND CHARACTERISTICS

ID #	Stream Name	Road Name	Drainage	County Map #	Township, Range, Section	Latitude and Longitude Coordinates	Road ID #	Milemarker or Name and Distance to nearest Crossroad	Type of Culvert	Construction Material	Corrugation Dimensions	Culvert Length (ft)	Culvert Dimensions: Diameter, height/width, or rise/span (ft)	% Slope thru Culvert
SC-001	Queseria Creek	Swanton Road	Scott Cr	5N	T10S, R3W	37° 02' 35.83" 122° 13' 17.27"	32001	1.32	Circular	Concrete	N/A	42.2	2.5	2.75
SC-002	Archibald Creek	Swanton Road	Scott Cr	5N	T10S, R3W	37° 03' 14.88" 122° 13' 28.11"	32001	2.17	Circular	Plastic	N/A	41.1	4.0	0.85
SC-003	Unnamed tributary #1 to Scott Creek	Swanton Road	Scott Cr	5N	T10S, R3W	37° 03' 35.88" 122° 13' 28.80"	32001	3.45	Circular	Plastic	N/A	41.1	4.0	5.47
SC-004	Unnamed tributary #2 to Scott Creek	Swanton Road	Scott Cr	5N	T10S, R3W	37° 04' 32.32" 122° 14' 21.41"	32001	4.05	Circular	Plastic	N/A	41.4	4.0	3.79
SC-005	Molino Creek	Swanton Road	Coastal	5N	T10S, R3W	37° 02' 14.19" 122° 13' 11.41"	32001	0.71	Box with arch top	Concrete	N/A	29.4	7.0 X 7.4	0.92
SC-006	West Liddell Creek #1	Bonny Doon Road	Liddell Creek - Coastal	5N		37° 00' 20.95" 122° 10' 27.60"	3202	0.69	Box	Concrete	Smooth	31.0	3.8 x 4.8	1.80
SC-007	West Liddell Creek #2	Bonny Doon Road	Liddell Creek - Coastal	5N		37° 00' 27.04" 122° 10' 28.22"	3202	0.71	Pipe Arch	CSP	??	??	??	??
SC-008	West Liddell Creek #3	Bonny Doon Road	Liddell Creek - Coastal	5N		37° 00' 41.84" 122° 10' 30.53"	3202	0.94	Circular	SSP	$2^2/_3$" X $^1/_2$"	39.0	5.5	2.60
SC-009	Redwood Creek #1	Glen Canyon Road	Glen Canyon-Branciforte Cr-Carbonera Cr-San Lorenzo R	5N15	T10S, R1W, Section 31	37° 00' 42.20" 122° 00' 39.86"	2401	1.02	Box	Concrete	N/A	116.7	5.0 X 5.0	2.03
SC-010	Redwood Creek #2	Redwood Drive	Glen Canyon-Branciforte Cr-Carbonera Cr-San Lorenzo R	5N15	T10S, R1W, Section 31	37° 00' 47.05" 122° 00' 38.01"	34001	0.10	Box	Concrete	N/A	37.2	5.0 X 5.0	3.20

ID #	Rustline Height (ft)	Inlet Type	Inlet Alignment to Channel	Outlet Configuration	Outlet Apron	Culvert Embedded?	Culvert Condition	Average Active Channel Width (ft)	Estimated Road fill (cubic yards)	Previous Modifications to Culvert	Additional Comments from Initial Site Visit
SC-001	N/A	Headwall	30°- 45°	Cascade over Riprap	N/A	No	Good	5.7	176	No	Data collected at 11:45AM on 9/10/02. Air = 25°C Water = 13°C. Creek is narrow and gentle gradient. Dense hardwood canopy. Upstream culvert 50 ft away and seems like a barrier. Creek is being realigned. Coho present last year. Continuous flow was present in the channel at time of survey, however no fish were observed.
SC-002	N/A	Headwall	<30°	At Stream Grade	N/A	No	Good	3.5	90	No	Data collected on 9/10/02. Fair fish habitat. Thick, brushy canopy. Confluence with Scott Creek is close downstream. Next to farm. Substrate of cobbles and boulders. Channel was dry at time of survey.
SC-003	N/A	Projecting	<30°	At Stream Grade	N/A	No	Fair - erosion of ds road fill	5.9	273	No	Data collected on 9/10/02. Fair fish habitat. Confluence with Scott Creek relatively close. Upstream is possibly steep. Channel was dry at time of survey.
SC-004	N/A	Projecting	<30°	At Stream Grade	N/A	No	Good	6.7	264	No	Data collected on 9/10/02. Fair fish habitat. May be steep upstream. Confluence with Scott Creek is a couple hundred feet from Xing. Lots of woody debris up & down stream. Dense brush canopy. Channel was dry at time of survey.
SC-005	N/A	Headwall	>45°	Freefall into pool	N/A	No	Poor- walls cracked, outlet broken off, undercutting of floor	11.9	890	No	Data collected at 9AM on 9/10/02. Air = 18°C Water = 10°C. Good fish habitat. Very perched. Dense brush and hardwood canopy. Private ford upstream ~200 ft. Signs of cattle in creek. Continuous flow was present in the channel at time of survey, and several fish of unknown species and less than 3" in length were observed in the channel upstream of the crossing.
SC-006	N/A	Wingwall	30°- 45°	Freefall into pool	N/A	No	Fair- undercut at outlet. Stream banks are damaged too.	8.9		No	Site was surveyed in October of 2001 during the FSOS/CDFG Fish Passage Workshop. Good fish habitat - about six juvenile salmonids were observed in the channel upstream of the box culvert - one was 5-8" and the rest were y-o-y's. Culvert is obviously undersized and high flows have caused scour and damage to the stream channel and road slope downstream of the box culvert.
SC-007	??	Projecting	30°- 45°	Freefall into pool	N/A	No	Extremely poor - floor rusted through, pipe is crushed	8.9		No	Site was not surveyed, but was examined briefly in October of 2001 during the FSOS/CDFG Fish Passage Workshop. Good fish habitat - about six juvenile salmonids were observed in the channel downstream of the arch culvert - one was 5-8" and the rest were y-o-y's. Culvert is in terrible shape and is obviously undersized and high flows have caused scour and damage to the stream channel and road slope downstream of the box culvert.
SC-008	0.7	Headwall	30°- 45°	Freefall into pool	Length=2.0' Slope=39.5%	No	Fair - some wear on culvert floor	7.8		No	Site was surveyed in October of 2001 during the FSOS/CDFG Fish Passage Workshop. Good fish habitat - at this point Bonny Doon Road veers away from the creek. Culvert is appears undersized. The perched outlet looks like a migration barrier.
SC-009	N/A	Wingwall	<30°	At Stream Grade	N/A	Inlet=0.0' Outlet=0.25'	Good	7.0	2,288	No	Data collected at 4PM on 9/26/02. Air = 16°C Water = 13°C. Good fish habitat. Confluence with Glen Canyon Creek close to outlet. Dense mixed canopy. Isolated pools were present in the channel at time of survey, and several fish of unknown species and less than 3" in length were observed in the channel downstream of the crossing.
SC-010	N/A	Wingwall	30°- 45°	Freefall into pool	Length=14.4' Slope=2.85%	No	Good	9.2	268	No	Data collected at 4:15PM on 9/26/02. Air = 16°C Water = 13°C. Good fish habitat. Substrate of fines, gravels and some cobbles. Moderate mixed canopy. Isolated pools were present in the channel at time of survey, and a moderate abundance (10 to 50) fish of unknown species and less than 3" in length were observed in the channel downstream of the crossing.

SANTA CRUZ COUNTY STREAM CROSSING LOCATIONS AND CHARACTERISTICS

ID #	Stream Name	Road Name	Drainage	County Map #	Township, Range, Section	Latitude and Longitude Coordinates	Road ID #	Milemarker or Name and Distance to nearest Crossroad	Type of Culvert	Construction Material	Corrugation Dimensions	Culvert Length (ft)	Culvert Dimensions: Diameter, height/width, or rise/span (ft)	% Slope thru Culvert
SC-011	Redwood Creek #3	Redwood Drive	Glen Canyon-Branciforte Cr-Carbonera Cr-San Lorenzo R	5N15	T10S, R1W, Section 31	37° 00' 52.08" 122° 00' 36.08"	34001	0.20	Circular	SSP	$2^2/_3$" X $^1/_2$"	40.4	6.0	5.62
SC-012	Redwood Creek #4	Redwood Drive	Glen Canyon-Branciforte Cr-Carbonera Cr-San Lorenzo R	5N15	T10S, R1W, Section 30	37° 01' 47.45" 122° 00' 26.80"	34001	1.34	Circular	Plastic	N/A	39.7	4.0	2.80
SC-013	Redwood Creek #5	Redwood Drive	Glen Canyon-Branciforte Cr-Carbonera Cr-San Lorenzo R	5N15	T10S, R1W, Section 30	37° 01' 55.10" 122° 00' 28.50"	34001	1.45	Circular	Concrete	N/A	57.2	3.0	3.04
SC-014	Redwood Creek #6	Redwood Drive	Glen Canyon-Branciforte Cr-Carbonera Cr-San Lorenzo R	5N15	T10S, R1W, Section 30	37° 01' 57.77" 122° 00' 28.27"	34001	1.48	Circular	Plastic	N/A	81.1	4.0	5.49
SC-015	Redwood Creek #7	Redwood Drive	Glen Canyon-Branciforte Cr-Carbonera Cr-San Lorenzo R	5N15	T10S, R1W, Section 30	37° 02' 6.03" 122° 00' 28.04"	34001	1.67	Circular	SSP	$2^2/_3$" X $^1/_2$"	160.7	3.0	2.68
SC-016	Granite Creek	Granite Road	Branciforte Cr-Carbonera Cr-San Lorenzo R	6N11	T10S, R1W, Section 29	37° 01' 35.81" 121° 59' 51.54"	34002	0.55	Box	Concrete	N/A	45.9	5.0 X 5.0	1.61
SC-017	Crystal Creek #1	Branciforte Drive	Branciforte Cr-Carbonera Cr-San Lorenzo R	6N11	T10S, R1W, Section 29	37° 01' 38.71" 121° 59' 11.01"	3401	2.02	Box	Concrete	N/A	36.1	5.0 X 5.0	0.06
SC-018	Crystal Creek #2	Happy Valley Road	Branciforte Cr-Carbonera Cr-San Lorenzo R	6N11	T10S, R1W, Section 29	37° 01' 40.98" 121° 59' 6.75"	34003	0.09	Circular	CSP	$2^2/_3$" X $^1/_2$"	48.2	6.0	1.64
SC-019	Crystal Creek #3	Happy Valley Road	Branciforte Cr-Carbonera Cr-San Lorenzo R	6N11	T10S, R1W, Section 29	37° 01' 43.96" 121° 59' 2.43"	34003	0.18	Circular	Aluminum	7" X 4"	42.7	6.0	0.80
SC-020	Branciforte Creek #1	Branciforte Drive	Carbonera Cr-San Lorenzo R	6N11	T10S, R1W, Section 20	37° 02' 26.61" 121° 58' 59.98"	3401	4.20	Bridge with Weir	Concrete	N/A	24.0	8.0 X 18.0	2.79
SC-021	Tie Gulch	Branciforte Drive	Branciforte Cr-Carbonera Cr-San Lorenzo R	6N11	T10S, R1W, Section 21	37° 02' 58.92" 121° 58' 49.66"	3401	0.38	Box	Concrete	N/A	79.8	4.0 X 6.0	0.86

ID #	Rustline Height (ft)	Inlet Type	Inlet Alignment to Channel	Outlet Configuration	Outlet Apron	Culvert Embedded?	Culvert Condition	Average Active Channel Width (ft)	Estimated Road fill (cubic yards)	Previous Modifications to Culvert	Additional Comments from Initial Site Visit
SC-011	1.4	Projecting	<30°	Freefall into pool	N/A	No	Poor- Rusted through in spots	7.7	266	No	Data collected at 9AM on 9/27/02. Air = 15°C Water = 14°C. Good fish habitat. Good pools. Dense mixed canopy. Isolated pools were present in the channel at time of survey, however no fish were observed in the channel adjacent to the crossing.
SC-012	N/A	Wingwall	30°- 45°	Cascade over Riprap	N/A	No	Fair	4.9	90	No	Data collected on 9/27/02. Good fish habitat. Creek seems small and possibly steep. Sparse mixed canopy. Channel was dry at time of survey.
SC-013	N/A	Wingwall	>45°	Freefall into pool	N/A	No	Fair	4.2	289	No	Data collected at 10:30AM on 9/27/02. Air = 14°C Water = 14°C. Good fish habitat. Moderate redwood canopy. Large outlet pool. Next crossing very close upstream. Isolated pools were present in the channel at time of survey, however no fish were observed in the channel adjacent to the crossing.
SC-014	N/A	Wingwall	<30°	Cascade over Riprap	N/A	No	Good	6.4	112	No	Data collected at 12PM 9/27/02. Air = 14°C Water = 14°C. Fair fish habitat. Pretty far up in the system. Crossing is a definite barrier. Sparse redwood canopy. Isolated pools were present in the channel at time of survey, however no fish were observed in the channel adjacent to the crossing.
SC-015	0.6	Headwall	<30°	Freefall into pool	N/A	No	Extremely Poor- rusted through & completely broken at inlet and outlet	5.3	1,010	No	Data collected at 9AM on 10/1/02. Air = 11°C Water = 11°C. Good fish habitat. Undersized and long pipe. Dense redwood canopy. Pooled water at inlet where its broken and rusted through. Isolated pools were present in the channel at time of survey, however no fish were observed in the channel adjacent to the crossing.
SC-016	N/A	Wingwall	30°- 45°	Freefall into pool	Length=4.0' Slope=30.5%	No	Fair	15.8	472	No	Data collected at 9:30AM on 9/24/02. Air = 15°C Water = 14°C. Good fish habitat. Moderate canopy of hardwoods and redwoods. Isolated pools were present in the channel at time of survey and no fish were observed in the channel adjacent to the crossing.
SC-017	N/A	Wingwall	>45°	At Stream Grade	N/A	Inlet=0.0' Outlet=0.05'	Good	7.5	250	No	Data collected at 1PM on 9/25/02. Air = 18°C Water = 14°C. Good fish habitat. Culvert backwatered. Dense hardwood canopy. Continuous flow was present in the channel at time of survey, however no fish were observed.
SC-018	1.4	Headwall	<30°	At Stream Grade	N/A	No	Good	7.4	274	No	Data collected at 10:30AM on 9/24/02. Air = 16°C Water = 14°C. Good fish habitat. Culvert backwatered. Local said lots of fish present in creek. Continuous flow was present in the channel at time of survey, however no fish were observed. Moderate mixed canopy.
SC-019	N/A	Wingwall	30°- 45°	At Stream Grade	N/A	Inlet=0.0' Outlet=1.5'	Fair- Separated at a section	9.0	244	No	Data collected at 12PM on 9/24/02. Air = 23°C Water = 14°C. Good fish habitat. Culvert backwatered. Moderate mixed canopy. Continuous flow was present in the channel at time of survey and several fish of unknown species and of less than 3" in length were observed upstream of the crossing.
SC-020	N/A	Wingwall	30°- 45°	At Stream Grade	N/A	Natural Bottom	Good	19.4	235	Weir after outlet	Data collected at 3:30PM on 9/25/02. Air = 20°C Water = 14°C. Good fish habitat. Moderate canopy of hardwoods. Bridge is probably not problematic but the jump at the weir may be. The weir fully spans the channel after the outlet pool and has a 1.5 ft wide sluce gate that can be removed. Continuous flow was present in the channel at time of survey, however no fish were observed.
SC-021	N/A	Wingwall	30°- 45°	At Stream Grade	N/A	No	Good	6.0	191	No	Data collected at 12PM on 9/26/02. Air = 14°C Water = 15°C. OK fish habitat. Not many features. Dense brush and hardwood canopy. Continuous flow was present in the channel at time of survey and several fish of unknown species and of less than 3" in length were observed upstream of the crossing.

SANTA CRUZ COUNTY STREAM CROSSING LOCATIONS AND CHARACTERISTICS

ID #	Stream Name	Road Name	Drainage	County Map #	Township, Range, Section	Latitude and Longitude Coordinates	Road ID #	Milemarker or Name and Distance to nearest Crossroad	Type of Culvert	Construction Material	Corrugation Dimensions	Culvert Length (ft)	Culvert Dimensions: Diameter, height/width, or rise/span (ft)	% Slope thru Culvert
SC-022	Branciforte Creek #2	Branciforte Drive	Carbonera Cr-San Lorenzo R	6N11	T10S, R1W, Section 21	37° 03' 1.65" 121° 58' 45.27"	3401	5.00	Box	Concrete	N/A	26.6	10.0 X 10.0	0.00
SC-023	Mountain View Creek #1	Vine Hill Road	Branciforte Cr-Carbonera Cr-San Lorenzo R	6N11	T10S, R1W, Section 16	37° 03' 16.01" 121° 58' 35.48"	33155	0.00	Box	Concrete	N/A	45.0	6.0 X 5.0	0.67
SC-024	Mountain View Creek #2	Mountain View Road	Branciforte Cr-Carbonera Cr-San Lorenzo R	6N11	T10S, R1W, Section 16	37° 03' 21.53" 121° 58' 5.81"	3402	0.76	Oval	SSP	$2^2/_3$" X $^1/_2$"	40.6	3.6 X 6.0	3.52
SC-025	Blackburn Gulch	Vine Hill Road	Branciforte Cr-Carbonera Cr-San Lorenzo R	6N11	T10S, R1W, Section 16	37° 03' 30.19" 121° 58' 47.23"	33155	0.31	Pipe Arch	SSP	10" X 3"	31.0	8.8 X 14.0	-1.06
SC-026	Unnamed tributary to Carbonera Creek	La Madrona Drive	Carbonera Cr-San Lorenzo R	5N15	T10S, R2W	37° 01' 29.29" 122° 01' 41.61"	2303	1.30	Circular	Concrete	N/A	76.4	4.0	9.61
SC-027	Gold Gulch	Brookside Way	San Lorenzo R	5N15	T10S, R2W	37° 02' 14.44" 122° 04' 17.14"	33036	at Willow Way	Circular	SSP	$2^2/_3$" X $^1/_2$"	82.8	7.0	4.35
SC-028	Shingle Mill Creek	Redwood Drive	San Lorenzo R	5N15	T10S, R2W	37° 02' 20.88" 122° 04' 51.99"	33045	at Oak Drive	Circular	CSP	$2^2/_3$" X $^1/_2$"	40.3	3.5	-1.04
SC-029	Bean Creek #1	Mt. Hermon Road	Zayante Cr-San Lorenzo R	5N15	T10S, R2W, Section 14	37° 03' 18.69" 122° 02' 25.36"	3302	1.8	Pipe Arch	Concrete	N/A	296.6	21.75 X 21.85	1.17
SC-030	Lockhart Gulch	Lockhart Gulch Road	Bean Creek-Zayante Cr-San Lorenzo R	5N15	T10S, R2W, Section 13	37° 03' 25.50" 122° 01' 54.44"	33028	0.60	Box	Concrete	N/A	52.2	6.1 X 6.0	1.09

ID #	Rustline Height (ft)	Inlet Type	Inlet Alignment to Channel	Outlet Configuration	Outlet Apron	Culvert Embedded?	Culvert Condition	Average Active Channel Width (ft)	Estimated Road fill (cubic yards)	Previous Modifications to Culvert	Additional Comments from Initial Site Visit
SC-022	N/A	Wingwall	>45°	At Stream Grade	N/A	Inlet=0.0' Outlet=1.0'	Good	13.8	243	No	Data collected at 3PM on 9/24/02. Air = 26.5°C Water = 15°C. Good fish habitat. Moderate canopy of hardwoods. Culvert doesn't seem problematic. Fully embedded except for a little exposed concrete at inlet on right bank.
SC-023	N/A	Wingwall	<30°	At Stream Grade	N/A	Inlet=0.5' Outlet=0.8'	Good	9.2	307	No	Data collected at 8:30AM on 9/26/02. Air = 14°C Water = 14°C. Fair fish habitat. Numerous upstream crossings. Outlet into Branciforte Cr. Moderate hardwood canopy. Continuous flow was present in the channel at time of survey and several fish of unknown species and of less than 3" in length were observed both downstream and upstream of the crossing.
SC-024	All	Projecting	30°- 45°	Freefall into pool	N/A	No	Poor- Rusty and warped	10.0	293	No	Data collected at 11AM on 9/26/02. Air = 17°C Water = 13°C. Fair fish habitat. Deep pool, dense redwood canopy. Creek splits upstream. Four more county crossings upstream and a private crossing approximately 100 feet downstream of Mountain View Road. Isolated pools were present in the channel at time of survey and several fish of unknown species (less than 3" in length and between 3"-6") were observed upstream of the crossing.
SC-025	0.0	Headwall	>45°	At Stream Grade	N/A	Natural Bottom	Good	9.9	308	No	Data collected at 4:30PM on 9/25/02. Air = 21°C Water = 15°C. Good fish habitat. Moderate canopy of hardwoods and redwoods. Culvert appears to be fairly new installation/replacement. Continuous flow was present in the channel at time of survey, however no fish were observed.
SC-026	N/A	Headwall	<30°	At Stream Grade	Length=7.7' Slope=14.81%	No	Good	6.1	1,776	Concrete outlet beam	Data collected at 12:30PM on 10/1/02. Air = 18°C Water = 13°C. Fair fish habitat. Good resting pools but creek seems fairly steep. Area upstream of culvert may be natural barrier. Moderate mixed canopy. Isolated pools were present in the channel at time of survey and no fish were observed.
SC-027	1.7	Projecting	30°- 45°	At Stream Grade	N/A	No	Extremely Poor- extremely rusted through	13.2	1,829	No	Data collected at 1PM on 9/30/02. Air = 16°C Water = 13°C. Good fish habitat. Pipe is in horrible condition with jagged metal and breaks in slope. Local said they saw salmon in the creek. Moderate hardwood canopy. Continuous flow was present in the channel at time of survey and a moderate abundance of fish (10 to 50) of unknown species and of less than 3" in length were observed both downstream and upstream of the crossing.
SC-028	1.2	Wingwall	>45°	Cascade over Riprap	N/A	No	Poor- Very rusty, starting to rust through	5.2	463	No	Data collected at 11AM on 9/30/02. Air = 13°C Water = 13°C. Fair fish habitat. Not many resting pools up or down stream. The upstream weir and downstream riprap seems problematic for fish. Continuous flow was present in the channel at time of survey, however no fish were observed.
SC-029	N/A	Wingwall	<30°	At Stream Grade	Length=29.0' Slope=0.00%	No	Good	26.5	61,139	9 concrete baffles. Notched weir downstream.	Data collected at 11AM on 9/5/02. Air = 16°C Water = 15°C. Significant flow and pooling in culvert. Dense redwood canopy. 9 sets of baffles, 1.4 ft high, angled downstream which seems ineffective to slow velocities, they are on each side of the culvert with a 1.5ft gap in the middle, and are partially embedded. Outlet weir at end of apron is 4.5 ft high with a 2.5 ft notch. Continuous flow was present in the channel at time of survey and an abundance of fish (50 - 100) of unknown species and of less than 3" in length were observed both downstream and upstream of the crossing.
SC-030	N/A	Wingwall	>45°	At Stream Grade	N/A	No	Good	8.5	343	No	Data collected at 9:30AM on 9/5/02. Air = 14°C Water = 14°C. Pretty good fish habitat. Culvert is backwatered. Dense canopy of hardwoods, brush and berries. Continuous flow was present in the channel at time of survey, however no fish were observed.

SANTA CRUZ COUNTY STREAM CROSSING LOCATIONS AND CHARACTERISTICS

ID #	Stream Name	Road Name	Drainage	County Map #	Township, Range, Section	Latitude and Longitude Coordinates	Road ID #	Milemarker or Name and Distance to nearest Crossroad	Type of Culvert	Construction Material	Corrugation Dimensions	Culvert Length (ft)	Culvert Dimensions: Diameter, height/width, or rise/span (ft)	% Slope thru Culvert
SC-031	Bean Creek #2	Bean Creek Road	Zayante Cr-San Lorenzo R	5N15	T10S, R1W, Section 7	37° 04' 51.67" 122° 00' 35.73"	33030	3.0	Pipe Arch	Aluminum w/ concrete floor	10" X 3"	28.5	10.7 X 16.7	0.49
SC-032	Lompico Creek #1	Lompico Road	Zayante Cr-San Lorenzo R	5M55	T10S, R2W, Section 2	37° 05' 23.02" 122° 03' 7.51"	33031	0.4	Circular	CSP	$2^2/_3$" X $^1/_2$"	114.8	9.0	1.68
SC-033	Lompico Creek #2	Lompico Road	Zayante Cr-San Lorenzo R	5M55	T10S, R2W, Section 2	37° 05' 24.94" 122° 03' 8.75"	33031	0.5	Circular	CSP - Spiral	$2^2/_3$" X $^1/_2$"	108.4	9.0	0.76
SC-034	Lompico Creek #3	Lompico Road	Zayante Cr-San Lorenzo R	5M55	T9S, R2W, Section 35	37° 06' 28.29" 122° 02' 57.15"	33031	2.0	Box	Concrete	N/A	20.5	8.0 X 11.5	0.59
SC-035	Cobble Creek	East Zayante Road	Zayante Cr-San Lorenzo R	5M55	T9S, R2W, Section 36	37° 06' 7.55" 122° 01' 51.03"	3303	4.58	Box	Concrete	N/A	50.5	4.0 X 4.0	7.05
SC-036	Mountain Charlie Gulch	East Zayante Road	Zayante Cr-San Lorenzo R	5M55	T9S, R1W, Section 31	37° 06' 22.24" 122° 01' 14.70"	3303	5.21	Open Bottom Arch	SSP	6" X 2"	42.8	11.2 X 14.0	-0.77
SC-037	Unnamed tributary to Zayante Creek	East Zayante Road	Zayante Cr-San Lorenzo R	5M55	T9S, R1W, Section 30	37° 07' 10.41" 122° 01' 5.99"	3303	6.22	Circular	SSP	$2^2/_3$" X $^1/_2$"	40.5	4.0	2.15
SC-038	South Fall Creek #1	Felton Empire Road	San Lorenzo R	5N	T10S, R2W, Section 17	37° 03' 28.12" 122° 06' 19.58"	3301	1.28	Circular	SSP	$2^2/_3$" X $^1/_2$"	43.0	2.5	7.86
SC-039	South Fall Creek #2	Felton Empire Road	San Lorenzo R	5N	T10S, R2W, Section 17	37° 03' 40.21" 122° 06' 42.80"	3301	0.73	Circular	SSP	$2^2/_3$" X $^1/_2$"	57.0	2.0	8.46

ID #	Rustline Height (ft)	Inlet Type	Inlet Alignment to Channel	Outlet Configuration	Outlet Apron	Culvert Embedded?	Culvert Condition	Average Active Channel Width (ft)	Estimated Road fill (cubic yards)	Previous Modifications to Culvert	Additional Comments from Initial Site Visit
SC-031	N/A	Wingwall	<30°	At Stream Grade	Length=5.6' Slope=4.46%	No	Fair- rebar exposed	16.1	767	No	Data collected at 3:20PM on 9/5/02. Air = 18°C Water = 15°C. Great fish habitat. Moderate canopy of redwoods and hardwoods. Concrete floor is only about 0.2' thick. Continuous flow was present in the channel at time of survey and several fish (less than 10) of unknown species and of less than 3" in length were observed both downstream and upstream of the crossing.
SC-032	1.5	Projecting	<30°	Freefall into pool	N/A	No	Poor - rusted through in places	16.0	1,759	High flow baffles, 5 downstream concrete sac weirs.	Data collected at 8:30AM on 9/4/02. Air = 15°C Water = 15°C. Very good fish habitat. Moderately dense hardwood and redwood canopy. Nine baffles, probably effective at higher flows, but may snag and hold debris. Downstream concrete sac weirs. Continuous flow was present in the channel at time of survey, however no fish were observed.
SC-033	1.3	Wingwall	<30°	Freefall into pool	N/A	Inlet=0.0' Outlet=0.0'	Good	20.9	388	8 concrete baffles, 2 downstream weirs.	Data collected at 11:30AM on 9/4/02. Air = 23°C Water = 16°C. Good fish habitat. Moderate canopy. 8 baffles contributing to embeddedness. Two downstream concrete sac weirs. Continuous flow was present in the channel at time of survey and a high abundance of fish (greater than 100) of unknown species and of less than 3" in length were observed both downstream and upstream of the crossing.
SC-034	N/A	Wingwall	<30°	Freefall into pool	N/A	No	Fair- Rebar exposed & outlet apron broken	10.9	94	No	Data collected at 4:30PM on 9/19/02. Air = 20°C Water = 15°C. Great fish habitat. Local said water reached top of culvert about every year. Dense hardwood canopy. Continuous flow was present in the channel at time of survey and an abundance of fish (50 - 100) of unknown species and of less than 3" in length were observed both downstream and upstream of the crossing.
SC-035	N/A	Headwall	30°- 45°	Freefall into pool	Length=6.0' Slope=7.83%	No	Fair	10.4	321	No	Confluence with Zayante Creek is approximatley 50 feet downstream of outlet. Young-of-year salmonids present in Zayante Creek. Culvert seems undersized and too perched for passage. Stream channel was dry at time of site survey on 9/4/02.
SC-036	Concrete footings	Wingwall	30°- 45°	At Stream Grade	N/A	Natural Bottom	Good	19.1	929	No	Data collected at 2:45PM on 9/4/02. Air = 21°C Water = 15°C. Very good fish habitat. Fairly dense canopy of hardwoods and redwoods. Max pool is within culvert. Culvert seems to pose no barrier. Confluence with Zayante Creek 50' from outlet. Continuous flow was present in the channel at time of survey and several fish (less than 10) of unknown species and of less than 3" in length were observed both downstream and upstream of the crossing.
SC-037	1.2	Wingwall	<30°	Freefall into pool	N/A	No	Poor- very rusted	6.4	225	No	Data collected at 2PM on 9/19/02. Air = 28°C Water = 14°C. Great fish habitat with moderate canopy of hardwoods and redwoods. Confluence with Zayante Cr ~60 ft from outlet. Continuous flow was present in the channel at time of survey and several fish (less than 10) of unknown species in two size classes (less than 3" in length and 3" to 6") were observed both downstream and upstream of the crossing.
SC-038	0.6	Headwall	>45°	Cascade over Riprap	N/A	No	Poor- sunken, warped & crushed at the inlet	6.7	308	No	Fair fish habitat. Steep, small creek. Lots of fines. Culvert appears undersized. Stream channel was dry at time of survey on 9/30/02.
SC-039	0.5	Projecting	<30°	Freefall into pool	N/A	No	Extremely Poor- squashed inlet, rust holes at outlet	3.8	174	No	Data collected at 4PM on 9/30/02. Air = 17°C Water = 13°C. Creek seems small and possibly steep. Pools present with dense redwood canopy. Evidence of bank erosion and ponding at crossing inlet due to squashed culvert inlet. Isolated pools were present in the channel at time of survey and no fish were observed.

SANTA CRUZ COUNTY STREAM CROSSING LOCATIONS AND CHARACTERISTICS

ID #	Stream Name	Road Name	Drainage	County Map #	Township, Range, Section	Latitude and Longitude Coordinates	Road ID #	Milemarker or Name and Distance to nearest Crossroad	Type of Culvert	Construction Material	Corrugation Dimensions	Culvert Length (ft)	Culvert Dimensions: Diameter, height/width, or rise/span (ft)	% Slope thru Culvert
SC-040	Love Creek #1	Love Creek Road	San Lorenzo R	5M55	T10S, R2W, Section 4	37° 05' 41.78" 122° 05' 6.30"	33011	0.4	Box	Concrete	N/A	33.8	10.0 X 10.5	1.24
SC-041	Love Creek #2	Love Creek Road	San Lorenzo R	5M55	T9S, R2W, Section 33	37° 06' 6.89" 122° 05' 5.00"	33011	0.9	Box	Concrete	N/A	48.4	8.0 X 7.9	2.77
SC-042	Love Creek #3	Love Creek Road	San Lorenzo R	5M55	T9S, R2W, Section 33	37° 06' 28.02" 122° 05' 7.66"	33011	1.3	Circular	SSP	6" X 2"	69.2	12	1.03
SC-043	Hubbard Gulch	Hubbard Gulch Road	Marshall Cr-San Lorenzo R	5M54	T10S, R2W, Section 5	37° 05' 29.80" 122° 06' 2.13"	33058	0.37	Circular	CSP	$2^2/_3$" X $^1/_2$"	80.4	5.5	10.27
SC-044	Marshall Creek	Hubbard Gulch Road	San Lorenzo R	5M54	T10S, R2W, Section 5	37° 05' 31.10" 122° 06' 5.07"	33057	0.40	Circular	SSP	$2^2/_3$" X $^1/_2$"	40.4	3	8.24
SC-045	Clear Creek	Clear Creek Road	San Lorenzo R	5M54	T9S, R2W, Section 32	37° 06' 25.62" 122° 06' 31.01"	43029	0.05	Open Bottom Arch	SSP	6" X 2"	25.2	6.4 X 16.5	3.93
SC-046	Unnamed tributary to Jamison Creek	Jamison Creek Road	Jamison Cr-Boulder Cr-San Lorenzo R	5M54	T9S, R3W, Section 14	37° 09' 0.44" 122° 09' 56.04"	4201	2.49	Box	Concrete	N/A	47.0	3.0 X 3.0	3.62
SC-047	Hare Creek	Hare Way	Boulder Cr-San Lorenzo R	5M54	T9S, R3W, Section 14	37° 09' 12.51" 122° 09' 43.27"	42033	0.20	Circular	SSP	$2^2/_3$" X $^1/_2$"	71.2	6	3.48
SC-048	Hopkins Gulch	Bear Creek Road	Bear Cr-San Lorenzo R	5M55	T9S, R2W, Section 20	37° 08' 13.74" 122° 05' 56.36"	4301	1.5	Circular	CSP	$2^2/_3$" X $^1/_2$"	170.2	6	3.63
SC-049	Two Bar Creek #1	Two Bar Road	San Lorenzo R	5M54	T9S, R2W, Section 18	37° 08' 58.59" 122° 07' 26.89"	43025	0.63	Open Bottom Arch	Concrete	N/A	36.8	14.0 X 15.2	4.65

ID #	Rustline Height (ft)	Inlet Type	Inlet Alignment to Channel	Outlet Configuration	Outlet Apron	Culvert Embedded?	Culvert Condition	Average Active Channel Width (ft)	Estimated Road fill (cubic yards)	Previous Modifications to Culvert	Additional Comments from Initial Site Visit
SC-040	N/A	Headwall	<30°	At Stream Grade	N/A	Inlet=0.6' Outlet=0.4'	Good	14.3	365	No	Data collected at 11:30AM on 9/3/02. Air = 22°C Water = 16°C. Very good fish habitat. Moderate canopy of hardwoods & redwoods. Local said fish ladder downstream blocks fish. Continuous flow was present in the channel at time of survey, however no fish were observed.
SC-041	N/A	Wingwall	<30°	At Stream Grade	N/A	Inlet=0.8' Outlet=0.4	Good	19.8	210	3 concrete corner baffles	Data collected at 1:30PM 9/3/02. Air = 22.5°C Water = 16.5°C. Very good fish habitat with deep pools and dense conifer canopy. Low gradient stream. Continuous flow was present in the channel at time of survey and several fish (less than 10) of unknown species and of less than 3" in length were observed downstream of the crossing.
SC-042	3.0	Wingwall	<30°	At Stream Grade	N/A	Inlet=1.3' Outlet=1.1'	Fair- coated with bit, slightly warped	15.8	704	Coated with bituminous	Data collected at 3:15PM on 9/3/02. Air = 20°C Water = 18°C. Very good fish habitat. Moderate canopy of redwoods & hardwoods. Culvert does not seem problematic. Continuous flow was present in the channel at time of survey and several fish (less than 10) of unknown species and of less than 3" in length were observed both downstream and upstream of the crossing.
SC-043	1.1	Headwall	<30°	Cascade over Riprap	Length=1.8' Slope=4.44%	No	Poor- rusted through	6.6	1,371	No	Data collected at 5:25PM on 9/9/02. Air = 17°C Water = 14°C. Good fish habitat. Dense canopy of redwoods & hardwoods. Continuous flow was present in the channel at time of survey, however no fish were observed.
SC-044	2.0	Wingwall	30°- 45°	Cascade over Riprap	N/A	No	Poor- rusted through	8.3	369	No	Data collected at 11:45AM on 9/19/02. Air = 14°C Water = 19°C. Good fish habitat. Steep drop in vicinity of Xing. Moderately dense redwood and hardwood canopy. LWD in front of inlet. Continuous flow was present in the channel at time of survey, however no fish were observed.
SC-045	1.0	Headwall	<30°	At Stream Grade	N/A	Natural Bottom	Good	12.5	225	No	Data collected at 3:30PM on 9/9/02. Air = 22°C Water = 14.5°C. Very good fish habitat. Stream goes under house 14 ft downstream and crossing seems much more problematic than this one. Continuous flow was present in the channel at time of survey and several fish (less than 10) of unknown species and of less than 3" in length were observed upstream of the crossing.
SC-046	N/A	Headwall	<30°	Freefall into pool	Length=9.0' Slope=3.78%	No	Good	8.4	338	No	Data collected at 10AM on 9/19/02. Air = 19°C Water = 14°C. Excellent fish habitat. Seems steep upstream. Large pools and dense redwood and hardwood canopy. Confluence with Jamison Cr ~60 ft from outlet. Continuous flow was present in the channel at time of survey, however no fish were observed.
SC-047	1.0	Wingwall	30°- 45°	Cascade over Riprap	Length=5.3' Slope=4.91%	Inlet=0.0' Outlet=0.2'	Poor- rusted through throughout culvert	6.5	300	Notched outlet beam	Data collected at 3:30PM on 10/1/02. Air = 15°C Water = 12°C. Fair fish habitat. Outlet configuration maybe difficult for fish to navigate. Dense mixed canopy. Shallow slope, good pools. Isolated pools were present in the channel at time of survey and no fish were observed.
SC-048	1.8	Wingwall	>45°	Freefall into pool	Length=18.4' Slope=6.68%	No	Fair- very rusty	6.8	7,349	No	Data collected at 10:15AM on 9/9/02. Air = 15°C Water = 11°C. Fair fish habitat. Fairly small creek. Xing near confluence with Bear Creek. Extremely perched creating definite barrier. Local resident says he has not seen any fish in creek over the past 12 years. Continuous flow was present in the channel at time of survey, however no fish were observed.
SC-049	N/A	Headwall	<30°	At Stream Grade	N/A	Natural Bottom of bedrock, fines in pools	Good	15.0	1,021	No	Data collected at 9:45AM on 9/6/02. Air = 13°C Water = 13°C. Very good fish habitat. Moderate canopy of redwoods& hardwoods. Culvert has natural bottom. Upstream concrete weir- fairly large. Slope of culvert not true representative of channel slope due to presence of pools. Slope from inlet to the outlet pool TWC is 1.78%. Continuous flow was present in the channel at time of survey and several fish (less than 10) of unknown species and of less than 3" in length were observed both downstream and upstream of the crossing.

SANTA CRUZ COUNTY STREAM CROSSING LOCATIONS AND CHARACTERISTICS

ID #	Stream Name	Road Name	Drainage	County Map #	Township, Range, Section	Latitude and Longitude Coordinates	Road ID #	Milemarker or Name and Distance to nearest Crossroad	Type of Culvert	Construction Material	Corrugation Dimensions	Culvert Length (ft)	Culvert Dimensions: Diameter, height/width, or rise/span (ft)	% Slope thru Culvert
SC-050	Two Bar Creek #2	Two Bar Road	San Lorenzo R	5M54	T9S, R2W, Section 18	37° 09' 7.73" 122° 07' 21.16"	43025	0.86	Circular	SSP	6" X 2"	70.1	14	1.63
SC-051	Two Bar Creek #3	Two Bar Road	San Lorenzo R	5M54	T9S, R2W, Section 8	37° 10' 8.35" 122° 05' 54.34"	43025	2.7	Bridge with Weirs	Concrete	N/A	25.2	11.65 X 13.55	-4.88
SC-052	Logan Creek	Kings Creek Road	Kings Cr-San Lorenzo R	5M44	T9S, R2W, Section 6	37° 11' 3.51" 122° 07' 19.63"	43026	2.65	Open Bottom Arch	Aluminum	10" X 4"	59.3	7.7 X 8.6	0.81
SC-053	Debris Flow Creek	Kings Creek Road	Kings Cr-San Lorenzo R	5M44	T8S, R2W, Section 31	37° 11' 11.84" 122° 07' 23.04"	43026	2.82	Circular	SSP	$2^2/_3$" X $^1/_2$"	60.6	2.5	1.09
SC-054	Arana Gulch #1 1of2	Capitola Road	Coastal	6N21	T11S, R1W, Section 8	36° 58' 53.32" 121° 59' 43.05"	2411	0.1 miles to Soquel Ave	Circular	SSP	$2^2/_3$" X $^1/_2$"	85.5	7.0	0.74
SC-054	Arana Gulch #1 2of2	Capitola Road	Coastal	6N21	T11S, R1W, Section 8	36° 58' 53.32" 121° 59' 43.05"	2411	0.1 miles to Soquel Ave	Circular	SSP	$2^2/_3$" X $^1/_2$"	85.5	7.0	0.82
SC-055	Arana Gulch #2	Soquel Avenue	Coastal	6N21	T11S, R1W, Section 8	36° 58' 58.36" 121° 59' 40.69"	2421	0.1 miles to Capitola Road	Circular	1st half=SSP 2nd half=concrete	6" X 2"	132.7	10.0	0.00
SC-056	Arana Gulch #3 1of2	Brookwood Drive	Coastal	6N21	T11S, R1W, Section 8	36° 59' 21.61" 121° 59' 12.09"	24099	0.20	Open Bottom Arch	SSP	10" X 3"	25.7	3 X 13.7	0.74
SC-056	Arana Gulch #3 2of2	Brookwood Drive	Coastal	6N21	T11S, R1W, Section 8	36° 59' 21.61" 121° 59' 12.09"	24099	0.20	Open Bottom Arch	SSP	10" X 3"	25.7	3 X 13.7	-5.02
SC-057	Arana Gulch #4	Paul Sweet Road	Coastal	6N11	T11S, R1W, Section 5	37° 0' 13.07" 121° 58' 59.58"	24041	1.30	Box	Concrete	N/A	24.6	3.0 X 4.0	1.83
SC-058	Bates Creek	Main Street	Soquel Creek	6N21	T11S, R1W	36° 59' 49.23" 121° 57' 4.99"	2406	0.60	Circular	SSP	$2^2/_3$" X $^1/_2$"	56.8	8.0	0.69

ID #	Rustline Height (ft)	Inlet Type	Inlet Alignment to Channel	Outlet Configuration	Outlet Apron	Culvert Embedded?	Culvert Condition	Average Active Channel Width (ft)	Estimated Road fill (cubic yards)	Previous Modifications to Culvert	Additional Comments from Initial Site Visit
SC-050	1.0	Headwall	<30°	Freefall into pool	N/A	No	Poor- Rusted through, low flow under pipe	10.3	1,155	No	Data collected at 9:45AM on 9/6/02. Air = 18°C Water = 14°C. Fair fish habitat with dense hardwood canopy. Culvert in terrible condition. Continuous flow was present in the channel at time of survey and an abundance of fish (50 - 100) of unknown species and of less than 3" in length were observed both downstream and upstream of the crossing.
SC-051	N/A	Headwall	30°- 45°	Freefall into pool	Length=7.0' Slope=56.14%	Natural Bottom	Fair	10.7	155	Inlet & Outlet Weir	Data collected at 1PM on 9/9/02. Air = 23°C Water = 13°C. Very good fish habitat. Dense redwood and hardwood canopy. Crossing is a bridge with 2 weirs, with steep sloped aprons on the weirs. Continuous flow was present in the channel at time of survey, however no fish were observed.
SC-052	N/A	Projecting	30°- 45°	At Stream Grade	N/A	Natural Bottom	Good	10.3	362	4 Upstream Weirs	Temperature data were collected at 1:40PM on 9/6/02. Air = 20°C Water = 14°C. Fair to good fish habitat. Moderate redwood & hardwood canopy. New installation according to local. Four upstream rock weirs. Isolated pools were present in the channel at time of survey and several fish (less than 10) of unknown species and of less than 3" in length were observed upstream of the crossing.
SC-053	0.7	Projecting	>45°	At Stream Grade	N/A	No	Poor- rusted through, crushed	4.6	530	No	Fairly poor fish habitat. Channel upstream not very defined. Outlet close to confluence with Kings Creek. Stream channel was dry at time of survey on 9/6/02.
SC-054	2.6	Wingwall	>45°	At Stream Grade	Length=10.8' Slope=0.00%	Inlet=0.0' Outlet=0.3'	Fair- warped and rusty	11.3	833	Old broken concrete outlet weir	Temperature data were collected at 9:00AM on 9/11/02. Air = 14°C Water = 14°C. Outlet weir is broken in half and sunken at outlet of culvert 2of2. Outlet apron is under pool. Continuous flow was present in the channel at time of survey, however no fish were observed.
SC-054	2.3	Headwall	>45°	At Stream Grade	Length=10.8' Slope=0.00%	No	Fair- warped and rusty	11.3	833	Old broken concrete outlet weir	Temperature data were collected at 9:00AM on 9/11/02. Air = 14oC Water = 14oC. Outlet weir is broken in half and sunken at outlet of culvert 2of2. Outlet apron is under pool. Continuous flow was present in the channel at time of survey, however no fish were observed.
SC-055	1.2	Wingwall	30°- 45°	At Stream Grade	N/A	Inlet=3.0' Outlet=3.0'	Fair	9.5	462	No	Temperature data were collected at 11:45am on 9/11/02. Air = 17°C Water = 14°C. Seems to be Poor habitat. Creek lacks features with mostly fines as substrate. Upstream channel is confined. Moderate canopy. Continuous flow was present in the channel at time of survey, however no fish were observed.
SC-056	completely rusted	Headwall	<30°	At Stream Grade	N/A	Natural Bottom	Fair- filling with sediment	7.4	86	No	Temperature data were collected at 2:30PM on 9/11/02. Air = 24°C Water = 15°C. Fair fish habitat. Local said crossing often floods road. Moderate hardwood canopy. Continuous flow was present in the channel at time of survey, however no fish were observed.
SC-056	completely rusted	Headwall	<30°	At Stream Grade	N/A	Natural Bottom	Fair- filling with sediment	7.4	86	No	Temperature data were collected at 2:30PM on 9/11/02. Air = 24°C Water = 15°C. Fair fish habitat. Local said crossing often floods road. Moderate hardwood canopy. Continuous flow was present in the channel at time of survey, however no fish were observed.
SC-057	N/A	Wingwall	30°- 45°	Cascade over Riprap	N/A	No	Fair	7.1	206	No	Temperature data were collected at 4:30PM on 9/11/02. Air = 18°C Water = 14°C. Good fish habitat. Moderate redwood canopy. Habitat is improving going upstream. Local hasn't seen fish for years. Continuous flow was present in the channel at time of survey, however no fish were observed.
SC-058	0.8	Headwall	<30°	Cascade over Riprap	Length=4.9' Slope=7.35%	No	Poor- large rusted through section	10.9	737	No	Temperature data were collected at 9:00AM on 9/12/02. Air = 13.5°C Water = 13°C. Fair to good habitat. Downstream confined by concrete banks. Continuous flow was present in the channel at time of survey, however no fish were observed.

SANTA CRUZ COUNTY STREAM CROSSING LOCATIONS AND CHARACTERISTICS

ID #	Stream Name	Road Name	Drainage	County Map #	Township, Range, Section	Latitude and Longitude Coordinates	Road ID #	Milemarker or Name and Distance to nearest Crossroad	Type of Culvert	Construction Material	Corrugation Dimensions	Culvert Length (ft)	Culvert Dimensions: Diameter, height/width, or rise/span (ft)	% Slope thru Culvert
SC-059	Moores Gulch	Soquel San Jose Road	Soquel Creek	6N11	T10S, R1W, Section 27	37° 1' 50.71" 121° 56' 48.70"	2405	3.10	Circular	SSP	5" X 1"	170.5	8.5	1.76
SC-060	Hester Creek	Soquel San Jose Road	West Branch Soquel Cr-Soquel Cr	6N11	T10S, R1W, Section 14	37° 3' 20.32" 121° 56' 23.50"	2405	5.3	Box	Concrete	N/A	89.9	10.6 X 10	4.05
SC-061	West Branch Soquel Creek	Redwood Lodge Road	Soquel Cr	6M51	T9S, R1W	37° 07' 7.74" 121° 57' 37.28"	44004	1.88	Circular	SSP	5" X 1"	103.0	12	3.73
SC-062	Laurel Creek #1	Morrell Road	West Branch Soquel Cr-Soquel Cr	6M51	T9S, R1W	37° 07' 15.45" 121° 56' 15.03"	44005	0.85	Box	Concrete	N/A	80.4	8.1 X 10.1	12.71
SC-063	Laurel Creek #2	Soquel San Jose Road	West Branch Soquel Cr-Soquel Cr	6M51	T9S, R1W	37° 07' 6.20" 121° 55' 28.73"	2405	11.00	Circular	Concrete	N/A	226.4	8.0	10.64
SC-064	Valencia Creek #1	Soquel Drive	Aptos Cr	6N22	T11S, R1E	36° 58' 32.79" 121° 53' 50.03"	2416	6.20	Box	Concrete	N/A	166.6	12.0 X 12.0	1.79
SC-065	Valencia Creek #2	Valencia Road	Aptos Cr	6N22	T11S, R1E	36° 59' 52.62" 121° 52' 3.23"	2503	2.29	Circular	Concrete	N/A	67.9	10.0	3.90
SC-066	Browns Creek #1	Browns Valley Road	Corralitos Cr-Salsipuedes Cr-Pajaro R	6N13	T10S, R2E, Section 32	37° 1' 31.79" 121° 46' 47.18"	2609	3.3	Box	Concrete	N/A	38.7	8.0 X 12.0	2.87

ID #	Rustline Height (ft)	Inlet Type	Inlet Alignment to Channel	Outlet Configuration	Outlet Apron	Culvert Embedded?	Culvert Condition	Average Active Channel Width (ft)	Estimated Road fill (cubic yards)	Previous Modifications to Culvert	Additional Comments from Initial Site Visit
SC-059	1.2	Headwall	30°- 45°	Freefall into pool	N/A	No	Good	14.4	13,748	Steel ramp baffles, fish ladder/weirs at outlet	Temperature data were collected at 1PM on 9/12/02. Air = 16°C Water = 14°C. Good fish habitat. Outlet is 20 ft from confluence with Soquel Cr. Fish ladder at outlet is a weir-pool style with 3 low flow weirs and 1 high flow weir with adjustable heights- very unique design. Lower jump pools may become submerged at high flows by Soquel Cr. 14 steel ramp baffles in pipe. Continuous flow was present in the channel at time of survey and several fish (less than 10) of unknown species and of less than 3" in length were observed both downstream and upstream of the crossing.
SC-060	N/A	Wingwall	<30°	Freefall into pool	N/A	No	Fair- rebar exposed	14.0	3,419	No	Temperature data were collected at 4PM on 9/12/02. Air = 18°C Water = 15°C. Good fish habitat. Dense hardwood and redwood canopy. Deep outlet pool. Confluence with West Branch Soquel Cr very close. Continuous flow was present in the channel at time of survey and several fish (less than 10) of unknown species and of less than 3" in length were observed both downstream and upstream of the crossing.
SC-061	3.0	Wingwall	<30°	Freefall into pool	N/A	No	Poor- concrete lining worn to rebar	23.2	5,320	No	Temperature data were collected at 11AM on 9/23/02. Air = 16°C Water = 15°C. Good fish habitat. Huge outlet pool. 7ft high dam wall in creek about 200 ft downstream and local said there is a 16 ft dam downstream. Moderate hardwood canopy. Huge trash rack at inlet. Continuous flow was present in the channel at time of survey and several fish (less than 10) of unknown species and of 3" - 6" in length were observed downstream of the crossing.
SC-062	N/A	Wingwall	<30°	Freefall into pool	N/A	No	Good	24.5	3,450	1 ft deep, 3 ft wide low flow partition	Temperature data were collected at 9AM on 9/23/02. Air = 16°C Water = 14°C. Good fish habitat, possible steep. Substrate is mostly boulders. Moderately dense mixed canopy. Continuous flow was present in the channel at time of survey, however no fish were observed.
SC-063	N/A	Wingwall	<30°	At Stream Grade	Length=14.3' Slope=62.03%	No	Good	11.8	24,809	Unique weirs at end of outlet apron, 5 ft high	Fair fish habitat, sparse coverage of hardwoods. Very interesting outlet configuration with very sloped apron and 3 wall type weirs to raise pool elevation at outlet. Isolated pools were present at time of survey on 9/20/02, no fish were observed, and no air/water temperatures were measured.
SC-064	N/A	Wingwall	<30°	Freefall into pool	N/A	Inlet=0.0' Outlet=0.5'	Fair - Baffles broken, worn	18.9	10,100	Partition wall with Washington baffles	Temperature data were collected at 10AM on 9/25/02. Air = 13°C Water = 13°C. Fair fish habitat. Right bank of culvert captures flow from low flow partition wall at inlet and is modified with Washington baffles. Concrete structure in outlet pool probably raises pool elevation and decreases velocities at high flows. Continuous flow was present in the channel at time of survey, however no fish were observed.
SC-065	N/A	Wingwall	<30°	Cascade over Riprap	Length=13.9' Slope=-4.53%	No	Good	16.0	3,023	6 steel ramp baffles, concave outlet beam	Temperature data were collected at 3PM on 9/18/02. Air = 21.5°C Water = 15°C. Very good fish habitat. Moderately dense hardwood canopy. 6 alternating, steel ramp baffles 1.1 ft high. Outlet apron has a concave beam at the outlet creating a pool before the outlet. Jump onto apron may be problematic. Continuous flow was present in the channel at time of survey and several fish (less than 10) of unknown species in three size classes (less than 3" in length, 3" to 6", and greater than 6") were observed both downstream and upstream of the crossing.
SC-066	N/A	Wingwall	>45°	Freefall into pool	N/A	No	Good	24.8	752	0.5' high low flow partition wall	Temperature data were collected at 9:30AM on 9/13/02. Air = 12.5°C Water = 12.5°C. Very good fish habitat. Moderate hardwood canopy. Low flow partition wall at inlet is 0.6' high with an opening 2.1' wide. Continuous flow was present in the channel at time of survey and many fish (between 50 to 100) of unknown species in three size classes (less than 3" in length, 3" to 6", and greater than 6") were observed both downstream and upstream of the crossing.

SANTA CRUZ COUNTY STREAM CROSSING LOCATIONS AND CHARACTERISTICS

ID #	Stream Name	Road Name	Drainage	County Map #	Township, Range, Section	Latitude and Longitude Coordinates	Road ID #	Milemarker or Name and Distance to nearest Crossroad	Type of Culvert	Construction Material	Corrugation Dimensions	Culvert Length (ft)	Culvert Dimensions: Diameter, height/width, or rise/span (ft)	% Slope thru Culvert
SC-067	Browns Creek #2	Browns Valley Road	Corralitos Cr-Salsipuedes Cr-Pajaro R	6N13	T10S, R2E, Section 32	37° 1' 34.34" 121° 46' 43.71"	2609	3.4	Box	Concrete	N/A	47.0	8.0 X 12.0	2.26
SC-068	Gamecock Canyon	Hazel Dell Road	Browns Cr-Corralitos Cr-Salsipuedes Cr-Pajaro R	6N13	T10S, R2E, Section 32	37° 1' 32.56" 121° 46' 24.94"	2602	3.3	Open Bottom Arch	Concrete with an SSP top	6" X 2"	23.0	7.4 X 8.0	-0.87
SC-069	Rider Creek	Rider Road	Corralitos Cr-Salsipuedes Cr-Pajaro R	6N12	T10S, R1E, Section 35	37° 00' 57.27" 121° 49' 11.18"	35001	0.29	Circular	Spiral & SSP	$2^{2}/_{3}$" X $^{1}/_{2}$"	56.8	6.0	2 breaks 0.70% 2.95% 4.41%
SC-070	Corralitos Creek	Eureka Canyon Road	Salsipuedes Cr-Pajaro R	6N12	T10S, R1E, Section 35	37° 1' 32.15" 121° 49' 9.38"	35003	2.95	Box	Concrete	N/A	94.8	12.2 X 12.0	2.39
SC-071	Shingle Mill Gulch #1	Eureka Canyon Road	Corralitos Cr-Salsipuedes Cr-Pajaro R	6N12	T10S, R1E, Section 24	37° 2' 41.41" 121° 48' 27.96"	35003	4.8	Open Bottom Arch	SSP	6" X 2"	34.9	7.7 X 11.5	-0.43
SC-072	Shingle Mill Gulch #2	Eureka Canyon Road	Corralitos Cr-Salsipuedes Cr-Pajaro R	6N12	T10S, R1E, Section 24	37° 2' 44.64" 121° 48' 8.51"	35003	5.24	Circular	SSP	$2^{2}/_{3}$" X $^{1}/_{2}$"	33.3	6.0	5.17
SC-073	Casserly Creek #1	Casserly Road	Salsipuedes Cr-Pajaro R	6N23	T11S, R2E	36° 58' 33.66" 121° 44' 28.87"	2607	1.50	Open Bottom Arch	Concrete	N/A	69.0	6.2 X 9.5	-0.61% 1.96%
SC-074	Casserly Creek #2	Mt. Madonna Road	Salsipuedes Cr-Pajaro R	6N23	T11S, R2E	36° 59' 19.71" 121° 44' 18.45"	26059	1.0	Circular	SSP	$2^{2}/_{3}$" X $^{1}/_{2}$"	30.3	6.0	0.30
SC-075	Green Valley Creek #1 1of2	Casserly Road	Salsipuedes Cr-Pajaro R	6N23	T11S, R2E	36° 58' 19.92" 121° 45' 49.69"	2607	0.20	Box	Concrete	N/A	42.3	12.0 X 12.0	0.05
SC-075	Green Valley Creek #1 2of2	Casserly Road	Salsipuedes Cr-Pajaro R	6N23	T11S, R2E	36° 58' 19.92" 121° 45' 49.69"	2607	0.20	Box	Concrete	N/A	42.3	12.0 X 12.0	-0.02

ID #	Rustline Height (ft)	Inlet Type	Inlet Alignment to Channel	Outlet Configuration	Outlet Apron	Culvert Embedded?	Culvert Condition	Average Active Channel Width (ft)	Estimated Road fill (cubic yards)	Previous Modifications to Culvert	Additional Comments from Initial Site Visit
SC-067	N/A	Wingwall	30°- 45°	Freefall into pool	N/A	No	Good	20.2	284	Low flow channel depressed in center of floor	Temperature data were collected at 11:30AM on 9/13/02. Air = 14°C Water = 13°C. Very good fish habitat. Low flow partition cut into floor (1' wide and 0.3' deep). 2ft weir 200 ft upstream. Deep outlet pool. Dense redwood and hardwood canopy. Continuous flow was present in the channel at time of survey and a moderate abundance of fish (between 10 to 50) of unknown species in three size classes (less than 3" in length, 3" to 6", and greater than 6") were observed both downstream and upstream of the crossing.
SC-068	N/A	Wingwall	<30°	Freefall into pool	Yes - Short extension	Natural Bottom	Good	17.0	453	No	Temperature data were collected at 9AM on 9/16/02. Air = 14°C Water = 13°C. Good fish habitat. Low gradient. Jump at outlet. Dense hardwood and redwood canopy. Continuous flow was present in the channel at time of survey and several fish (less than 10) of unknown species and of less than 3" in length were observed both downstream and upstream of the crossing.
SC-069	0.7	Wingwall	>45°	Cascade over Riprap	N/A	No	Fair- pipe is separating and caving in	7.4	1,165	No	Temperature data were collected at 1PM on 9/16/02. Air = 15°C Water = 13°C. Good fish habitat. Moderate redwood canopy. Culvert is in three different segments which are starting to break apart. Continuous flow was present in the channel at time of survey, however no fish were observed.
SC-070	N/A	Wingwall	<30°	Freefall into pool	N/A	No	Fair- rebar exposed	22.3	4,988	No	Temperature data were collected at 11:30AM on 9/16/02. Air = 16°C Water = 15°C. Very good to excellent fish habitat. Seems like a low flow partition chute was set up but is not effective due to no partition wall at the inlet to confine flow. Moderately dense redwood and hardwood canopy. Continuous flow was present in the channel at time of survey and an abundance of fish (50 - 100) of unknown species and of less than 3" in length were observed upstream of the crossing.
SC-071	0.0	Wingwall	30°- 45°	Freefall into pool	Length=15.3' Slope=5.69%	Natural Bottom	Good	10.6	321	Concrete outlet beam	Temperature data were collected at 3PM on 9/16/02. Air = 16.5°C Water = 14.5°C. Very good fish habitat. Resident says he sees many STHD here and they make it past the Xing. Flooded over road in 1982. Next crossing is a barrier, according to resident. Moderate hardwood and redwood canopy. Continuous flow was present in the channel at time of survey, however no fish were observed.
SC-072	1.3	Wingwall	30°- 45°	Freefall into pool	Length=4.7' Slope=16.60%	No	Poor- rusted through, jagged	14.5	129	No	Temperature data were collected at 4:45PM on 9/16/02. Air = 18°C Water = 17°C. Good fish habitat. Moderate redwood canopy. Continuous flow was present in the channel at time of survey and several fish (less than 10) of unknown species and of less than 3" in length were observed downstream of the crossing.
SC-073	N/A	Wingwall	<30°	At Stream Grade	N/A	Natural Bottom	Fair- concrete is cracked	8.1	870	No	Temperature data were collected at 5PM on 9/17/02. Air = 19°C Water = 16°C. Fair fish habitat. Moderately dense mixed canopy. Concrete floor starts at station 62 to the outlet. Isolated pools were present in the channel at time of survey and no fish were observed in the channel adjacent to the crossing.
SC-074	1.0	Projecting	30°- 45°	Freefall into pool	Length=8.0' Slope=8.75%	No	Poor- rusted through	8.4	476	No	Temperature data were collected at 12 noon on 9/18/02. Air = 22°C Water = 14°C. Good fish habitat. Moderately dense mixed canopy. Undercut banks at outlet. Continuous flow was present in the channel at time of survey, however no fish were observed.
SC-075	N/A	Wingwall	>45°	Cascade over Riprap	N/A	No	Good	13.5	425	No	Temperature data were collected at 11AM on 9/18/02. Air = 20°C Water = 16°C. Fair to poor fish habitat. Moderate redwood canopy. Continuous flow was present in the channel at time of survey, however no fish were observed.
SC-075	N/A	Wingwall	>45°	Cascade over Riprap	N/A	No	Good	13.5	425	No	Temperature data were collected at 11AM on 9/18/02. Air = 20°C Water = 16°C. Fair to poor fish habitat. Moderate redwood canopy. Continuous flow was present in the channel at time of survey, however no fish were observed.

SANTA CRUZ COUNTY STREAM CROSSING LOCATIONS AND CHARACTERISTICS

ID #	Stream Name	Road Name	Drainage	County Map #	Township, Range, Section	Latitude and Longitude Coordinates	Road ID #	Milemarker or Name and Distance to nearest Crossroad	Type of Culvert	Construction Material	Corrugation Dimensions	Culvert Length (ft)	Culvert Dimensions: Diameter, height/width, or rise/span (ft)	% Slope thru Culvert
SC-076	Green Valley Creek #2	Green Valley Road	Salsipuedes Cr-Pajaro R	6N23	T11S, R2E	36° 58' 36.48" 121° 46' 30.63"	2604	4.03	Open Bottom Arch	Concrete footings w/ SSP top	6" X 2"	37.0	12.8 X 18.9	0.00
SC-077	Green Valley Creek #3	Green Valley Road	Salsipuedes Cr-Pajaro R	6N23	T11S, R2E	36° 59' 15.97" 121° 46' 34.95"	2604	3.25	Open Bottom Arch	Concrete	N/A	18.1	17.1 X 23.8	-4.59
SC-078	Green Valley Creek #4	Green Valley Road	Salsipuedes Cr-Pajaro R	6N13	T11S, R2E	37° 00' 11.57" 121° 46' 7.26"	2604	1.98	Box	Concrete	N/A	21.6	17 X 25	-1.53
SC-079	Green Valley Creek #5	Green Valley Road	Salsipuedes Cr-Pajaro R	6N13	T11S, R2E	37° 00' 2.75" 121° 45' 8.74"	2604	.89	Circular	CSP - Spiral	5" X 1"	80.8	12.0	0.15
SC-080	Green Valley Creek #6	Green Valley Road	Salsipuedes Cr-Pajaro R	6N13	T11S, R2E	37° 00' 1.38" 121° 44' 56.80"	2604	.69	Circular	SSP	$2^{2}/_{3}$" X $^{1}/_{2}$"	40.1	8.0	0.62

ID #	Rustline Height (ft)	Inlet Type	Inlet Alignment to Channel	Outlet Configuration	Outlet Apron	Culvert Embedded?	Culvert Condition	Average Active Channel Width (ft)	Estimated Road fill (cubic yards)	Previous Modifications to Culvert	Additional Comments from Initial Site Visit
SC-076	N/A	Wingwall	<30°	Cascade over Riprap	Length=18.9' Slope=12.60%	Natural Bottom	Good	15.4	1,067	No	Temperature data were collected at 3PM on 9/17/02. Air = 20°C Water = 16°C. Low gradient channel. Presence of concrete beams/wall at inlet and outlet, may be for structural integrity. Concrete outlet beam is 2.3 ft wall with no pool behind it and an apron with rock concreted into place leading into riprap and the outlet pool. Isolated pools were present in the channel at time of survey and several fish (less than 10) of unknown species and of less than 3" in length were observed downstream of the crossing.
SC-077	N/A	Headwall	30°- 45°	Freefall into pool	Length=3.5' Slope=7.71%	Natural Bottom	Fair	14.1	1,226	Concrete outlet beam	Temperature data were collected at 1PM on 9/17/02. Air = 18°C Water = 15°C. Fair fish habitat. Surrounded by agriculture fields. Substrate mostly fines. Outlet beam is 2.1 ft high with a 3 ft apron attached to it, other than that site doesn't seem to be a passage problem. Isolated pools were present in the channel at time of survey and no fish were observed in the stream channel adjacent to the crossing.
SC-078	N/A	Headwall	<30°	Freefall into pool	Length=35.2' Slope=9.74%	Natural Bottom	Good	18.5	545	Notched concrete outlet beam	Good fish habitat. Substrate of fines. Moderately dense canopy. Outlet beam is 3ft high with a 0.6' X 0.5' notch. Outlet beam appears to have been installed to stabilized the bed and not for fish passage. Stream channel was dry at time of survey on 9/17/02.
SC-079	0.5	Projecting	30°- 45°	At Stream Grade	N/A	Inlet=0.8' Outlet=2.6'	Good	10.3	958	No	Fair fish habitat. Sparse canopy. Culvert seems passable. Stream channel was dry at time of survey on 9/18/02.
SC-080	2.0	Wingwall	<30°	At Stream Grade	Length=9.9' Slope=8.69%	No	Poor- Rusted through w/ jutting metal	9.6	251	No	Temperature data were collected at 10AM on 9/17/02. Air = 17.5°C Water = 13°C. Good fish habitat. Moderately dense mixed canopy. Local said there used to be many fish but not now. Continuous flow was present in the channel at time of survey and several fish (less than 10) of unknown species and of less than 3" in length were observed downstream of the crossing.

SANTA CRUZ SURVEYED ELEVATIONS

QUESERIA CREEK - Swanton Road ID# SC-001

Station (ft)	BS (+)	HI	FS (-)	Elevation (ft)	WS	Slope	Station Description, Comments
	3.81						Temporary Bench Mark-TBM
9.0		103.81	9.06	94.75		12.31%	TW Control of 1st resting habitat
16.8		103.81	10.02	93.79		2.75%	Inlet Invert
	3.00		12.44				Turning Point
59.0		94.37	1.74	92.63			Outlet Invert
59.1		94.37	2.88	91.49			Outlet Riprap
	3.81						TBM
62.2		103.81	13.63	90.18	91.08		Max. Pool Depth=0.9
67.0		103.81	12.82	90.99			TW Control
75.5		103.81	14.56	89.25		20.47%	Downstream Slope

TAILWATER CROSS-SECTION at Station 67.0

Station (ft)	BS (+)	HI	FS (-)	Elevation (ft)	WS	Slope	Station Description, Comments
6.3		103.81	10.37	93.44			LB on Bank
8.4		103.81	11.02	92.79			On Boulder Weir
9.6		103.81	11.77	92.04			LB ACM
11.1		103.81	12.83	90.98			Thalweg d=0.25
12.9		103.81	12.82	90.99			In Channel d=0.2'
14.3		103.81	11.46	92.35			RB ACM
17.0		103.81	10.11	93.70			RB on Bank

ARCHIBALD CREEK - Swanton Road ID# SC-002

Station (ft)	BS (+)	HI	FS (-)	Elevation (ft)	WS	Slope	Station Description, Comments
	4.20						Temporary Bench Mark-TBM
8.1		104.20	9.75	94.45		1.02%	Inlet Apron
13.0		104.20	9.80	94.40		0.85%	Inlet Invert
54.1		104.20	10.15	94.05			Outlet Invert
56.1		104.20	11.29	92.91			Max. Pool Depth=0
63.2		104.20	10.46	93.74			TW Control
73.3		104.20	11.26	92.94		7.92%	Downstream Slope
		104.20	9.53	94.67			ACM
		104.20	10.13	94.07			ACM
		104.20	10.16	94.04			ACM

UNT #1 TO SCOTT CR - Swanton Road ID# SC-003

Station (ft)	BS (+)	HI	FS (-)	Elevation (ft)	WS	Slope	Station Description, Comments
	3.91						Temporary Bench Mark-TBM
4.5		103.91	8.95	94.96		16.12%	TW Control of 1st resting habitat
19.2		103.91	11.32	92.59		5.47%	Inlet Invert
60.3		103.91	13.57	90.34			Outlet Invert
67.5		103.91	13.98	89.93			TW Control
88.0		103.91	15.95	87.96		9.61%	Downstream Slope

TAILWATER CROSS-SECTION at Station 67.5

Station (ft)	BS (+)	HI	FS (-)	Elevation (ft)	WS	Slope	Station Description, Comments
13.5		103.91	9.54	94.37			LB Bankfull
14.5		103.91	12.37	91.54			LB ACM
17.4		103.91	13.39	90.52			In Channel
20.9		103.91	13.98	89.93			Thalweg
22.7		103.91	13.24	90.67			In Channel
25.8		103.91	12.39	91.52			RB ACM
28.8		103.91	10.83	93.08			RB Bankfull

UNT #2 TO SCOTT CR - Swanton Road ID# SC-004

Station (ft)	BS (+)	HI	FS (-)	Elevation (ft)	WS	Slope	Station Description, Comments
	3.43						Temporary Bench Mark-TBM
22.3		103.43	9.06	94.37		6.50%	TW Control of 1st resting habitat
40.0		103.43	10.21	93.22		3.79%	Inlet Invert
81.4		103.43	11.78	91.65			Outlet Invert
85.2		103.43	13.68	89.75			Max. Pool Depth=0'
93.0		103.43	12.16	91.27			TW Control
109.2		103.43	13.74	89.69		9.75%	Downstream Slope
		103.43	11.53	91.90			ACM
		103.43	11.86	91.57			ACM

MOLINO CREEK - Swanton Road ID# SC-005

Station (ft)	BS (+)	HI	FS (-)	Elevation (ft)	WS	Slope	Station Description, Comments
	1.64						Temporary Bench Mark-TBM
5.6		101.64	1.93	99.71	100.26		TW Control of 1st resting habitat d=0.55'
9.4		101.64	1.48	100.16	100.21	0.92%	Inlet Invert d=0.05'
38.8		101.64	1.75	99.89			Outlet Invert
39.9		101.64	6.38	95.26	97.66		Max. Pool Depth=2.4'
57.9		101.64	4.17	97.47	97.67		TW Control d=0.2'
78.6		101.64	4.90	96.74	97.14	3.53%	Downstream Slope d=0.4'

TAILWATER CROSS-SECTION at Station 57.9

Station (ft)	BS (+)	HI	FS (-)	Elevation (ft)	WS	Slope	Station Description, Comments
4.0		101.64	3.67	97.97			LB ACM
5.5		101.64	3.96	97.68			LEW
9.7		101.64	4.17	97.47	97.67		TW Control d=0.2'
12.0		101.64	4.03	97.61			In Channel
13.2		101.64	4.01	97.63			REW
16.5		101.64	3.77	97.87			RB ACM
18.6		101.64	3.91	97.73			RB on Gravel Bar

REDWOOD CREEK #1 - Glen Canyon Road ID# SC-009

Station (ft)	BS (+)	HI	FS (-)	Elevation (ft)	WS	Slope	Station Description, Comments
	3.58						Temporary Bench Mark-TBM
16.8		103.58	2.28	101.30	101.40	-1.34%	TW Control of 1st resting habitat d=0.1'
25.0		103.58	2.17	101.41		2.03%	Inlet Invert
141.7		103.58	4.54	99.04	99.44		Outlet Invert d=0.4'
146.8		103.58	5.14	98.44	99.44		Max pool within 5' of outlet d=1.0'
150.7		103.58	5.30	98.28	99.43		Max. Pool Depth=1.15'
172.7		103.58	3.95	99.63			TW Control
187.0		103.58	4.30	99.28		2.45%	Downstream Slope
		103.58	3.14	100.44	100.31		ACM
		103.58	3.41	100.17			ACM

REDWOOD CREEK #2 - Redwood Drive ID# SC-010

Station (ft)	BS (+)	HI	FS (-)	Elevation (ft)	WS	Slope	Station Description, Comments
	3.76						Temporary Bench Mark-TBM
11.5		103.76	2.71	101.05	101.45	-6.27%	TW Control of 1st resting habitat d=0.4'
15.7		103.76	2.82	100.94	101.44		Just Before Inlet d=0.5'
17.4		103.76	2.34	101.42		3.20%	Inlet Invert
54.6		103.76	3.53	100.23			Outlet Invert - Thalweg
54.6		103.76	3.47	100.29			Outlet Invert - Centerline
69.0		103.76	3.94	99.82		3.26%	Outlet Apron
74.0		103.76	5.59	98.17	99.17		Max pool within 5' of outlet d=1.0'
78.2		103.76	6.14	97.62	99.32		Max. Pool Depth=1.7'
101.5		103.76	4.63	99.13	99.33		TW Control d=0.2'
121.8		103.76	5.78	97.98	99.28	5.67%	Downstream Slope d=1.3'
		103.76	3.08	100.68			ACM
		103.76	3.43	100.33			ACM
		103.76	3.61	100.15			ACM

REDWOOD CREEK #3 - Redwood Drive ID# SC-011

Station (ft)	BS (+)	HI	FS (-)	Elevation (ft)	WS	Slope	Station Description, Comments
	1.90						Temporary Bench Mark-TBM
13.0		101.90	10.91	90.99	91.09	-2.22%	TW Control of 1st resting habitat d=0.1'
16.6		101.90	10.83	91.07		5.62%	Inlet Invert
57.0		101.90	13.10	88.80			Outlet Invert
62.0		101.90	15.96	85.94	88.24		Max. Pool Depth=2.3'
82.5		101.90	13.47	88.43			TW Control
105.0		101.90	14.45	87.45	87.50	4.36%	Downstream Slope d=0.05'

TAILWATER CROSS-SECTION at Station 82.5

Station (ft)	BS (+)	HI	FS (-)	Elevation (ft)	WS	Slope	Station Description, Comments
2.0		101.90	10.68	91.22			LB on Bank
5.0		101.90	11.39	90.51			LB on Bank
6.0		101.90	12.60	89.30			LB ACM
6.6		101.90	13.43	88.47			Bottom of LB
12.4		101.90	13.47	88.43			TWC
14.0		101.90	13.22	88.68			Bottom of RB
14.3		101.90	12.89	89.01			RB ACM
17.0		101.90	9.58	92.32			RB on Bank

REDWOOD CREEK #4 - Redwood Drive ID# SC-012

Station (ft)	BS (+)	HI	FS (-)	Elevation (ft)	WS	Slope	Station Description, Comments
	2.48						Temporary Bench Mark-TBM
3.0		102.48	9.05	93.43			Upstream Pool
3.5		102.48	8.25	94.23			TWC
8.9		102.48	8.32	94.16		2.54%	Inlet Apron
14.8		102.48	8.47	94.01		2.80%	Inlet Invert
54.5		102.48	9.58	92.90			Outlet Invert
55.0		102.48	9.93	92.55		34.50%	Outlet Riprap- Top
57.0		102.48	10.62	91.86			Bottom of Riprap
58.6		102.48	11.01	91.47			Max. Pool Depth
65.8		102.48	10.09	92.39			TW Control
86.2		102.48	11.00	91.48		4.46%	Downstream Slope

TAILWATER CROSS-SECTION at Station 65.8

Station (ft)	BS (+)	HI	FS (-)	Elevation (ft)	WS	Slope	Station Description, Comments
4.0		102.48	5.01	97.47			LB on Bank
7.3		102.48	8.87	93.61			LB ACM
7.6		102.48	9.54	92.94			On Bedrock at bottom of bank
15.0		102.48	9.66	92.82			Edge of Bedrock
15.1		102.48	10.00	92.48			In Channel
15.9		102.48	10.09	92.39			TWC
17.0		102.48	10.01	92.47			Edge of Cobbles
17.3		102.48	9.12	93.36			RB ACM
18.5		102.48	6.70	95.78			RB on Bank

REDWOOD CREEK #5 - Redwood Drive ID# SC-013

Station (ft)	BS (+)	HI	FS (-)	Elevation (ft)	WS	Slope	Station Description, Comments
	2.28						Temporary Bench Mark-TBM
6.0		102.28	9.12	93.16		5.86%	TW Control of 1st resting habitat
18.0		102.28	10.39	91.89			Pool before Inlet d=0.5'
18.8		102.28	9.87	92.41		3.04%	Inlet Invert
76.0		102.28	11.61	90.67			Outlet Invert
80.8		102.28	14.21	88.07			Max depth wihin 5' of outlet d=1.55'
85.7		102.28	14.97	87.31			Max. Pool Depth=2.35'
105.7		102.28	12.60	89.68			TW Control
114.8		102.28	12.85	89.43		2.75%	Downstream Slope
		102.28	12.13	90.15			ACM
		102.28	12.21	90.07			ACM

REDWOOD CREEK #6 - Redwood Drive ID# SC-014

Station (ft)	BS (+)	HI	FS (-)	Elevation (ft)	WS	Slope	Station Description, Comments
	0.71						Temporary Bench Mark-TBM
34.8		100.71	6.84	93.87		1.63%	Inlet Apron
39.7		100.71	6.92	93.79		5.49%	Inlet Invert
120.8		100.71	11.37	89.34			Outlet Invert
121.4		100.71	13.04	87.67			Drop after outlet
122.2		100.71	12.39	88.32			Riprap
125.5		100.71	12.21	88.50			Riprap
128.0		100.71	13.58	87.13			Riprap
135.3		100.71	14.92	85.79			Riprap
141.8		100.71	15.59	85.12			End of Riprap
142.6		100.71	17.70	83.01	84.31		Max. Pool Depth=1.3'
154.8		100.71	16.59	84.12	84.32		TW Control d=0.2'
162.7		100.71	16.83	83.88		3.04%	Downstream Slope
		100.71	15.68	85.03			ACM
		100.71	15.66	85.05			ACM

REDWOOD CREEK #7 - Redwood Drive ID# SC-015

Station (ft)	BS (+)	HI	FS (-)	Elevation (ft)	WS	Slope	Station Description, Comments
	2.59						Temporary Bench Mark-TBM
1.0		102.59	18.95	83.64	83.89	3.85%	TW Control of 1st resting habitat d=0.25'
28.0		102.59	19.99	82.60	83.00	2.68%	Inlet Invert d=0.4'
188.7		102.59	24.29	78.30			Outlet Invert
190.7		102.59	27.09	75.50	76.90		After Outlet d=1.4'
198.7		102.59	28.87	73.72	76.82		Max. Pool Depth=3.1'
	3.23		2.59				Turning Point
214.7		103.23	26.40	76.83			TW Control
		103.23	25.32	77.91			ACM
		103.23	25.22	78.01			ACM

GRANITE CREEK - Granite Creek Road ID# SC-016

Station (ft)	BS (+)	HI	FS (-)	Elevation (ft)	WS	Slope	Station Description, Comments
	3.20						Temporary Bench Mark-TBM
34.5		103.20	11.19	92.01		9.41%	TW Control of 1st resting habitat
48.1		103.20	12.47	90.73		-1.54%	Inlet Apron
49.4		103.20	12.45	90.75		1.61%	Inlet Invert
95.3		103.20	13.19	90.01			Outlet Invert
99.3		103.20	14.41	88.79		30.50%	Outlet Apron
104.8		103.20	19.15	84.05	88.35		Max. Pool Depth=4.3'
115.6		103.20	15.03	88.17	88.37		TW Control d=0.2'
137.0		103.20	15.45	87.75	87.95	1.96%	Downstream Slope d=0.2'
TAILWATER CROSS-SECTION at Station 115.6							
Station (ft)	BS (+)	HI	FS (-)	Elevation (ft)	WS	Slope	Station Description, Comments
3.5		103.20	11.15	92.05			LB on Bank
9.6		103.20	13.69	89.51			LB ACM
12.8		103.20	15.03	88.17	88.37		TW Control d=0.2'
21.6		103.20	13.54	89.66			RB ACM
22.7		103.20	8.64	94.56			RB on Bank

CRYSTAL CREEK #1 - Branciforte Drive ID# SC-017

Station (ft)	BS (+)	HI	FS (-)	Elevation (ft)	WS	Slope	Station Description, Comments
	3.96						Temporary Bench Mark-TBM
8.5		103.96	3.34	100.62			TW Control of 1st resting habitat
20.5		103.96	4.62	99.34			Pool before Inlet d=1.3'
22.2		103.96	3.96	100.00			Inlet Invert d=0.6'
58.3		103.96	3.98	99.98			Outlet Invert - Thalweg d=0.6'
58.3		103.96	3.88	100.08			Outlet Invert - Centetline d=0.5'
93.0		103.96	3.37	100.59			TW Control
105.0		103.96	4.28	99.68			Downstream Slope d=0.5'
TAILWATER CROSS-SECTION at Station 64.0							
Station (ft)	BS (+)	HI	FS (-)	Elevation (ft)	WS	Slope	Station Description, Comments
1.0		103.96	1.43	102.53			LB on Bank
2.0		103.96	2.73	101.23			LB ACM
5.2		103.96	3.38	100.58			LEW
10.4		103.96	3.37	100.59			TW Control
11.7		103.96	3.37	100.59			Edge of Bank
11.9		103.96	2.83	101.13			RB ACM
12.4		103.96	1.09	102.87			RB on Bank

CRYSTAL CREEK #2 - Happy Valley Road ID# SC-018

Station (ft)	BS (+)	HI	FS (-)	Elevation (ft)	WS	Slope	Station Description, Comments
	4.06						Temporary Bench Mark-TBM
7.0		104.06	11.78	92.28		0.94%	Upstream Channel
39.5		104.06	13.55	90.51	92.11		Pool before Inlet d=1.6'
55.8		104.06	12.24	91.82	92.12		TW Control of 1st resting habitat d=0.3'
60.3		104.06	12.24	91.82	92.12	1.64%	Inlet Invert d=0.3'
108.5		104.06	13.03	91.03	92.03		Outlet Invert d=1.0'
111.8		104.06	13.34	90.72	92.07		Max depth wihtin 5' of outlet=1.35'
120.6		104.06	13.46	90.60	92.10		Max. Pool Depth=1.5'
140.5		104.06	11.91	92.15			TW Control
158.0		104.06	12.47	91.59	91.69	3.20%	Downstream Slope d=0.1'
TAILWATER CROSS-SECTION at Station 140.5							
Station (ft)	BS (+)	HI	FS (-)	Elevation (ft)	WS	Slope	Station Description, Comments
2.5		104.06	9.62	94.44			LB Bankfull
4.5		104.06	11.07	92.99			LB ACM
9.0		104.06	11.52	92.54			Channel
12.5		104.06	11.95	92.11			LEW
13.3		104.06	11.91	92.15			In Channel
15.5		104.06	11.76	92.30			On Boulder Weir
18.0		104.06	12.01	92.05			REW
19.7		104.06	11.50	92.56			RB ACM
26.6		104.06	10.14	93.92			RB Bankfull

CRYSTAL CREEK #3 - Happy Valley Road ID# SC-019

Station (ft)	BS (+)	HI	FS (-)	Elevation (ft)	WS	Slope	Station Description, Comments
	4.38						Temporary Bench Mark-TBM
2.3		104.38	11.82	92.56		1.78%	TW Control of 1st resting habitat
7.7		104.38	12.70	91.68	92.38		Max pool before intlet d=0.7'
15.2		104.38	12.05	92.33	92.43	0.80%	Inlet Invert d=0.1'
57.9		104.38	12.39	91.99	92.14		Outlet Invert d=0.15'
61.6		104.38	12.98	91.40	92.10		Max. Pool Depth=0.7'
71.4		104.38	12.40	91.98	92.08		TW Control d=0.1'
88.7		104.38	12.96	91.42	92.12	3.24%	Downstream Slope d=0.7'
TAILWATER CROSS-SECTION at Station 71.4							
Station (ft)	BS (+)	HI	FS (-)	Elevation (ft)	WS	Slope	Station Description, Comments
2.5		104.38	8.92	95.46			LB Bankfull
6.7		104.38	11.18	93.20			LB ACM
9.8		104.38	12.32	92.06			LEW
11.2		104.38	12.40	91.98			TW Control d=0.1'
12.0		104.38	12.38	92.00			In Channel
12.8		104.38	12.38	92.00			In Channel
15.7		104.38	12.28	92.10			REW
16.6		104.38	11.70	92.68			RB ACM
18.4		104.38	10.70	93.68			RB Bankfull

BRANCIFORTE CREEK #1 - Branciforte Drive ID# SC-020

Station (ft)	BS (+)	HI	FS (-)	Elevation (ft)	WS	Slope	Station Description, Comments
	3.61						Temporary Bench Mark-TBM
2.0		103.61	6.03	97.58	100.03		Inlet Invert - Centerline d=2.45'
2.0		103.61	7.43	96.18	100.03	2.79%	Inlet Invert - Thalweg d=3.85'
26.0		103.61	8.10	95.51	99.91		Outlet Invert - Thalweg d=4.4'
26.0		103.61	5.45	98.16	99.96		Outlet Invert - Centerline d=1.8'
31.0		103.61	7.44	96.17	99.57		Max depth within 5' of outlet d=3.4'
54.0		103.61	8.00	95.61	99.61		Max. Pool Depth=4.0'
59.0		103.61	3.61	100.00			Outlet Weir
59.0		103.61	5.92	97.69			Left Notch in Weir
59.0		103.61	3.77	99.84			Right Notch
59.5		103.61	5.19	98.42			Top of Riprap
70.5		103.61	7.94	95.67			Bottom of Riprap
72.5		103.61	9.79	93.82	95.02		Max pool after Riprap d=1.2'
84.0		103.61	9.43	94.18	94.68		TW Control d=0.5'
114.0		103.61	9.27	94.34	94.64	-0.53%	Downstream Slope d=0.3'
TAILWATER CROSS-SECTION at Station 84.0							
Station (ft)	BS (+)	HI	FS (-)	Elevation (ft)	WS	Slope	Station Description, Comments
5.0		103.61	6.04	97.57			LB on Bank
10.1		103.61	7.69	95.92			LB ACM
16.7		103.61	9.16	94.45			LEW
18.0		103.61	9.43	94.18			TW Control d=0.5'
21.9		103.61	8.76	94.85			In Channel
27.0		103.61	9.15	94.46			In Channel
27.6		103.61	9.06	94.55			REW d=0.4'
30.1		103.61	7.39	96.22			RB ACM
38.8		103.61	4.35	99.26			RB on Bank

TIE GULCH - Branciforte Drive ID# SC-021

Station (ft)	BS (+)	HI	FS (-)	Elevation (ft)	WS	Slope	Station Description, Comments
	2.08						Temporary Bench Mark-TBM
12.0		102.08	2.53	99.55	100.05	-3.75%	Top of Inlet Apron d=0.5'
12.8		102.08	2.50	99.58	100.08		Bottom of Inlet Apron d=0.5'
13.0		102.08	2.08	100.00		0.86%	Inlet Invert
92.8		102.08	2.77	99.31			Outlet Invert
98.0		102.08	3.18	98.90	99.30		Max. Pool Depth=0.4'
99.0		102.08	2.98	99.10	99.20		TW Control d=0.1'
111.7		102.08	3.81	98.27	98.87		Pool before X-section d=0.6'
126.3		102.08	3.90	98.18	98.28	3.37%	Downstream Slope d=0.1'
TAILWATER CROSS-SECTION at Station 117.5							
Station (ft)	BS (+)	HI	FS (-)	Elevation (ft)	WS	Slope	Station Description, Comments
1.9		102.08	2.00	100.08			LB on Bank
3.5		102.08	2.71	99.37			LB ACM
5.6		102.08	2.92	99.16			On Boulder Weir
7.0		102.08	3.33	98.75			In Channel
9.2		102.08	3.45	98.63			TW Control d=0.2'
9.7		102.08	3.39	98.69			REW d=0.1'
9.8		102.08	2.71	99.37			RB ACM
10.0		102.08	1.20	100.88			RB on Bank

BRANCIFORTE CREEK #2 - Branciforte Drive ID# SC-022

Station (ft)	BS (+)	HI	FS (-)	Elevation (ft)	WS	Slope	Station Description, Comments
	4.04						Temporary Bench Mark-TBM
0.0		104.04	3.07	100.97	102.97	5.39%	TW Control of 1st resting habitat d=2.0'
18.0		104.04	4.04	100.00	101.10	0.00%	Inlet Invert d=1.1'
39.8		104.04	4.80	99.24	101.24		Max pool in Culvert d=2.0'
44.6		104.04	4.04	100.00	101.10		Outlet Invert d=1.1'
50.5		104.04	4.18	99.86	101.11		Max. Pool Depth=1.25'
55.5		104.04	3.12	100.92	101.12		TW Control d=0.2'
79.8		104.04	3.54	100.50	100.75	1.73%	Downstream Slope d=0.25'

MOUNTAIN VIEW CREEK #1 - Vine Hill Road ID# SC-023

Station (ft)	BS (+)	HI	FS (-)	Elevation (ft)	WS	Slope	Station Description, Comments
	3.07						Temporary Bench Mark-TBM
2.2		103.07	2.55	100.52		3.21%	TW Control of 1st resting habitat
10.8		103.07	5.00	98.07	100.47		Max pool before inlet d=2.4'
18.4		103.07	3.07	100.00	100.50	-3.03%	Inlet Apron d=0.5'
29.3		103.07	2.74	100.33	100.53		Inlet Invert- Centerline d=0.2'
29.3		103.07	3.01	100.06	100.46	0.67%	Inlet Invert- Thalweg d=0.4'
74.3		103.07	3.31	99.76	99.86		Outlet Invert- Thalweg d=0.1'
74.3		103.07	3.12	99.95			Outlet Invert- Centerline
83.4		103.07	5.57	97.50	100.90		Max. Pool Depth=3.4'
98.8		103.07	3.29	99.78	99.88		TW Control d=0.1'
144.4		103.07	3.62	99.45	99.65	0.72%	Downstream Slope d=0.2'

TAILWATER CROSS-SECTION at Station 98.8

Station (ft)	BS (+)	HI	FS (-)	Elevation (ft)	WS	Slope	Station Description, Comments
1.7		103.07	0.13	102.94			LB Retaining Wall
2.0		103.07	3.16	99.91			LEW - Bottom of Wall
7.7		103.07	3.29	99.78			TW Control d=0.1'
14.3		103.07	3.27	99.80			In channel
18.8		103.07	3.26	99.81			In channel
21.2		103.07	3.15	99.92			REW
22.3		103.07	2.72	100.35			RB ACM
26.2		103.07	0.79	102.28			RB on Bank

MOUNTAIN VIEW CREEK #2 - Mountain View Road ID# SC-024

Station (ft)	BS (+)	HI	FS (-)	Elevation (ft)	WS	Slope	Station Description, Comments
	5.64						Temporary Bench Mark-TBM
1.0		105.64	9.09	96.55		0.44%	TW Control of 1st resting habitat
15.0		105.64	11.00	94.64	96.54		Max pool before inlet d=1.9'
23.8		105.64	9.19	96.45	96.55	3.52%	Inlet d=0.1'
64.4		105.64	10.62	95.02			Outlet
64.5		105.64	12.12	93.52	93.97		Drop after outlet d=0.45'
69.4		105.64	13.71	91.93	93.93		Max depth within 5' of outlet d=2.0'
76.3		105.64	15.04	90.60	93.90		Max. Pool Depth=3.3'
91.7		105.64	11.55	94.09			TW Control
116.0		105.64	11.95	93.69		1.65%	Downstream Slope
		105.64	10.99	94.65			ACM
		105.64	11.01	94.63			ACM

BLACKBURN GULCH - Vine Hill Road ID# SC-025

Station (ft)	BS (+)	HI	FS (-)	Elevation (ft)	WS	Slope	Station Description, Comments
	2.65						Temporary Bench Mark-TBM
7.7		102.65	4.68	97.97	98.57	1.20%	TW Control of 1st resting habitat d=0.6'
12.2		102.65	5.20	97.45	98.55		Pool at inlet d=1.1'
16.0		102.65	4.07	98.58			Inlet Invert - Centerline
16.0		102.65	4.78	97.87	98.52	-1.06%	Inlet Invert - Thalweg d=0.65'
47.0		102.65	4.45	98.20	98.50		Outlet Invert - Thalweg d=0.3'
47.0		102.65	4.20	98.45	98.50		Outlet Invert - Centerline d=0.05'
55.0		102.65	4.83	97.82	98.12		TW Control d=0.3'
89.0		102.65	5.37	97.28	97.83	1.59%	Downstream Slope d=0.55'

TAILWATER CROSS-SECTION at Station 55.0

Station (ft)	BS (+)	HI	FS (-)	Elevation (ft)	WS	Slope	Station Description, Comments
1.0		102.65	1.74	100.91			LB on Bank
5.0		102.65	3.49	99.16			LB ACM
6.1		102.65	3.67	98.98			On Gravel Bar
14.1		102.65	4.04	98.61			On Gravel Bar
17.2		102.65	4.28	98.37			LEW
20.3		102.65	4.21	98.44			On Gravel Bar
21.8		102.65	4.55	98.10			In channel
24.0		102.65	4.83	97.82			TW Control d=0.3'
26.3		102.65	4.58	98.07			REW
27.8		102.65	3.73	98.92			RB ACM
32.0		102.65	2.60	100.05			RB on Bank

UNT to CARBONERA CREEK - La Madrona Drive ID# SC-026

Station (ft)	BS (+)	HI	FS (-)	Elevation (ft)	WS	Slope	Station Description, Comments
	25.37						Temporary Bench Mark-TBM
7.4		125.37	15.79	109.58		54.56%	TW Control of 1st resting habitat d=0.6'
13.1		125.37	18.90	106.47		-11.22%	Inlet Apron
18.0		125.37	18.35	107.02		9.61%	Inlet Invert
	3.05		25.37				Turning Point- TBM
94.4		103.05	3.37	99.68			Outlet Invert
94.5		103.05	3.50	99.55			Top of Outlet Apron
102.2		103.05	4.64	98.41			Bottom of Outlet Apron
102.5		103.05	3.05	100.00			Outlet Beam
114.5		103.05	6.66	96.39			TW Control
125.5		103.05	6.83	96.22		1.55%	Downstream Slope

TAILWATER CROSS-SECTION at Station 114.5

Station (ft)	BS (+)	HI	FS (-)	Elevation (ft)	WS	Slope	Station Description, Comments
2.6		103.05	3.07	99.98			LB on Bank
5.3		103.05	5.42	97.63			LB ACM
8.0		103.05	6.26	96.79			On bedrock in channel
9.2		103.05	6.66	96.39			TW Control
10.8		103.05	5.62	97.43			RB ACM
13.6		103.05	4.50	98.55			RB on Bank
17.5		103.05	1.00	102.05			RB on Bank

GOLD GULCH - Brookside Way ID# SC-027

Station (ft)	BS (+)	HI	FS (-)	Elevation (ft)	WS	Slope	Station Description, Comments
	1.91						Temporary Bench Mark-TBM
19.1		101.91	0.85	101.06	101.66	2.50%	TW Control of 1st resting habitat d=0.6'
27.1		101.91	1.05	100.86	100.96	1.97%	Inlet Invert d=0.1'
38.8		101.91	1.28	100.63		6.67%	Break in slope
39.1		101.91	1.30	100.61		1.14%	Break in slope
59.3		101.91	1.53	100.38		4.37%	Break in slope
79.2		101.91	2.40	99.51			Break in slope
79.3		101.91	2.23	99.68		11.19%	Break in slope
99.4		101.91	4.48	97.43			Break in slope
99.6		101.91	4.83	97.08		-1.75%	Break in slope
109.9		101.91	4.65	97.26			Outlet Invert
114.9		101.91	5.98	95.93	97.13		Max depth within 5' of outlet d=1.2'
116.9		101.91	6.40	95.51	97.11		Max. Pool Depth=1.6'
132.0		101.91	5.02	96.89	97.19		TW Control d=0.3'
146.0		101.91	5.09	96.82	97.37	0.50%	Downstream Slope d=0.55'
		101.91	4.21	97.70			ACM
		101.91	3.86	98.05			ACM
		101.91	4.12	97.79			ACM

SHINGLE MILL CREEK - Redwood Drive ID# SC-028

Station (ft)	BS (+)	HI	FS (-)	Elevation (ft)	WS	Slope	Station Description, Comments
	6.25						Temporary Bench Mark-TBM
44.0		106.25	2.43	103.82			TWC upstream of Weir
49.5		106.25	2.38	103.87			Top of notch Weir
49.6		106.25	1.33	104.92			Top of upstream Weir
51.0		106.25	2.61	103.64			Bottom of Weir
51.5		106.25	4.79	101.46			Top of Riprap after Weir
57.5		106.25	7.53	98.72			Bottom of Riprap
61.0		106.25	7.99	98.26	98.56		Upstream Max Pool d=0.3'
62.3		106.25	7.86	98.39	98.49		TWC of Pool d=0.1'
90.7		106.25	10.23	96.02	96.32		TW Control of 1st resting habitat d=0.3'
94.0		106.25	10.42	95.83		9.19%	Inlet Apron
97.7		106.25	10.76	95.49	95.69	-1.04%	Inlet Invert d=0.2'
138.0		106.25	10.34	95.91	96.11		Outlet Invert d=0.2'
	3.12		6.25				Turning Point
138.5		103.12	11.77	91.35			Top of Riprap
143.2		103.12	14.79	88.33			Middle of Riprap
149.0		103.12	17.91	85.21			Bottom of Riprap
162.0		103.12	19.09	84.03	84.23		TW Control d=0.2'
183.6		103.12	20.44	82.68	82.78	6.25%	Downstream Slope d=0.1'

TAILWATER CROSS-SECTION at Station 162.0

Station (ft)	BS (+)	HI	FS (-)	Elevation (ft)	WS	Slope	Station Description, Comments
1.0		103.12	14.39	88.73			LB Bankfull
5.7		103.12	17.66	85.46			LB ACM
6.5		103.12	18.53	84.59			LEW
10.2		103.12	18.09	85.03			Gravel Bar
13.0		103.12	18.83	84.29			Channel
16.0		103.12	19.09	84.03			TWC
21.4		103.12	19.08	84.04			REW
25.4		103.12	18.17	84.95			RB ACM
27.0		103.12	15.15	87.97			RB Bankfull

BEAN CREEK #1 - Mt. Hermon Road ID# SC-029

Station (ft)	BS (+)	HI	FS (-)	Elevation (ft)	WS	Slope	Station Description, Comments
	6.72						Temporary Bench Mark-TBM
7.0		106.72	4.85	101.87	102.27	0.37%	TW Control of 1st resting habitat d=0.4'
47.6		106.72	5.00	101.72	101.92		Inlet Invert d=0.2'
47.6		106.72	5.08	101.64	101.94	1.17%	Inlet Invert, Thalweg d=0.3'
74.3		106.72	5.61	101.11	101.81		Baffle 1 d=0.7'
102.4		106.72	5.84	100.88	101.58		Baffle 2 d=0.7'
131.7		106.72	6.00	100.72	101.42		Baffle 3 d=0.7'
163.3		106.72	6.20	100.52	101.22		Baffle 4 d=0.7'
195.6		106.72	6.37	100.35	100.85		Baffle 5 d=0.5'
222.2		106.72	6.64	100.08	100.68		Baffle 6 d=0.6'
254.7		106.72	7.89	98.83	99.33		Baffle 7 d=0.5'
285.7		106.72	7.10	99.62	100.12		Baffle 8 d=0.5'
314.5		106.72	7.55	99.17	99.97		Baffle 9 d=0.8'
	3.62		6.72				Turning Point TBM
344.2		103.62	5.44	98.18	98.98		Outlet Invert d=0.8'
373.2		103.62	5.44	98.18	98.88		Outlet notced weir/apron end d=0.7'
373.8		103.62	9.14	94.48	97.58		Max. Pool Depth=3.1'
403.5		103.62	6.54	97.08	97.58		TW Control d=0.5'
425.5		103.62	6.89	96.73		1.59%	Downstream Slope

TAILWATER CROSS-SECTION at Station 123.0

Station (ft)	BS (+)	HI	FS (-)	Elevation (ft)	WS	Slope	Station Description, Comments
2.5		103.62	0.33	103.29			Left Bank (LB) on the bank
6.0		103.62	2.08	101.54			On Bank
8.0		103.62	3.35	100.27			On Bank
9.0		103.62	4.01	99.61			Left Active Chanel Margin(ACM)
11.0		103.62	6.02	97.60			Left Edge of Water (LEW)
12.0		103.62	6.54	97.08			Thalweg d=0.5
16.0		103.62	5.94	97.68			Gravel Bar
19.0		103.62	6.25	97.37			In Channel d=0.2'
24.0		103.62	6.01	97.61			Gravel Bar
29.5		103.62	6.37	97.25			In Channel d=0.3'
32.0		103.62	6.45	97.17			Right Edge of Water (REW)
34.0		103.62	4.22	99.40			Right ACM
36.0		103.62	2.46	101.16			Right Bank
36.5		103.62	0.64	102.98			Right Bank

LOCKHART GULCH - Lockhart Gulch Road ID# SC-030

Station (ft)	BS (+)	HI	FS (-)	Elevation (ft)	WS	Slope	Station Description, Comments
	2.59						Temporary Bench Mark-TBM
7.4		102.59	14.42	88.17	88.57	-1.51%	TW Control of 1st resting habitat d=0.4'
16.0		102.59	14.29	88.30	88.70	1.09%	Inlet Invert d=0.4'
68.2		102.59	14.86	87.73	88.73		Outlet Invert d=1.0'
70.5		102.59	15.08	87.51	88.71		Max. Pool Depth=1.2'
78.0		102.59	14.12	88.47	88.72		TW Control d=0.25'
98.0		102.59	14.95	87.64	87.94	4.15%	Downstream Slope d=0.3'

TAILWATER CROSS-SECTION at Station 78.0'

Station (ft)	BS (+)	HI	FS (-)	Elevation (ft)	WS	Slope	Station Description, Comments
3.7		102.59	10.65	91.94			LB on Bank
4.8		102.59	13.17	89.42			LB ACM
5.1		102.59	13.89	88.70			LEW
7.2		102.59	14.07	88.52			In Channel
11.2		102.59	14.12	88.47			Thalweg d=0.25
13.4		102.59	14.05	88.54			In Channel d=0.2'
15.3		102.59	13.90	88.69			REW
15.8		102.59	13.43	89.16			RB ACM
18.5		102.59	12.21	90.38			RB on Bank

BEAN CREEK #2 - Bean Creek Road ID# SC-031

Station (ft)	BS (+)	HI	FS (-)	Elevation (ft)	WS	Slope	Station Description, Comments
	2.39						Temporary Bench Mark-TBM
27.5		102.39	3.00	99.39	99.59	3.13%	TW Control of 1st resting habitat d=0.2'
49.9		102.39	3.70	98.69	99.49	-8.71%	Inlet Apron d=0.8'
53.0		102.39	3.43	98.96	99.56	0.49%	Inlet Invert d=0.6'
81.5		102.39	3.57	98.82	99.52		Outlet Invert d=0.7'
82.5		102.39	3.81	98.58	99.58		After Outler, Top of Apron d=1.0'
87.1		102.39	3.82	98.57	99.57	0.22%	Outlet Apron d=1.0'
92.1		102.39	6.17	96.22	99.42		Max Depth within 5' of outlet d=3.2'
94.6		102.39	6.55	95.84	99.54		Max. Pool Depth=3.7'
146.8		102.39	3.04	99.35	99.55		TW Control d=0.2'
172.5		102.39	4.04	98.35		3.89%	Downstream Slope

TAILWATER CROSS-SECTION at Station 146.8

Station (ft)	BS (+)	HI	FS (-)	Elevation (ft)	WS	Slope	Station Description, Comments
6.8		102.39	0.27	102.12			LB Bank full
9.7		102.39	1.62	100.77			LB ACM
12.0		102.39	2.90	99.49			LEW
14.0		102.39	2.97	99.42			In Channel d=0.1'
17.4		102.39	2.99	99.40			In Channel d=0.1'
22.9		102.39	3.04	99.35			Thalweg d=0.2'
28.8		102.39	2.99	99.40			In Channel d=0.1'
31.2		102.39	3.02	99.37			In Channel d=0.1'
35.9		102.39	2.88	99.51			REW
37.2		102.39	2.13	100.26			RB ACM
41.0		102.39	0.15	102.24			RB Bankfull

LOMPICO CREEK #1 - Lompico Road ID# SC-032

Station (ft)	BS (+)	HI	FS (-)	Elevation (ft)	WS	Slope	Station Description, Comments
	4.05						Temporary Bench Mark-TBM
11.0		104.05	0.80	103.25	103.45		TW Control of 1st resting habitat d=0.2'
11.8		104.05	2.10	101.95	102.05	1.68%	Inlet Invert d=0.1'
126.6		104.05	4.03	100.02	100.12		Outlet Invert d=0.1'
135.4		104.05	8.45	95.60	99.30		Max. Pool Depth=3.7'
137.0		104.05	5.20	98.85	99.35		Weir #1 Thalweg d=0.5'
139.3		104.05	5.89	98.16	100.86		Pool after Weir #1 d=2.7'
146.6		104.05	5.40	98.65	98.85		Weir #2 Thalweg d=0.2'
148.6		104.05	7.94	96.11	97.81		Pool after Weir #2 d=1.7'
158.1		104.05	6.57	97.48	97.58		Weir #3 Thalweg d=0.1'
161.6		104.05	9.34	94.71	96.71		Pool after Weir #3 d=2.0'
169.0		104.05	7.51	96.54	96.64		Weir #4 Thalweg d=0.1'
171.6		104.05	8.80	95.25	96.65		Pool after Weir #4 d=1.4'
178.5		104.05	7.66	96.39	96.59		Weir #5 Thalweg d=0.2'
181.0		104.05	8.06	95.99	96.49		Pool after Weir #5 d=0.5"
197.8		104.05	7.79	96.26	96.46		TW Control d=0.2' after weirs
210.8		104.05	8.28	95.77	96.07	3.77%	Downstream Slope d=0.3'

TAILWATER CROSS-SECTION at Station 197.8'

Station (ft)	BS (+)	HI	FS (-)	Elevation (ft)	WS	Slope	Station Description, Comments
5.7		104.05	5.63	98.42			LB Bankfull
7.6		104.05	7.16	96.89			LB ACM
9.4		104.05	7.64	96.41			LEW
11.6		104.05	7.79	96.26			Thalweg d=0.2'
15.3		104.05	7.56	96.49			REW
22.8		104.05	7.44	96.61			RB ACM
24.2		104.05	5.60	98.45			RB Bankfull

LOMPICO CREEK #2 - Lompico Road ID# SC-033

Station (ft)	BS (+)	HI	FS (-)	Elevation (ft)	WS	Slope	Station Description, Comments
	3.54						Temporary Bench Mark-TBM
41.6		103.54	2.25	101.29	101.34	6.67%	TW Control of 1st resting habitat d=0.05'
62.6		103.54	3.65	99.89	100.04	0.76%	Inlet Invert d=0.15'
171.0		103.54	4.47	99.07	99.17		Outlet Invert d=0.1'
176.0		103.54	8.14	95.40	99.00		Max. Pool Depth=3.6'
183.3		103.54	6.47	97.07	99.07		Weir #1 Thalweg d=2.0'
186.0		103.54	6.70	96.84	99.04		Pool after Weir #1 d=2.2'
200.0		103.54	4.74	98.80	98.90		Weir #2 Thalweg d=0.1'
202.0		103.54	7.73	95.81	97.11		Pool after Weir #2 d=1.3'
205.2		103.54	6.96	96.58	97.08		TW Control d=0.5' after weirs
216.4		103.54	7.57	95.97	96.07	5.45%	Downstream Slope d=0.1'

TAILWATER CROSS-SECTION at Station 205.2'

Station (ft)	BS (+)	HI	FS (-)	Elevation (ft)	WS	Slope	Station Description, Comments
10.6		103.54	1.84	101.70			LB Bankfull
13.0		103.54	5.12	98.42			LB ACM
15.0		103.54	6.10	97.44			LEW
22.0		103.54	6.66	96.88	97.08		In Channel d=0.2'
25.5		103.54	6.76	96.78	97.28		Thalweg d=0.5'
28.5		103.54	6.75	96.79	97.09		In Channel d=0.3'
30.5		103.54	6.51	97.03			REW
34.6		103.54	4.71	98.83			RB ACM
37.2		103.54	1.43	102.11			RB Bankfull

LOMPICO CREEK #3 - Lompico Road ID# SC-034

Station (ft)	BS (+)	HI	FS (-)	Elevation (ft)	WS	Slope	Station Description, Comments
	3.55						Temporary Bench Mark-TBM
1.7		103.55	3.14	100.41	100.51	-0.25%	TW Control of 1st resting habitat d=0.1'
33.7		103.55	3.06	100.49		0.59%	Inlet Invert
54.2		103.55	3.18	100.37			Outlet Invert
56.8		103.55	3.81	99.74			Part of broken outlet apron
60.1		103.55	6.32	97.23	98.83		Max. Pool Depth=1.6'
87.4		103.55	5.33	98.22	98.82		TW Control d=0.6'
103.0		103.55	5.45	98.10	98.90	0.77%	Downstream Slope d=0.8'

TAILWATER CROSS-SECTION at Station 87.4'

Station (ft)	BS (+)	HI	FS (-)	Elevation (ft)	WS	Slope	Station Description, Comments
3.3		103.55	1.00	102.55			LB on Bank
3.6		103.55	1.66	101.89			LB Bankfull
12.5		103.55	4.04	99.51			LB ACM
13.3		103.55	4.67	98.88			LEW
13.8		103.55	5.33	98.22	98.82		TW Control d=0.6'
15.1		103.55	5.19	98.36	98.86		In Channel d=0.5'
16.4		103.55	4.68	98.87			On Concrete in Channel
18.4		103.55	4.84	98.71	98.91		In Channel d=0.2'
20.1		103.55	4.62	98.93			REW
20.6		103.55	4.32	99.23			RB ACM
21.7		103.55	0.97	102.58			RB Bankfull

COBBLE CREEK - East Zayante Road ID#SC-035

Station (ft)	BS (+)	HI	FS (-)	Elevation (ft)	WS	Slope	Station Description, Comments
	4.55						Temporary Bench Mark-TBM
2.0		104.55	9.72	94.83		2.96%	TW Control of 1st resting habitat
58.5		104.55	11.39	93.16		7.05%	Inlet Invert
109.0		104.55	14.95	89.60			Outlet Invert
115.0		104.55	15.42	89.13		7.83%	Outlet Apron
115.5		104.55	18.30	86.25			Drop after Apron
120.0		104.55	19.28	85.27			Max. Pool Depth=0.0'
121.5		104.55	17.94	86.61			TW Control
132.0		104.55	21.66	82.89		35.43%	Downstream Slope

TAILWATER CROSS-SECTION at Station 121.5'

Station (ft)	BS (+)	HI	FS (-)	Elevation (ft)	WS	Slope	Station Description, Comments
3.5		104.55	11.49	93.06			LB on Bank
6.3		104.55	16.46	88.09			LB ACM
9.5		104.55	17.94	86.61			TW Control
13.0		104.55	17.25	87.30			RB ACM
15.0		104.55	13.50	91.05			RB on Bank

MOUNTAIN CHARLIE GULCH - East Zayante Road ID# SC-036

Station (ft)	BS (+)	HI	FS (-)	Elevation (ft)	WS	Slope	Station Description, Comments
	3.59						Temporary Bench Mark-TBM
7.9		103.59	4.06	99.53	99.83		TW Control of 1st resting habitat d=0.3'
10.9		103.59	5.05	98.54	99.84	-0.77%	Inlet Invert d=1.3'
20.5		103.59	6.27	97.32	99.82		Max. Pool Depth=2.5'
53.7		103.59	4.72	98.87	99.87		Outlet Invert - Thalweg d=1.0'
53.7		103.59	4.30	99.29	99.84		Outlet Invert - Centerline d=0.55'
56.6		103.59	4.31	99.28	99.78		Max depth within 5' of Outlet d=0.5'
61.8		103.59	4.00	99.59	99.79		TW Control d=0.2'
86.3		103.59	6.46	97.13	98.63	10.04%	Downstream Slope d=1.5'

TAILWATER CROSS-SECTION at Station 61.8'

Station (ft)	BS (+)	HI	FS (-)	Elevation (ft)	WS	Slope	Station Description, Comments
19.0		103.59	1.50	102.09			LB on Bank
24.6		103.59	3.34	100.25			LB ACM
26.5		103.59	3.83	99.76			LEW
31.0		103.59	4.00	99.59	99.79		In Channel d=0.2'
33.9		103.59	3.94	99.65	99.85		TW Control d=0.2'
38.0		103.59	3.76	99.83			REW
38.5		103.59	3.36	100.23			RB ACM
42.2		103.59	1.98	101.61			RB on Bank

UNT to ZAYANTE CREEK - East Zayante Road ID# SC-037

Station (ft)	BS (+)	HI	FS (-)	Elevation (ft)	WS	Slope	Station Description, Comments
	8.52						Temporary Bench Mark-TBM
2.0		108.52	10.21	98.31			LWD
9.0		108.52	14.79	93.73	95.43		Max pool upstream of inlet d=1.7'
17.0		108.52	13.34	95.18	95.38	1.71%	TW Control of 1st resting habitat d=0.2'
20.5		108.52	13.40	95.12	95.37	2.15%	Inlet Invert d=0.25'
61.0		108.52	14.27	94.25	94.35		Outlet Invert d=0.1'
65.6		108.52	16.20	92.32	94.22		Max depth within 5' of Outlet d=1.9'
74.0		108.52	16.77	91.75	94.15		Max. Pool Depth=2.4'
91.5		108.52	14.58	93.94	94.14		TW Control d=0.2'
120.0		108.52	17.94	90.58		11.79%	Downstream Slope

TAILWATER CROSS-SECTION at Station 91.5'

Station (ft)	BS (+)	HI	FS (-)	Elevation (ft)	WS	Slope	Station Description, Comments
2.0		108.52	9.00	99.52			LB on Bank
9.0		108.52	11.14	97.38			LB on Bank
14.5		108.52	12.94	95.58			LB on Bank
19.0		108.52	13.50	95.02			LB ACM
25.7		108.52	14.35	94.17			LEW
27.7		108.52	14.58	93.94			TW Control d=0.2'
28.7		108.52	14.45	94.07			REW
30.5		108.52	13.85	94.67			RB ACM
33.5		108.52	12.78	95.74			RB on Bank
36.0		108.52	11.91	96.61			RB on Bank

SOUTH FALL CREEK #1 - Felton Empire Road ID# SC-038

Station (ft)	BS (+)	HI	FS (-)	Elevation (ft)	WS	Slope	Station Description, Comments
	4.79						Temporary Bench Mark-TBM
1.0		104.79	11.17	93.62		13.47%	TW Control of 1st resting habitat
8.5		104.79	12.18	92.61		7.86%	Inlet Invert
51.5		104.79	15.56	89.23			Outlet Invert
52.5		104.79	15.98	88.81			Top of Riprap
53.5		104.79	16.83	87.96			Bottom of Riprap
55.3		104.79	17.71	87.08			Max. Pool Depth=0'
59.8		104.79	16.39	88.40			TW Control
73.0		104.79	16.93	87.86		4.09%	Downstream Slope
		104.79	16.13	88.66			ACM
		104.79	16.13	88.66			ACM

SOUTH FALL CREEK #2 - Felton Empire Road ID# SC-039

Station (ft)	BS (+)	HI	FS (-)	Elevation (ft)	WS	Slope	Station Description, Comments
	11.03						Temporary Bench Mark-TBM
1.0		111.03	6.70	104.33		25.09%	Upstream Channel
6.5		111.03	8.08	102.95		8.73%	TW Control of 1st resting habitat
12.0		111.03	8.56	102.47		8.46%	Inlet Invert
69.0		111.03	13.38	97.65			Outlet Invert
70.0		111.03	17.25	93.78	94.23		Drop after outlet d=0.45
75.0		111.03	18.79	92.24	94.19		Max. Pool Depth=1.95'
83.0		111.03	17.00	94.03	94.18		TW Control d=0.15'
111.0		111.03	19.62	91.41		9.36%	Downstream Slope
		111.03	16.40	94.63			ACM
		111.03	16.51	94.52			ACM

LOVE CREEK #1 - Love Creek Road ID# SC-040

Station (ft)	BS (+)	HI	FS (-)	Elevation (ft)	WS	Slope	Station Description, Comments
	4.87						Temporary Bench Mark-TBM
0.0		104.87	17.92	86.95		5.17%	TW Control of 1st resting habitat
16.5		104.87	20.55	84.32	87.12		Pool before Inlet d=2.8'
30.2		104.87	19.48	85.39	87.19	1.24%	Inlet Invert d=1.8'
64.0		104.87	19.90	84.97	87.07		Outlet Invert - Thalweg d=2.1'
64.0		104.87	19.75	85.12	87.02		Outlet Invert - Centerline d=1.9'
64.1		104.87	19.90	84.97	87.07		Max. Pool Depth=2.1'
97.3		104.87	18.08	86.79	87.09		TW Control d=0.3'
114.9		104.87	18.95	85.92		4.94%	Downstream Slope

TAILWATER CROSS-SECTION at Station 97.3'

Station (ft)	BS (+)	HI	FS (-)	Elevation (ft)	WS	Slope	Station Description, Comments
0.0		104.87	13.85	91.02			LB Bankfull
4.8		104.87	17.11	87.76			LB ACM
5.7		104.87	17.78	87.09			LEW
14.5		104.87	18.08	86.79	87.09		TW Control d=0.3'
19.4		104.87	17.85	87.02			REW
20.8		104.87	17.44	87.43			RB ACM
23.4		104.87	15.37	89.50			RB Bankfull

LOVE CREEK #2 - Love Creek Road ID# SC-041

Station (ft)	BS (+)	HI	FS (-)	Elevation (ft)	WS	Slope	Station Description, Comments
	3.60						Temporary Bench Mark-TBM
20.7		103.60	3.20	100.40	100.70	3.77%	TW Control of 1st resting habitat d=0.3'
31.3		103.60	3.60	100.00	100.40	2.77%	Inlet Invert d=0.4'
36.0		103.60	4.60	99.00	100.40		Pool #1 in Culvert d=1.4'
42.0		103.60	3.98	99.62	100.42		Baffle #1 Thalweg d=0.8'
53.0		103.60	4.49	99.11	100.41		Pool #2 in Culvert d=1.3'
56.3		103.60	4.23	99.37	100.42		Baffle #2 Thalweg d=1.05'
64.3		103.60	4.58	99.02	100.42		Pool #3 in Culvert d=1.4'
70.7		103.60	4.07	99.53	100.43		Baffle #3 Thalweg d=0.9'
74.3		103.60	5.00	98.60	100.40		Max. Pool Depth=1.8'
79.7		103.60	4.94	98.66	100.41		Outlet Invert d=1.75''
91.3		103.60	5.22	98.38	100.38		Max. Pool Depth=2.0'
119.0		103.60	3.42	100.18	100.38		TW Control d=0.2'
		103.60	2.42	101.18			ACM
		103.60	2.67	100.93			ACM

LOVE CREEK #3 - Love Creek Road ID# SC-042

Station (ft)	BS (+)	HI	FS (-)	Elevation (ft)	WS	Slope	Station Description, Comments
	0.94						Temporary Bench Mark-TBM
1.3		100.94	1.92	99.02		4.40%	TW Control of 1st resting habitat
19.7		100.94	2.73	98.21	98.51		Inlet Invert - Centerline d=0.3'
19.7		100.94	2.90	98.04	98.49	1.03%	Inlet Invert - Thalweg d=0.45'
88.9		100.94	3.61	97.33	97.78		Outlet Invert - Thalweg d=.45'
88.9		100.94	3.37	97.57	97.77		Outlet Invert - Centerline d=0.2'
92.3		100.94	3.70	97.24	97.74		Max. Pool Depth=0.5'
95.0		100.94	3.30	97.64	97.74		TW Control d=0.1'
108.8		100.94	4.00	96.94	97.34	5.07%	Downstream Slope d=0.4'

TAILWATER CROSS-SECTION at Station 95.0'

Station (ft)	BS (+)	HI	FS (-)	Elevation (ft)	WS	Slope	Station Description, Comments
5.0		100.94	1.02	99.92			LB Bankfull
6.3		100.94	2.85	98.09			LB ACM
6.8		100.94	2.91	98.03			LEW
10.6		100.94	3.30	97.64	97.74		TW Control d=0.1'
14.7		100.94	3.18	97.76			On Gravel Bar
18.2		100.94	2.92	98.02			On Gravel Bar
18.9		100.94	2.22	98.72			RB ACM
23.7		100.94	0.10	100.84			RB Bankfull

HUBBARD GULCH - Hubbard Gulch Road ID# SC-043

Station (ft)	BS (+)	HI	FS (-)	Elevation (ft)	WS	Slope	Station Description, Comments
	1.82						Temporary Bench Mark-TBM
22.8		101.82	18.16	83.66		9.20%	TW Control of 1st resting habitat
32.8		101.82	19.08	82.74	82.84	10.27%	Inlet Invert d=0.1'
113.2		101.82	27.34	74.48	74.58		Outlet Invert d=.1'
113.3		101.82	27.72	74.10		4.44%	Top of Outlet Apron
115.1		101.82	27.80	74.02			Bottom of Outlet Apron
115.8		101.82	28.91	72.91		158.57%	Outlet Riprap
119.1		101.82	30.44	71.38	71.83		Max. Pool Depth=0.45'
121.6		101.82	30.38	71.44	71.64		TW Control d=0.2'

TAILWATER CROSS-SECTION at Station 121.6'

Station (ft)	BS (+)	HI	FS (-)	Elevation (ft)	WS	Slope	Station Description, Comments
4.0		101.82	21.54	80.28			LB on Bank
5.7		101.82	26.12	75.70			LB Bankfull
15.8		101.82	28.98	72.84			LB ACM
20.5		101.82	30.38	71.44			TW Control d=0.2'
23.0		101.82	27.91	73.91			Top of Debris Jam
27.7		101.82	30.00	71.82			REW
29.6		101.82	29.22	72.60			RB ACM
35.4		101.82	26.86	74.96			RB on Bank

MARSHALL CREEK - Hubbard Gulch Road ID# SC-044

Station (ft)	BS (+)	HI	FS (-)	Elevation (ft)	WS	Slope	Station Description, Comments
	4.30						Temporary Bench Mark-TBM
15.5		104.30	10.20	94.10	94.20	6.23%	TW Control of 1st resting habitat d=0.1'
27.7		104.30	10.96	93.34	93.49	8.24%	Inlet Invert d=0.15'
68.1		104.30	14.29	90.01			Outlet Invert
	4.23		14.16				Turning Point
70.0		94.37	5.37	89.00			Outlet Riprap
75.3		94.37	7.97	86.40			Riprap
84.0		94.37	11.05	83.32			Riprap
87.7		94.37	12.44	81.93	83.03		Max. Pool Depth=1.1'
94.1		94.37	11.51	82.86	82.96		TW Control d=0.1'
107.4		94.37	14.01	80.36	80.56	18.80%	Downstream Slope d=0.2'
		94.37	11.00	83.37			ACM

		94.37	11.00	83.37			ACM

CLEAR CREEK - Clear Creek Road ID# SC-045

Station (ft)	BS (+)	HI	FS (-)	Elevation (ft)	WS	Slope	Station Description, Comments
	0.94						Temporary Bench Mark-TBM
9.5		100.94	2.45	98.49	98.89	1.71%	TW Control of 1st resting habitat d=0.4'
26.5		100.94	2.41	98.53	98.63		Inlet Invert - Centerline d=0.1'
26.5		100.94	2.74	98.20	98.60	3.93%	Inlet Invert - Thalweg d=0.4'
51.7		100.94	3.73	97.21	97.41		Outlet Invert d=.2'
59.0		100.94	4.57	96.37	96.97		Max. Pool Depth=0.6'
61.6		100.94	4.30	96.64	96.94		TW Control d=0.3'
64.9		100.94	5.16	95.78	96.08		Inlet of Downstream Crossing d=0.3'
		100.94	3.59	97.35			ACM
		100.94	3.06	97.88			ACM
		100.94	3.47	97.47			ACM

UNT TO JAMISON CR - Jamison Creek Road ID# SC-046

Station (ft)	BS (+)	HI	FS (-)	Elevation (ft)	WS	Slope	Station Description, Comments
	3.94						Temporary Bench Mark-TBM
1.0		103.94	6.39	97.55	97.65	14.15%	Upstream Channel Slope d=0.1'
21.0		103.94	9.22	94.72		15.44%	TW Control of 1st resting habitat
30.0		103.94	10.61	93.33		3.62%	Inlet Invert
77.0		103.94	12.31	91.63			Outlet Invert
86.0		103.94	12.65	91.29		3.78%	Outlet Apron
91.0		103.94	15.76	88.18	90.08		Max Depth wihtin 5' of Outlet d=1.9'
94.5		103.94	17.03	86.91	90.06		Max. Pool Depth=3.15'
112.5		103.94	13.89	90.05			TW Control
126.0		103.94	14.63	89.31		5.48%	Downstream Slope
		103.94	13.26	90.68			ACM
		103.94	13.44	90.50			ACM

HARE CREEK - Hare Way ID# SC-047

Station (ft)	BS (+)	HI	FS (-)	Elevation (ft)	WS	Slope	Station Description, Comments
	3.24						Temporary Bench Mark-TBM
8.0		103.24	2.50	100.74	101.14		Pool before Inlet d=0.4'
14.0		103.24	2.04	101.20		4.27%	Inlet Invert
44.0		103.24	3.32	99.92		2.86%	Break in Slope
85.2		103.24	4.50	98.74	99.34		Outlet Invert d=0.6'
90.5		103.24	4.76	98.48	99.33	4.91%	Outlet Apron d=0.85'
91.0		103.24	3.35	99.89			Beginning of Riprap
93.0		103.24	3.24	100.00			Notch of Boulder Weir
98.0		103.24	4.01	99.23			Riprap
100.5		103.24	3.78	99.46			Riprap
105.0		103.24	4.67	98.57			Riprap
110.6		103.24	5.81	97.43	98.83		Max. Pool Depth=1.4'
126.0		103.24	4.42	98.82			TW Control
130.0		103.24	4.70	98.54		7.00%	Downstream Slope
		103.24	3.75	99.49			ACM
		103.24	3.62	99.62			ACM

HOPKINS GULCH - Bear Creek Road ID# SC-048

Station (ft)	BS (+)	HI	FS (-)	Elevation (ft)	WS	Slope	Station Description, Comments
	5.40						Temporary Bench Mark-TBM
32.5		105.40	0.90	104.50		3.63%	Inlet Invert
	2.59		5.40				Turning Point
202.7		102.59	4.27	98.32			Outlet Invert
221.1		102.59	5.50	97.09		6.68%	Outlet Apron
223.4		102.59	13.32	89.27			Drop after Outlet
229.6		102.59	14.81	87.78	89.48		Max. Pool Depth=1.7'
237.6		102.59	13.27	89.32	89.42		TW Control d=0.1'
252.4		102.59	13.37	89.22		0.68%	Downstream Slope
		102.59	12.86	89.73			ACM
		102.59	12.92	89.67			ACM

TWO BAR CREEK #1 - Two Bar Road ID# SC-049

Station (ft)	BS (+)	HI	FS (-)	Elevation (ft)	WS	Slope	Station Description, Comments
	3.53						Temporary Bench Mark-TBM
0.7		103.53	2.32	101.21			TW Control of 1st resting habitat
13.0		103.53	2.56	100.97	101.07		Top of Weir d=0.1'
17.1		103.53	2.80	100.73			Bottom of Weir
18.0		103.53	5.28	98.25	100.35		Pool after Weir d=2.1'
30.1		103.53	3.32	100.21	100.41		TWC of Pool d=0.2'
39.4		103.53	4.61	98.92	100.12		Pool before Inlet d=1.2'
43.6		103.53	3.60	99.93	100.03		TWC of Pool d=0.1'
46.6		103.53	3.85	99.68			Inlet Invert - Centerline
46.6		103.53	3.97	99.56	99.66	4.65%	Inlet Invert - Thalweg d=0.1'
61.4		103.53	5.90	97.63	98.93		Pool in Culvert d=1.3'

65.0		103.53	4.79	98.74	98.84		TWC of Pool in Culvert d=0.1'
83.4		103.53	5.68	97.85	98.65		Outlet Invert - Thalweg d=0.8'
83.4		103.53	5.51	98.02	98.52		Outlet Invert - Centerline d=0.5'
92.2		103.53	6.66	96.87	98.47		Max. Pool Depth=1.6'
104.0		103.53	4.99	98.54	98.59		TW Control d=0.05'
124.4		103.53	5.15	98.38	98.58	0.78%	Downstream Slope d=0.2'

TAILWATER CROSS-SECTION at Station 104.0'

Station (ft)	BS (+)	HI	FS (-)	Elevation (ft)	WS	Slope	Station Description, Comments
0.0		103.53	3.10	100.43			LB on Bank
2.2		103.53	4.44	99.09			LB ACM
7.1		103.53	4.93	98.60			LEW
10.9		103.53	4.99	98.54			TW Control d=0.05'
15.7		103.53	4.93	98.60			REW
22.8		103.53	4.06	99.47			RB ACM
24.5		103.53	3.40	100.13			RB Bankfull
25.0		103.53	0.05	103.48			On Bedrock Wall

TWO BAR CREEK #2 - Two Bar Road ID# SC-050

Station (ft)	BS (+)	HI	FS (-)	Elevation (ft)	WS	Slope	Station Description, Comments
	4.01						Temporary Bench Mark-TBM
4.5		104.01	2.70	101.31		3.27%	TW Control of 1st resting habitat
19.2		104.01	3.18	100.83	100.88	1.63%	Inlet Invert d=0.05'
89.3		104.01	4.32	99.69			Outlet Invert
92.5		104.01	6.33	97.68	98.88		Max. Pool Depth=1.2'
97.5		104.01	5.37	98.64	98.84		TW Control d=0.2'
108.0		104.01	5.66	98.35	98.65	2.76%	Downstream Slope d=0.3'

TAILWATER CROSS-SECTION at Station 97.5'

Station (ft)	BS (+)	HI	FS (-)	Elevation (ft)	WS	Slope	Station Description, Comments
6.0		104.01	2.44	101.57			LB on Bank
10.0		104.01	3.12	100.89			LB Bankfull
15.3		104.01	4.71	99.30			LB ACM
20.0		104.01	4.71	99.30			LB Gravel Bar
23.0		104.01	5.35	98.66			LEW
29.0		104.01	5.19	98.82			In Channel
33.6		104.01	5.37	98.64			TW Control d=0.05'
34.6		104.01	5.20	98.81			REW
39.5		104.01	4.54	99.47			RB ACM
43.5		104.01	2.34	101.67			RB Bankfull
45.0		104.01	0.04	103.97			RB on Bank

TWO BAR CREEK #3 - Two Bar Road ID# SC-051

Station (ft)	BS (+)	HI	FS (-)	Elevation (ft)	WS	Slope	Station Description, Comments
	3.31						Temporary Bench Mark-TBM
2.0		103.31	12.21	91.10			TW Control of 1st resting habitat
23.5		103.31	12.34	90.97			Top of Upstream Weir
23.8		103.31	14.43	88.88			Top of Upstream Inlet Apron
32.7		103.31	15.60	87.71			End on Inlet Apron
33.8		103.31	16.57	86.74	87.14		Inlet Invert - Centerline d=0.4'
33.8		103.31	17.53	85.78	87.08	-4.88%	Inlet Invert - Thalweg d=1.3'
59.0		103.31	16.30	87.01	87.11		Outlet Invert - Thalweg d=0.1'
59.0		103.31	15.69	87.62			Outlet Invert - Centerline
68.5		103.31	15.55	87.76			Top of Outlet Weir
68.8		103.31	17.50	85.81			Beginning of Outlet Apron
75.5		103.31	19.48	83.83			Bottom of Outler Apron
76.0		103.31	21.24	82.07			Below Outlet
83.5		103.31	21.77	81.54	83.44		Max. Pool Depth=1.9'
94.0		103.31	20.01	83.30	83.40		TW Control d=0.1'
105.0		103.31	20.77	82.54	82.74	6.91%	Downstream Slope d=0.2'

TAILWATER CROSS-SECTION at Station 94.0'

Station (ft)	BS (+)	HI	FS (-)	Elevation (ft)	WS	Slope	Station Description, Comments
7.5		103.31	19.96	83.35			In Channel
5.0		103.31	15.85	87.46			LB Bankfull
6.3		103.31	19.16	84.15			LB ACM
7.0		103.31	19.94	83.37			LEW
13.0		103.31	19.99	83.32			In Channel
10.6		103.31	20.01	83.30			TW Control d=0.1'
14.5		103.31	19.48	83.83			RB ACM
18.3		103.31	15.72	87.59			RB Bankfull

LOGAN CREEK - Kings Creek Road ID# SC-052

Station (ft)	BS (+)	HI	FS (-)	Elevation (ft)	WS	Slope	Station Description, Comments
	0.57						Temporary Bench Mark-TBM
0.9		100.57	9.83	90.74		7.71%	TW Control of 1st weir
18.7		100.57	10.87	89.70	90.30		Max pool after first weir d=0.6'
28.5		100.57	10.12	90.45			2nd Weir
33.4		100.57	12.96	87.61	89.61		Max pool after second weir d=2.0'

44.5		100.57	10.67	89.90			3rd Weir
47.9		100.57	15.37	85.20	87.80		Max pool after 3rd weir d=2.6'
62.0		100.57	12.92	87.65			4th Weir
80.3		100.57	15.95	84.62	85.12	0.81%	Inlet Invert d=0.5'
139.6		100.57	16.43	84.14			Outlet Invert
145.0		100.57	16.46	84.11	84.21		TW Control d=0.1'
166.6		100.57	17.42	83.15		4.44%	Downstream Slope

TAILWATER CROSS-SECTION at Station 145.0'

Station (ft)	BS (+)	HI	FS (-)	Elevation (ft)	WS	Slope	Station Description, Comments
22.3		100.57	5.79	94.78			LB on Boulder Riprap
32.6		100.57	15.66	84.91			LB ACM
37.4		100.57	16.18	84.39			In Channel
44.9		100.57	16.46	84.11			TW Control d=0.1'
47.6		100.57	16.35	84.22			REW
49.2		100.57	15.94	84.63			RB ACM
55.0		100.57	8.65	91.92			RB on Bank

DEBRIS FLOW CREEK - Kings Creek Road ID# SC-053

Station (ft)	BS (+)	HI	FS (-)	Elevation (ft)	WS	Slope	Station Description, Comments
	3.62						Temporary Bench Mark-TBM
10.0		103.62	20.24	83.38			Upstream Channel
29.0		103.62	20.32	83.30			Upstream Pool
46.0		103.62	18.81	84.81		3.26%	TW Control of 1st resting habitat
54.6		103.62	19.09	84.53		1.09%	Inlet Invert
115.2		103.62	19.75	83.87			Outlet Invert
129.3		103.62	19.95	83.67			In Channel Downstream of Outlet
141.5		103.62	20.19	83.43			At Drop into Kings Creek
143.0		103.62	22.62	81.00			Confluence with Kings Creek
		103.62	19.29	84.33			ACM
		103.62	19.52	84.10			ACM

ARANA GULCH #1 1of2 - Capitola Road ID# SC-054

Station (ft)	BS (+)	HI	FS (-)	Elevation (ft)	WS	Slope	Station Description, Comments
	3.35						Temporary Bench Mark-TBM
26.0		103.35	3.66	99.69	99.89	2.33%	TW Control of 1st resting habitat d=0.2'
29.0		103.35	3.73	99.62	99.82	0.74%	Inlet Invert d=0.2'
114.5		103.35	4.36	98.99	99.49		Outlet Invert - Thalweg d=0.5'
114.5		103.35	4.29	99.06	99.46		Outlet Invert - Centerline d=0.4'
116.5		103.35	4.36	98.99	99.49		Max pool depth within 5' of outlet d=0.5'
120.7		103.35	4.36	98.99	99.49		Max. Pool Depth=0.5'
123.5		103.35	4.11	99.24	99.44		TW Control d=0.2'
125.3		103.35	4.36	98.99	99.49		End of Outlet Apron d=0.5'
129.6		103.35	6.70	96.65	98.85		Max pool after Weir d=2.2'
136.0		103.35	4.70	98.65	98.85		TWC of pool after weir d=0.2'
144.5		103.35	5.51	97.84	98.04	9.53%	Downstream Slope d=0.2'

TAILWATER CROSS-SECTION at Station 126.5'

Station (ft)	BS (+)	HI	FS (-)	Elevation (ft)	WS	Slope	Station Description, Comments
4.7		103.35	0.85	102.50			LB on Bank
8.1		103.35	2.76	100.59			LB ACM, beginning of weir
12.0		103.35	2.76	100.59			on Weir
15.0		103.35	2.06	101.29			on Weir
18.8		103.35	1.52	101.83			on Weir
20.0		103.35	3.80	99.55			Broken area of Weir
21.3		103.35	2.22	101.13			on Weir
23.6		103.35	2.42	100.93			on Weir
30.2		103.35	4.28	99.07			TWC, edge of sunken weir d=0.2'
30.8		103.35	4.25	99.10			REW
30.8		103.35	3.29	100.06			RB ACM
31.8		103.35	0.87	102.48			RB on Bank

ARANA GULCH #1 2of2 - Capitola Road ID# SC-054

Station (ft)	BS (+)	HI	FS (-)	Elevation (ft)	WS	Slope	Station Description, Comments
	3.35						Temporary Bench Mark-TBM
26.0		103.35	3.49	99.86	99.96	-28.00%	TW Control of 1st resting habitat d=0.1'
29.0		103.35	2.65	100.70	100.90	0.82%	Inlet Invert
114.5		103.35	3.35	100.00	100.50		Outlet Invert
119.5		103.35	4.05	99.30	99.40		Max pool depth within 5' of outlet d=0.1'
122.4		103.35	4.05	99.30	99.40		End of Outlet Apron d=0.1'
123.5		103.35	5.20	98.15	99.25		Max. Pool Depth=1.1'
126.5		103.35	4.28	99.07	99.27		TW Control d=0.2'
129.6		103.35	6.70	96.65	98.85		Max pool after Weir d=2.2'
136.0		103.35	4.70	98.65	98.85		TWC of pool after weir d=0.2'
144.5		103.35	5.51	97.84	98.04	9.53%	Downstream Slope d=0.2'

TAILWATER CROSS-SECTION at Station 126.5'

Station (ft)	BS (+)	HI	FS (-)	Elevation (ft)	WS	Slope	Station Description, Comments
4.7		103.35	0.85	102.50			LB on Bank

8.1		103.35	2.76	100.59			LB ACM, beginning of weir
12.0		103.35	2.76	100.59			on Weir
15.0		103.35	2.06	101.29			on Weir
18.8		103.35	1.52	101.83			on Weir
20.0		103.35	3.80	99.55			Broken area of Weir
21.3		103.35	2.22	101.13			on Weir
23.6		103.35	2.42	100.93			on Weir
30.2		103.35	4.28	99.07			TWC, edge of sunken weir d=0.2'
30.8		103.35	4.25	99.10			REW
30.8		103.35	3.29	100.06			RB ACM
31.8		103.35	0.87	102.48			RB on Bank

ARANA GULCH #2 - Soquel Avenue ID# SC-055

Station (ft)	BS (+)	HI	FS (-)	Elevation (ft)	WS	Slope	Station Description, Comments
	1.26						Temporary Bench Mark-TBM
8.6		101.26	3.49	97.77	98.77	-5.13%	TW Control of 1st resting habitat d=1.0'
20.1		101.26	2.90	98.36	98.66	0.00%	Inlet Invert d=0.3'
112.0		101.26	4.01	97.25	98.55		Max pool within Culvert d=1.3'
152.8		101.26	2.90	98.36	98.56		Outlet Invert d=0.2'
160.0		101.26	3.17	98.09	98.59		Max. Pool Depth=0.5'
167.5		101.26	3.01	98.25	98.55		TW Control d=0.3'
183.0		101.26	3.12	98.14	98.54	0.71%	Downstream Slope d=0.4'
TAILWATER CROSS-SECTION at Station 167.5'							
Station (ft)	BS (+)	HI	FS (-)	Elevation (ft)	WS	Slope	Station Description, Comments
7.0		101.26	0.57	100.69			LB on Bank
8.9		101.26	1.94	99.32			LB ACM
9.9		101.26	2.69	98.57			LEW
12.4		101.26	2.94	98.32	98.52		In Channel d=0.2'
14.7		101.26	2.86	98.40	98.55		In Channel d=0.15'
16.4		101.26	3.01	98.25	98.55		TW Control d=0.3'
19.5		101.26	2.70	98.56			REW
19.6		101.26	1.57	99.69			RB top of concrete ledge
22.6		101.26	0.27	100.99			RB on Bank

ARANA GULCH #3 1of2 - Brookwood Drive ID# SC-056

Station (ft)	BS (+)	HI	FS (-)	Elevation (ft)	WS	Slope	Station Description, Comments
	3.12						Temporary Bench Mark-TBM
15.0		103.12	8.80	94.32	94.42	1.14%	TW Control of 1st resting habitat d=0.1'
23.8		103.12	8.58	94.54			Inlet Invert - centerline
23.8		103.12	8.90	94.22	94.42	0.74%	Inlet Invert - Thalweg d=0.2'
49.5		103.12	9.09	94.03	94.33		Outlet Invert d=0.3'
57.3		103.12	9.09	94.03	94.33		Thalweg d=0.3'
73.3		103.12	9.19	93.93	94.23	0.62%	Downstream Slope d=0.3'
TAILWATER CROSS-SECTION at Station 57.3'							
Station (ft)	BS (+)	HI	FS (-)	Elevation (ft)	WS	Slope	Station Description, Comments
3.5		103.12	5.80	97.32			LB Bankfull
7.9		103.12	8.27	94.85			LB ACM
8.0		103.12	8.89	94.23			LEW
9.6		103.12	9.09	94.03	94.33		Thalweg d=0.3'
12.4		103.12	8.80	94.32			REW
17.8		103.12	8.18	94.94			ACM Middle Bar- L
21.0		103.12	7.65	95.47			on Gravel Bar
24.0		103.12	7.90	95.22			ACM Middle Bar- R
25.3		103.12	8.25	94.87			Thalweg of right channel
28.4		103.12	7.76	95.36			RB ACM
34.3		103.12	6.06	97.06			RB Bankfull

ARANA GULCH #3 2of2 - Brookwood Drive ID# SC-056

Station (ft)	BS (+)	HI	FS (-)	Elevation (ft)	WS	Slope	Station Description, Comments
	3.12						Temporary Bench Mark-TBM
15.0		103.12	8.80	94.32	94.42	-0.80%	TW Control of 1st resting habitat d=0.1'
23.8		103.12	7.40	95.72			Inlet Invert - centerline
23.8		103.12	8.73	94.39		-5.02%	Inlet Invert - Thalweg
49.5		103.12	7.44	95.68			Outlet Invert
56.0		103.12	8.21	94.91			Max. Pool Depth=0'
57.3		103.12	9.09	94.03			Thalweg
73.3		103.12	9.19	93.93		0.62%	Downstream Slope d=0.3'
TAILWATER CROSS-SECTION at Station 57.3'							
Station (ft)	BS (+)	HI	FS (-)	Elevation (ft)	WS	Slope	Station Description, Comments
3.5		103.12	5.80	97.32			LB Bankfull
7.9		103.12	8.27	94.85			LB ACM
8.0		103.12	8.89	94.23			LEW
9.6		103.12	9.09	94.03	94.33		Thalweg d=0.3'
12.4		103.12	8.80	94.32			REW
17.8		103.12	8.18	94.94			ACM Middle Bar- L
21.0		103.12	7.65	95.47			on Gravel Bar

24.0		103.12	7.90	95.22			ACM Middle Bar- R
25.3		103.12	8.25	94.87			Thalweg of right channel
28.4		103.12	7.76	95.36			RB ACM
34.3		103.12	6.06	97.06			RB Bankfull

ARANA GULCH #4 - Paul Sweet Road ID# SC-057

Station (ft)	BS (+)	HI	FS (-)	Elevation (ft)	WS	Slope	Station Description, Comments
	3.79						Temporary Bench Mark-TBM
3.9		103.79	9.56	94.23		-1.80%	TW Control of 1st resting habitat
15.0		103.79	9.36	94.43		1.83%	Inlet Invert
39.6		103.79	9.81	93.98			Outlet Invert
41.9		103.79	11.66	92.13		36.92%	Top of Riprap
45.8		103.79	13.10	90.69			Bottom of Riprap
48.5		103.79	14.43	89.36	90.16		Max. Pool Depth=0.8'
54.4		103.79	13.76	90.03	90.13		Thalweg d=0.1'
60.6		103.79	14.17	89.62	90.02	6.61%	Downstream Slope d=0.4'
		103.79	12.56	91.23			ACM
		103.79	12.46	91.33			ACM

BATES CREEK - Main Street ID# SC-058

Station (ft)	BS (+)	HI	FS (-)	Elevation (ft)	WS	Slope	Station Description, Comments
	4.42						Temporary Bench Mark-TBM
3.0		104.42	4.10	100.32	100.52	1.03%	TW Control of 1st resting habitat d=0.2'
21.5		104.42	4.29	100.13	100.53	0.69%	Inlet Invert d=0.4'
78.3		104.42	4.68	99.74	99.94		Outlet Invert d=0.2'
78.4		104.42	4.89	99.53		7.35%	Top of Outlet Apron
83.3		104.42	5.25	99.17			End of Outlet Apron
87.7		104.42	7.55	96.87	99.27		Max Depth within 5' of Outlet d=2.4'
95.0		104.42	7.93	96.49	99.29		Max. Pool Depth=2.8'
131.0		104.42	5.54	98.88	99.23		TW Control d=0.35'
151.0		104.42	5.61	98.81	99.01	0.35%	Downstream Slope d=0.2'

TAILWATER CROSS-SECTION at Station 131.0'

Station (ft)	BS (+)	HI	FS (-)	Elevation (ft)	WS	Slope	Station Description, Comments
1.5		104.42	2.84	101.58			LB on Bank
5.5		104.42	4.20	100.22			LB ACM
8.7		104.42	5.11	99.31			In Channel
10.3		104.42	5.54	98.88	99.23		TW Control d=0.35''
11.6		104.42	5.32	99.10			REW
13.0		104.42	4.64	99.78			RB ACM
16.3		104.42	1.42	103.00			RB on Concrete

MOORES GULCH - Soquel San Jose Road ID# SC-059

Station (ft)	BS (+)	HI	FS (-)	Elevation (ft)	WS	Slope	Station Description, Comments
	2.70						Temporary Bench Mark-TBM
14.5		102.70	0.65	102.05	102.35	-5.00%	Inlet Apron d=0.3'
15.5		102.70	0.60	102.10	102.30	1.76%	Inlet Invert d=0.2'
186.0		102.70	3.60	99.10	99.40		Outlet Invert d=0.3'
192.0		102.70	7.97	94.73	98.43		Max Pool of 1st step pool d=3.7'
193.4		102.70	4.89	97.81	98.01		1st Weir d=0.2'
196.7		102.70	7.81	94.89	97.09		Max Pool of 2nd step pool d=2.2'
198.8		102.70	5.77	96.93	97.03		2nd Weir d=0.1'
200.5		102.70	8.75	93.95	96.15		Max Pool of 3rd step pool d=2.2'
204.4		102.70	6.85	95.85	95.95		3rd Weir d=0.1'
192.0		102.70	8.54	94.16			High Flow Pool
193.4		102.70	5.85	96.85			High Flow Weir(adjustable)
218.3		102.70	10.75	91.95	94.15		Max. Pool Depth=2.2'
290.7		102.70	8.75	93.95	94.15		TW Control d=0.2'
		102.70	8.20	94.50			ACM
		102.70	8.26	94.44			ACM

HESTER CREEK - Soquel San Jose Road ID# SC-060

Station (ft)	BS (+)	HI	FS (-)	Elevation (ft)	WS	Slope	Station Description, Comments
	3.69						Temporary Bench Mark-TBM
21.3		103.69	0.95	102.74	102.94	2.46%	TW Control of 1st resting habitat d=0.2'
32.7		103.69	1.23	102.46	102.61	4.05%	Inlet Invert d=0.15'
122.6		103.69	4.87	98.82	99.02		Outlet Invert d=0.2'
127.6		103.69	7.72	95.97	98.67		Max Depth within 5' of Outlet d=2.7'
135.0		103.69	8.25	95.44	98.64		Max. Pool Depth=3.2'
159.0		103.69	5.38	98.31	98.61		TW Control d=0.3'
182.5		103.69	7.17	96.52	96.62	7.62%	Downstream Slope d=0.1'

TAILWATER CROSS-SECTION at Station 159.0'

Station (ft)	BS (+)	HI	FS (-)	Elevation (ft)	WS	Slope	Station Description, Comments
6.5		103.69	2.04	101.65			LB Bankfull
10.5		103.69	4.30	99.39			LB ACM
12.0		103.69	5.19	98.50			LEW
14.5		103.69	5.38	98.31	98.61		TW Control d=0.3'

22.0		103.69	5.06	98.63			REW
26.2		103.69	4.60	99.09			RB ACM
30.0		103.69	1.66	102.03			RB Bankfull

WEST BRANCH SOQUEL CREEK - Redwood Lodge Road ID# SC-061

Station (ft)	BS (+)	HI	FS (-)	Elevation (ft)	WS	Slope	Station Description, Comments
	4.17						Temporary Bench Mark-TBM
17.0		104.17	1.19	102.98		4.64%	Inlet Apron d=0.1'
37.9		104.17	2.16	102.01			Before inlet, end of Apron
38.0		104.17	2.91	101.26		3.73%	Inlet Invert d=0.2'
141.0		104.17	6.75	97.42			Outlet Invert
150.5		104.17	12.93	91.24			Max Depth within 5' of Outlet d=4.4'
154.5		104.17	13.52	90.65			Max. Pool Depth=5.0'
209.0		104.17	8.77	95.40			TW Control d=0.2'
232.0		104.17	9.85	94.32		4.70%	Downstream Slope d=0.2'
TAILWATER CROSS-SECTION at Station 209.0'							
Station (ft)	BS (+)	HI	FS (-)	Elevation (ft)	WS	Slope	Station Description, Comments
0.0		104.17	6.25	97.92			LB Bankfull
4.6		104.17	7.33	96.84			LB ACM
5.8		104.17	8.55	95.62			LEW
7.0		104.17	8.77	95.40	95.60		TW Control d=0.2'
11.0		104.17	8.71	95.46			REW
18.5		104.17	8.24	95.93			Center Gravel Bar
26.0		104.17	8.08	96.09			Gravel Bar
33.8		104.17	7.56	96.61			RB ACM
36.2		104.17	5.40	98.77			RB Bankfull

LAUREL CREEK #1 - Morrell Road ID# SC-062

Station (ft)	BS (+)	HI	FS (-)	Elevation (ft)	WS	Slope	Station Description, Comments
	1.00						Temporary Bench Mark-TBM
28.1		101.00	1.46	99.54	99.64	0.00%	TW Control of 1st resting habitat d=0.1'
32.5		101.00	1.46	99.54		12.71%	Inlet Invert
	1.98		7.97				Turning Point
112.9		95.01	5.69	89.32	89.42		Outlet Invert d=0.1'
119.0		95.01	8.06	86.95	88.95		Max. Pool Depth=2.0'
142.4		95.01	6.20	88.81			TW Control
160.1		95.01	6.83	88.18		3.56%	Downstream Slope
TAILWATER CROSS-SECTION at Station 142.4'							
Station (ft)	BS (+)	HI	FS (-)	Elevation (ft)	WS	Slope	Station Description, Comments
1.2		95.01	0.25	94.76			LB Bankfull
6.1		95.01	5.60	89.41			LB ACM
11.8		95.01	6.27	88.74			LEW
14.3		95.01	6.19	88.82			In Channel
16.3		95.01	6.20	88.81			TW Control
18.1		95.01	6.17	88.84			In Channel
19.2		95.01	6.17	88.84			REW
29.9		95.01	5.41	89.60			RB ACM
31.4		95.01	3.12	91.89			RB Bankfull

LAUREL CREEK #2 - Soquel San Jose Road ID# SC-063

Station (ft)	BS (+)	HI	FS (-)	Elevation (ft)	WS	Slope	Station Description, Comments
	0.95						Temporary Bench Mark-TBM
38.6		100.95	0.95	100.00		10.64%	Inlet Invert
	1.25	95.09	7.11	87.98			Turning Point
	0.54	88.54	7.09	81.45			Turning Point
	0.41	81.88	7.07	74.81			Turning Point
265.0		81.88	5.96	75.92			Outlet Invert
267.7		81.88	6.26	75.62			Outlet Apron
282.0		81.88	15.13	66.75		62.03%	Bottom of steep outlet apron
284.5		81.88	15.24	66.64			on Apron
300.7		81.88	14.71	67.17			on Apron
301.0		81.88	15.56	66.32			on Apron
309.0		81.88	15.60	66.28		1.74%	End of Apron (slope from steep section)
325.0		81.88	16.44	65.44			TW Control
347.2		81.88	18.19	63.69		7.88%	Downstream Slope
TAILWATER CROSS-SECTION at Station 325.0'							
Station (ft)	BS (+)	HI	FS (-)	Elevation (ft)	WS	Slope	Station Description, Comments
5.3		81.88	15.69	66.19			LB ACM
8.9		81.88	15.89	65.99			In Channel
11.3		81.88	16.44	65.44			TW Control
13.4		81.88	15.61	66.27			In Channel
15.0		81.88	16.16	65.72			In Channel
18.8		81.88	15.88	66.00			RB ACM
23.0		81.88	13.94	67.94			RB on Bank
25.0		81.88	11.70	70.18			RB on Bank

VALENCIA CREEK #1 - Soquel Drive ID# SC-064

Station (ft)	BS (+)	HI	FS (-)	Elevation (ft)	WS	Slope	Station Description, Comments
	1.55						Temporary Bench Mark-TBM
13.3		101.55	2.00	99.55		1.06%	TW Control of 1st resting habitat d=0.2'
51.1		101.55	1.50	100.05			Top of inlet partiton wall
51.1		101.55	2.40	99.15		1.79%	Inlet Invert d=0.5'
217.7		101.55	5.39	96.16			Outlet Invert before beam d=1.0'
220.5		101.55	9.55	92.00			Max. Pool Depth=0.8'
229.1		101.55	9.10	92.45			TW Control d=0.3'
253.7		101.55	9.21	92.34		0.45%	Downstream Slope d=0.2'
		101.55	8.19	93.36			ACM
		101.55	8.10	93.45			ACM

VALENCIA CREEK #2 - Valencie Raod ID# SC-065

Station (ft)	BS (+)	HI	FS (-)	Elevation (ft)	WS	Slope	Station Description, Comments
	2.43						Temporary Bench Mark-TBM
7.4		102.43	0.14	102.29	102.59	6.04%	TW Control of 1st resting habitat d=0.3'
12.2		102.43	0.43	102.00	102.10	6.26%	Inlet Apron d=0.1'
22.9		102.43	1.10	101.33	101.53	3.90%	Inlet Invert d=0.2'
90.8		102.43	3.75	98.68	99.28		Outlet Invert d=0.6'
91.0		102.43	3.93	98.50	99.30		Top of Outlet Apron d=0.8'
96.0		102.43	4.09	98.34	99.34		Max Pool on Apron d=1.0'
104.9		102.43	3.30	99.13	99.33	-4.53%	Outlet Apron Beam d=0.2'
106.5		102.43	5.16	97.27			Outlet Riprap
111.0		102.43	5.70	96.73	97.63		Max Depth within 5' of Outlet d=0.9'
112.7		102.43	5.17	97.26	97.56		End of Riprap d=0.3'
118.8		102.43	6.75	95.68	96.98		Max. Pool Depth=1.3'
139.8		102.43	5.73	96.70	97.00		TW Control d=0.3'
150.2		102.43	6.28	96.15	96.65	5.29%	Downstream Slope d=0.5'

TAILWATER CROSS-SECTION at Station 139.8'

Station (ft)	BS (+)	HI	FS (-)	Elevation (ft)	WS	Slope	Station Description, Comments
0.7		102.43	3.48	98.95			LB on Bank
3.3		102.43	4.65	97.78			LB ACM
3.7		102.43	5.59	96.84			LEW
7.3		102.43	5.67	96.76	96.96		In Channel d=0.2'
11.6		102.43	5.65	96.78	96.98		In Channel d=0.2'
15.4		102.43	5.67	96.76	97.06		In Channel d=0.3'
16.0		102.43	5.73	96.70	97.00		TW Control d=0.3'
18.5		102.43	5.40	97.03			REW
23.0		102.43	5.27	97.16			RB Gravel Bar
25.0		102.43	5.61	96.82			RB Gravel Bar
26.2		102.43	4.77	97.66			RB ACM
31.0		102.43	3.24	99.19			RB on Bank

BROWNS CREEK #1 - Browns Valley Road ID# SC-066

Station (ft)	BS (+)	HI	FS (-)	Elevation (ft)	WS	Slope	Station Description, Comments
	1.71						Temporary Bench Mark-TBM
35.5		101.71	3.29	98.42	99.62		TW Control of 1st resting habitat d=1.2'
46.0		101.71	1.64	100.07			Inlet Invert - Top of Partition Wall
46.0		101.71	2.26	99.45	99.50	2.87%	Inlet Invert - Thalweg d=0.05'
84.7		101.71	3.37	98.34	98.39		Outlet Invert - Thalweg d=0.05'
84.7		101.71	3.24	98.47			Outlet Invert - Centerline
88.0		101.71	7.39	94.32	97.72		Max Depth within 5' of Outlet d=3.4'
102.2		101.71	8.23	93.48	97.68		Max. Pool Depth=4.2'
128.7		101.71	4.17	97.54	97.74		TW Control d=0.2'
159.5		101.71	4.79	96.92	97.12	2.01%	Downstream Slope d=0.2'
		101.71	3.48	98.23			ACM
		101.71	3.66	98.05			ACM

TAILWATER CROSS-SECTION at Station 148.8'

Station (ft)	BS (+)	HI	FS (-)	Elevation (ft)	WS	Slope	Station Description, Comments
7.4		101.71	3.71	98.00			RB Channel
12.3		101.71	3.98	97.73			REW
17.1		101.71	3.97	97.74			In Channel
21.0		101.71	4.09	97.62			In Channel
27.5		101.71	4.11	97.60			In Channel
33.2		101.71	4.97	96.74	96.94		TW Control d=0.2'
36.3		101.71	4.22	97.49			LEW
37.5		101.71	2.13	99.58			LB on Bank

BROWNS CREEK #2 - Browns Valley Road ID# SC-067

Station (ft)	BS (+)	HI	FS (-)	Elevation (ft)	WS	Slope	Station Description, Comments
	3.93						Temporary Bench Mark-TBM
17.0		103.93	3.07	100.86	101.06	2.26%	Inlet Invert - low flow partition d=0.2'
64.0		103.93	4.13	99.80	100.00		Outlet Invert - low flow partition d=0.2'
67.5		103.93	6.95	96.98	99.78		Max Depth within 5' of Outlet d=2.8'
75.0		103.93	8.72	95.21	99.76		Max. Pool Depth=4.55'

124.0		103.93	4.60	99.33			TW Control
140.0		103.93	5.40	98.53		5.00%	Downstream Slope

TAILWATER CROSS-SECTION at Station 124.0'

Station (ft)	BS (+)	HI	FS (-)	Elevation (ft)	WS	Slope	Station Description, Comments
9.6		103.93	3.59	100.34			LB on Bank
11.5		103.93	3.86	100.07			LB ACM
14.0		103.93	4.21	99.72			LEW
17.7		103.93	4.29	99.64			In Channel
20.0		103.93	4.32	99.61	99.71		In Channel d=0.1'
22.1		103.93	4.60	99.33	99.73		TW Control d=0.4'
27.0		103.93	4.23	99.70			REW
30.4		103.93	3.93	100.00			RB ACM
35.0		103.93	2.59	101.34			RB on Bank

GAMECOCK CANYON - Hazel Dell Road ID# SC-068

Station (ft)	BS (+)	HI	FS (-)	Elevation (ft)	WS	Slope	Station Description, Comments
	1.56						Temporary Bench Mark-TBM
5.0		101.56	2.74	98.82	98.92	6.56%	TW Control of 1st resting habitat d=0.1'
23.0		101.56	3.55	98.01	98.26		Inlet Invert - Centerline d=0.25'
23.0		101.56	3.92	97.64	98.14	-0.87%	Inlet Invert - Thalweg d=0.5'
46.0		101.56	3.72	97.84	97.94		Outlet Invert d=0.1'
49.0		101.56	3.54	98.02		-9.33%	Top of outlet apron
52.0		101.56	3.26	98.30			Bottom of outlet apron
53.5		101.56	5.50	96.06	97.56		Max Depth within 5' of Outlet d=1.5'
60.2		101.56	5.62	95.94	97.54		Max. Pool Depth=1.6'
75.7		101.56	4.19	97.37	97.57		TW Control d=0.2'
112.0		101.56	4.52	97.04	97.14	0.91%	Downstream Slope d=0.1'

TAILWATER CROSS-SECTION at Station 75.7'

Station (ft)	BS (+)	HI	FS (-)	Elevation (ft)	WS	Slope	Station Description, Comments
2.5		101.56	0.71	100.85			LB Bankfull
3.4		101.56	2.98	98.58			LB ACM
3.5		101.56	4.10	97.46			LEW
4.4		101.56	4.19	97.37			TW Control d=0.2'
6.4		101.56	4.02	97.54			REW
13.0		101.56	3.85	97.71			On Gravel Bar
19.0		101.56	3.95	97.61			Bottom of RB
20.0		101.56	3.44	98.12			RB ACM
22.5		101.56	1.93	99.63			RB on Bank

RIDER CREEK - Rider Road ID# SC-069

Station (ft)	BS (+)	HI	FS (-)	Elevation (ft)	WS	Slope	Station Description, Comments
	2.18						Temporary Bench Mark-TBM
12.7		102.18	0.58	101.60	101.80	0.70%	Inlet Invert d=0.2'
32.7		102.18	0.72	101.46	101.66	2.95%	1st Break in Slope d=0.2'
53.4		102.18	1.33	100.85	101.05	4.41%	2nd Break in Slope d=0.2'
69.5		102.18	2.04	100.14	100.34		Outlet Invert d=0.2'
73.2		102.18	4.09	98.09		55.41%	Outlet Riprap
76.0		102.18	4.80	97.38	97.98		Max. Pool Depth=0.6'
81.0		102.18	4.50	97.68	97.98		TW Control d=0.3'
110.5		102.18	5.82	96.36	96.56	4.47%	Downstream Slope d=0.2'

TAILWATER CROSS-SECTION at Station 81.0'

Station (ft)	BS (+)	HI	FS (-)	Elevation (ft)	WS	Slope	Station Description, Comments
2.2		102.18	1.03	101.15			LB Bankfull
5.0		102.18	2.05	100.13			LB on Bank
6.3		102.18	3.52	98.66			LB ACM
9.0		102.18	4.27	97.91			LEW
10.3		102.18	4.50	97.68			Thalweg d=0.3'
13.6		102.18	4.31	97.87			In Channel
16.1		102.18	4.24	97.94			REW
20.0		102.18	3.24	98.94			RB ACM
25.7		102.18	0.51	101.67			RB Bankfull

CORRALITOS CREEK - Eureka Canyon Road ID# SC-070

Station (ft)	BS (+)	HI	FS (-)	Elevation (ft)	WS	Slope	Station Description, Comments
	3.72						Temporary Bench Mark-TBM
17.3		103.72	0.92	102.80	102.90	9.59%	TW Control of 1st resting habitat d=0.1'
34.2		103.72	2.54	101.18	101.23	2.39%	Inlet Invert d=0.05'
129.0		103.72	4.81	98.91	99.11		Outlet Invert d=0.2'
134.0		103.72	10.05	93.67	97.67		Max. Pool Depth=4.0'
176.5		103.72	6.14	97.58			TW Control
205.4		103.72	8.35	95.37	96.57	7.65%	Downstream Slope d=1.2'

TAILWATER CROSS-SECTION at Station 176.5'

Station (ft)	BS (+)	HI	FS (-)	Elevation (ft)	WS	Slope	Station Description, Comments
15.2		103.72	4.97	98.75			LB Gravel Bar
37.4		103.72	6.05	97.67			LEW
42.0		103.72	5.92	97.80			Top of Rock Weir

45.4		103.72	5.77	97.95			Top of Rock Weir
48.0		103.72	5.82	97.90			Top of Rock Weir
52.7		103.72	6.03	97.69			Top of Rock Weir
55.0		103.72	6.14	97.58			TW Control
60.0		103.72	6.12	97.60			REW
62.0		103.72	6.04	97.68			RB ACM
67.9		103.72	3.14	100.58			RB on Bank

SHINGLE MILL GULCH #1 - Eureka Canyon Road ID# SC-071

Station (ft)	BS (+)	HI	FS (-)	Elevation (ft)	WS	Slope	Station Description, Comments
	3.81						Temporary Bench Mark-TBM
18.3		103.81	1.37	102.44	102.94	8.36%	TW Control of 1st resting habitat d=0.5'
39.0		103.81	1.70	102.11			Inlet Invert - Centerline
39.0		103.81	3.10	100.71	101.91	-0.43%	Inlet Invert - Thalweg d=1.2'
53.2		103.81	3.32	100.49	101.89		Max pool within culvert d=1.4'
72.6		103.81	2.95	100.86	101.86		Before Outlet Beam d=1.0'
73.9		103.81	1.94	101.87			Outlet Beam
75.1		103.81	4.37	99.44			Top of Outlet Apron
90.4		103.81	5.24	98.57		5.69%	Bottom of Outlet Apron
95.5		103.81	9.05	94.76	96.96		Max. Pool Depth=2.2'
109.9		103.81	6.89	96.92	97.12		TW Control d=0.2'
120.6		103.81	7.30	96.51	96.71	3.83%	Downstream Slope d=0.2'

TAILWATER CROSS-SECTION at Station 109.9'

Station (ft)	BS (+)	HI	FS (-)	Elevation (ft)	WS	Slope	Station Description, Comments
2.8		103.81	2.11	101.70			LB Bankfull
4.8		103.81	6.05	97.76			LB ACM
7.7		103.81	6.60	97.21			LEW
9.3		103.81	6.76	97.05			In Channel
9.7		103.81	6.60	97.21			Middle
14.3		103.81	6.51	97.30			On Gravel Bar
15.9		103.81	6.67	97.14			Middle
17.0		103.81	6.77	97.04			In Channel
19.3		103.81	6.89	96.92			TW Control d=0.2'
21.8		103.81	6.63	97.18			REW
23.8		103.81	6.23	97.58			ACM
28.4		103.81	3.74	100.07			RB Bankfull

SHINGLE MILL GULCH #2 - Eureka Canyon Road ID# SC-072

Station (ft)	BS (+)	HI	FS (-)	Elevation (ft)	WS	Slope	Station Description, Comments
	4.46						Temporary Bench Mark-TBM
4.0		104.46	10.78	93.68	93.88	8.16%	TW Control of 1st resting habitat d=0.2'
21.4		104.46	12.20	92.26	92.36	5.17%	Inlet Invert d=0.1
54.7		104.46	13.92	90.54	90.64		Outlet Invert d=0.1'
59.4		104.46	14.70	89.76		16.60%	Outlet Apron
64.5		104.46	16.80	87.66	89.56		Max. Pool Depth=1.9'
80.6		104.46	14.77	89.69			TW Control
98.4		104.46	17.03	87.43	87.53	12.70%	Downstream Slope d=0.1'

TAILWATER CROSS-SECTION at Station 80.6'

Station (ft)	BS (+)	HI	FS (-)	Elevation (ft)	WS	Slope	Station Description, Comments
2.0		104.46	10.36	94.10			LB Bank
4.0		104.46	13.66	90.80			LB ACM
8.5		104.46	14.05	90.41			On Boulder Weir
13.8		104.46	14.77	89.69			TW Control
17.0		104.46	13.31	91.15			On Boulder Weir
20.3		104.46	13.53	90.93			ACM
22.9		104.46	11.08	93.38			RB Bank

CASSERLY CREEK #1 - Casserly Road ID# SC-073

Station (ft)	BS (+)	HI	FS (-)	Elevation (ft)	WS	Slope	Station Description, Comments
	2.45						Temporary Bench Mark-TBM
11.5		102.45	2.83	99.62	99.72	1.14%	TW Control of 1st resting habitat d=0.1'
25.0		102.45	3.91	98.54	99.74		Max Pool Before Inlet d=1.2'
29.0		102.45	2.94	99.51	99.71		Inlet Invert - Centerline d=0.2'
29.0		102.45	3.03	99.42	99.72	-0.61%	Inlet Invert - Thalweg d=0.3'
68.4		102.45	2.79	99.66		1.96%	Start of concrete floor
98.0		102.45	3.37	99.08			Outlet Invert
110.5		102.45	4.37	98.08	98.38		Max. Pool Depth=0.3'
118.3		102.45	4.18	98.27			TW Control
124.1		102.45	4.13	98.32		-0.86%	Downstream Slope

TAILWATER CROSS-SECTION at Station 102.2'

Station (ft)	BS (+)	HI	FS (-)	Elevation (ft)	WS	Slope	Station Description, Comments
2.0		102.45	2.14	100.31			LB Bank Bottom of wingwall
3.6		102.45	2.89	99.56			LB ACM
6.0		102.45	3.42	99.03			LEW
6.8		102.45	3.44	99.01			In Channel
7.7		102.45	3.57	98.88			In Channel

8.5		102.45	3.60	98.85			In Channel
9.4		102.45	3.62	98.83			REW
11.7		102.45	2.69	99.76			RB ACM
14.3		102.45	2.43	100.02			RB Bank

CASSERLY CREEK #2 - Mt. Madonna Road ID# SC-074

Station (ft)	BS (+)	HI	FS (-)	Elevation (ft)	WS	Slope	Station Description, Comments
	4.03						Temporary Bench Mark-TBM
6.5		104.03	2.30	101.73	101.83	10.83%	TW Control of 1st resting habitat d=0.1'
18.5		104.03	3.60	100.43	100.48	0.30%	Inlet Invert d=0.05'
48.8		104.03	3.69	100.34			Outlet Invert
56.8		104.03	4.39	99.64	99.74		Outlet Apron d=0.1'
56.8		104.03	7.65	96.38	97.38		Max. Pool Depth=1.0'
66.0		104.03	6.65	97.38			TW Control
76.0		104.03	7.00	97.03		3.50%	Downstream Slope
		104.03	4.95	99.08			ACM
		104.03	4.66	99.37			ACM

GREEN VALLEY CREEK #1 1of2 - Casserly Road ID# SC-075

Station (ft)	BS (+)	HI	FS (-)	Elevation (ft)	WS	Slope	Station Description, Comments
	2.39						Temporary Bench Mark-TBM
1.0		102.39	2.45	99.94		0.05%	Inlet Invert
43.3		102.39	2.47	99.92			Outlet Invert
46.0		102.39	3.55	98.84		40.00%	Outlet Riprap
56.8		102.39	4.45	97.94	98.54		TW Control d=0.6'
70.5		102.39	5.83	96.56		10.07%	Downstream Slope
TAILWATER CROSS-SECTION at Station 56.8'							
Station (ft)	BS (+)	HI	FS (-)	Elevation (ft)	WS	Slope	Station Description, Comments
4.0		102.39	2.86	99.53			LB Bank
5.6		102.39	3.30	99.09			LB ACM
10.3		102.39	3.88	98.51			In Channel
11.1		102.39	4.39	98.00			In Channel
12.3		102.39	3.97	98.42			In Channel
13.7		102.39	3.49	98.90			In Channel
14.8		102.39	4.45	97.94	98.54		TW Control d=0.6'
20.0		102.39	4.28	98.11			REW
21.0		102.39	3.23	99.16			RB ACM
21.8		102.39	2.71	99.68			RB Bank

GREEN VALLEY CREEK #1 2of2 - Casserly Road ID# SC-075

Station (ft)	BS (+)	HI	FS (-)	Elevation (ft)	WS	Slope	Station Description, Comments
	2.39						Temporary Bench Mark-TBM
1.0		102.39	2.45	99.94		-0.02%	Inlet Invert
43.3		102.39	2.44	99.95			Outlet Invert
46.0		102.39	4.70	97.69	98.69		Max Pool Depth=1.0'
56.8		102.39	4.45	97.94	98.54		TW Control d=0.6'
70.5		102.39	5.83	96.56		10.07%	Downstream Slope
TAILWATER CROSS-SECTION at Station 56.8'							
Station (ft)	BS (+)	HI	FS (-)	Elevation (ft)	WS	Slope	Station Description, Comments
4.0		102.39	2.86	99.53			LB Bank
5.6		102.39	3.30	99.09			LB ACM
10.3		102.39	3.88	98.51			In Channel
11.1		102.39	4.39	98.00	98.50		In Channel
12.3		102.39	3.97	98.42			In Channel
13.7		102.39	3.49	98.90			In Channel
14.8		102.39	4.45	97.94	98.54		TW Control d=0.6'
20.0		102.39	4.28	98.11			REW
21.0		102.39	3.23	99.16			RB ACM
21.8		102.39	2.71	99.68			RB Bank

GREEN VALLEY CREEK #2 - Green Valley Road ID# SC-076

Station (ft)	BS (+)	HI	FS (-)	Elevation (ft)	WS	Slope	Station Description, Comments
	3.81						Temporary Bench Mark-TBM
3.0		103.81	3.99	99.82	100.02		TW Control of 1st resting habitat d=0.2'
46.8		103.81	3.79	100.02			Inlet Invert - Centerline
46.8		103.81	3.86	99.95		0.00%	Inlet Invert - Thalweg on beam
83.8		103.81	3.86	99.95			Outlet Invert - on beam/wall
84.0		103.81	6.15	97.66			After outlet beam, Top of Apron
96.6		103.81	7.71	96.10		12.38%	Outlet Apron
99.0		103.81	9.96	93.85		93.75%	Outlet Riprap
103.5		103.81	11.54	92.27	93.77		Max. Pool Depth=1.5'
116.0		103.81	10.17	93.64	93.74		TW Control d=0.1'
133.5		103.81	10.29	93.52		0.69%	Downstream Slope
		103.81	7.85	95.96			ACM
		103.81	7.53	96.28			ACM

GREEN VALLEY CREEK #3 - Green Valley Road ID# SC-077

Station (ft)	BS (+)	HI	FS (-)	Elevation (ft)	WS	Slope	Station Description, Comments
	3.79						Temporary Bench Mark-TBM
11.0		103.79	5.33	98.46		-0.74%	TW Control of 1st resting habitat
17.2		103.79	6.67	97.12	97.42		Pool Before Inlet d=0.3'
28.5		103.79	4.74	99.05			Inlet Invert - Centerline
28.5		103.79	5.20	98.59		-4.59%	Inlet Invert - Thalweg on beam
46.6		103.79	4.37	99.42			Outlet Invert - on beam/wall
47.6		103.79	6.50	97.29			After outlet beam, Top of Apron
51.1		103.79	6.77	97.02		7.71%	Outlet Apron
53.3		103.79	9.03	94.76	95.36		Max. Pool Depth=0.6'
66.9		103.79	8.42	95.37			TW Control
83.5		103.79	8.76	95.03		2.05%	Downstream Slope

TAILWATER CROSS-SECTION at Station 66.9'

Station (ft)	BS (+)	HI	FS (-)	Elevation (ft)	WS	Slope	Station Description, Comments
1.0		103.79	7.98	95.81			LB Bank
1.7		103.79	8.33	95.46			LEW
5.2		103.79	8.42	95.37			TW Control
7.0		103.79	7.50	96.29			Top of concrete in chanel
9.0		103.79	8.26	95.53			In Channel
11.2		103.79	8.13	95.66			In Channel
14.5		103.79	8.06	95.73			REW

GREEN VALLEY CREEK #4 - Green Valley Road ID# SC-078

Station (ft)	BS (+)	HI	FS (-)	Elevation (ft)	WS	Slope	Station Description, Comments
	3.39						Temporary Bench Mark-TBM
5.0		103.39	3.68	99.71		0.38%	TW Control of 1st resting habitat
33.7		103.39	4.69	98.70			Inlet Invert - Centerline
33.7		103.39	3.79	99.60		2.64%	Inlet Invert - Thalweg
55.3		103.39	4.36	99.03			Outlet Invert - on notched beam
55.5		103.39	7.36	96.03		9.74%	After outlet beam, Top of Apron
90.7		103.39	10.79	92.60			End of Apron
91.2		103.39	14.00	89.39			After Apron
96.3		103.39	14.45	88.94			Max. Pool Depth=0
110.3		103.39	13.20	90.19			TW Control
122.5		103.39	13.90	89.49		5.74%	Downstream Slope
		103.39	11.95	91.44			ACM
		103.39	11.82	91.57			ACM

GREEN VALLEY CREEK #5 - Green Valley Road ID# SC-079

Station (ft)	BS (+)	HI	FS (-)	Elevation (ft)	WS	Slope	Station Description, Comments
	3.07						Temporary Bench Mark-TBM
24.3		103.07	3.26	99.81		3.35%	TW Control of 1st resting habitat
45.8		103.07	3.84	99.23			Inlet Invert - Centerline
45.8		103.07	3.98	99.09		0.15%	Inlet Invert - Thalweg
126.6		103.07	4.10	98.97			Outlet - thalweg
130.2		103.07	4.32	98.75			TW Control
154.0		103.07	4.70	98.37		1.60%	Downstream Slope

TAILWATER CROSS-SECTION at Station 130.2'

Station (ft)	BS (+)	HI	FS (-)	Elevation (ft)	WS	Slope	Station Description, Comments
4.1		103.07	3.29	99.78			LB Bank
4.8		103.07	3.41	99.66			LB ACM
8.4		103.07	3.99	99.08			In Channel
12.7		103.07	4.32	98.75			TW Control
15.0		103.07	4.14	98.93			In Channel
17.5		103.07	3.66	99.41			RB ACM
19.4		103.07	2.72	100.35			RB on Bank

GREEN VALLEY CREEK #6 - Green Valley Road ID# SC-080

Station (ft)	BS (+)	HI	FS (-)	Elevation (ft)	WS	Slope	Station Description, Comments
	3.11						Temporary Bench Mark-TBM
23.4		103.11	11.05	92.06		6.38%	TW Control of 1st resting habitat
36.1		103.11	11.86	91.25	91.35	0.62%	Inlet Invert d=0.1'
76.2		103.11	12.11	91.00	91.10		Outlet d=0.1'
86.1		103.11	12.97	90.14		8.69%	Outlet Apron
91.0		103.11	15.54	87.57	89.87		Max. Pool Depth=2.3'
102.5		103.11	13.40	89.71			TW Control
111.6		103.11	13.45	89.66		0.55%	Downstream Slope

TAILWATER CROSS-SECTION at Station 102.5'

Station (ft)	BS (+)	HI	FS (-)	Elevation (ft)	WS	Slope	Station Description, Comments
2.9		103.11	10.63	92.48			RB on Bank
3.7		103.11	12.63	90.48			RB ACM
7.5		103.11	13.25	89.86			REW
8.4		103.11	13.40	89.71			TW Control
12.0		103.11	13.25	89.86			LEW
22.6		103.11	12.45	90.66			LB ACM

25.0	103.11	10.39	92.72	LB on Bank

APPENDIX B:

COUNTY OF SANTA CRUZ STREAM CROSSING INVENTORY AND FISH PASSAGE EVALUATION PROJECT –

GIS MAP OF STREAM CROSSING LOCATIONS AND FISHERIES DISTRIBUTION

County of Santa Cruz Stream Crossing Inventory and Fish Passage Evaluation Map
Prepared by Ross Taylor and Associates and County of Santa Cruz Public Works
March 2004

Culvert Color Relates to the following:

Green - Meets CDFG & NOAA Passage Criteria

Yellow - Does Not Meet Passage Criteria Under Certain Flows and Life Stages.

Red - Does Not Meet Passage Criteria Under All Flow Conditions and for all Life Stages.

Grey - Not Within Fish-bearing Stream Reaches.

This map identifies the location, type, and passage rating of most county-maintained culverts on streams that support steelhead or coho salmon. Additional county-maintained culverts on non-fish-bearing streams are shown. This map was prepared with funding from the Department of Fish and Game, California Coastal Salmon Recovery Program, and the County of Santa Cruz.

Legend

Streams
- Intermittent Stream
- Perennial Stream

Current Salmonid Distribution
- Coho and Steelhead
- Steelhead
- Accessible to Steelhead under some flow conditions
- Resident Rainbow

Culvert Types
- Box
- Bridge with Weirs
- Circular
- Open Bottom Arch
- Oval
- Pipe Arch

Extent of Distribution / Migration Barriers
- Extent of distribution due to channel steepness and/or lack of suitable habitat.
- Extent of Distribution Unknown
- Complete Barrier / Human
- Complete Barrier / Natural
- Significant Partial Barrier / Human
- Significant Partial Barrier / Natural
- Break Between Steelhead / Coho and Steelhead Only
- Steelhead Downstream of Santa Cruz County
- Whole Stream In Santa Cruz County Accessible

Monterey Bay

N W E S

0 1.5 3 6 9 12 Miles

127-02 - April 2002
Prepared by the County of Santa Cruz GIS Staff

THE COUNTY OF SANTA CRUZ · SINE TIMORE AUDACIA · 1850 ·

APPENDIX C:

COUNTY OF SANTA CRUZ STREAM CROSSING INVENTORY AND FISH PASSAGE EVALUATION PROJECT –

FISH PASSAGE EVALUATIONS

Santa Cruz County - Summary of Fish Passage Analysis for Existing Passage Conditions

Culvert Location Information				Adult Salmon & Steelhead Fish Passage Criteria Flows (cfs)			Resident Trout Fish Passage Criteria Flows (cfs)			Juvenile Salmonids - Young of the Year Fish Passage Criteria Flows (cfs)				
ID#	Stream Name	Road Name	Drainage	Lower Q50% or 3 cfs	Upper Q1%	%Passable	Lower Q90% or 2 cfs	Upper Q5%	%Passable	Lower Q95% or 1 cfs	Upper Q10%	%Passable	Comments	Recommendations from interpreting model output
SC-001	Queseria Creek	Swanton Road	Scott Cr	3.0	10.0	**0%**	2.0	2.8	**0%**	1.0	1.3	**0%**	Fairly steep slope for a concrete pipe. Shallow jump pool. Minimal fill (~178 yd^3). Severely undersized (<2 year peak flow). Minimal fill (<200 yd^3).	Full replacement only feasible solution due to limited hydraulic capacity. Minimal fill and small creek make replacement relatively inexpensive. Recommend an embedded circular pipe (or other natural bottom structure) with at least 8 ft diameter.
SC-002	Archibald Creek	Swanton Road	Scott Cr	3.0	11.5	**71%**	2.0	3.2	**0%**	1.0	1.4	**0%**	Assumed Q1%=Active Channel Flow in outlet pool. Severely undersized (<1yr flow). Minimal fill ~90 yd^3.	Full replacement only feasible option due to limited hydraulic capacity. Minimal fill and small creek make replacement relatively inexpensive. An embedded circular pipe with a 9 ft diameter or other natural bottomed structure would be adequate for fish passage.
SC-003	UNT #1 to Scott Cr	Swanton Road	Scott Cr	3.0	11.9	**0%**	2.0	0.1	**0%**	1.0	0.0	**0%**	Possibly not fish bearing creek, very small and steep. Very low amount of habitat to open. Pipe width is constricts active channel width. Steep slope 5.47%	Raising tailwater elevation enough for passage may submerge pipe decreasing the ability to pass peak flows. Recommend full replacement with embedded 5 ft circular pipe.
SC-004	UNT #2 to Scott Cr	Swanton Road	Scott Cr	3.0	14.1	**46%**	2.0	0.7	**0%**	1.0	0.3	**0%**	Severely undersized <10 yr flow. Low amount of fill ~265 yd^3	Full replacement only feasible option due to limited hydraulic capacity. An embedded circular pipe with a 5 ft diameter or other natural bottomed structure would be adequate for fish passage.
SC-005	Molino Creek	Swanton Road	Coastal	3.0	24.9	**18%**	2.0	6.9	**0%**	1.0	3.1	**0%**	Undersized (<20 yr peak flow). Perched with increased velocities from concrete floor creates barrier. USGS map indicates a reservoir upstream limiting habitat to 2700 ft from a possible 11,000 ft.	Investigate presence of upstream reservoir for habitat purposes. Retrofitting pipe probably not possible due to limited hydraulic capacity. Recommend installing embedded pipe arch, open arch or bridge with 16 ft width.
SC-009	Redwood Creek #1	Glen Canyon Road	Glen Canyon-Branciforte Cr-Carbonera Cr-San Lorenzo R	3.0	14.4	**16%**	2.0	4.0	**0%**	1.0	1.8	**0%**	Assumed Q1%=Active Channel flow in outlet pool. Roughness increased to 0.024 n due to sediment retained within pipe. Outlet backwatered. Severely undersized ~6 yr peak flow. Large amount of fill ~2,288 yd^3. Close proximity to Glen Canyon Cr.	Interim fix, raise tailwater elevation 2 ft with 2 rock weirs, however the limited hydraulic capacity may pose flooding problems. Recommend installing an open arch with at least 13 ft span.
SC-010	Redwood Creek #2	Redwood Drive	Glen Canyon-Branciforte Cr-Carbonera Cr-San Lorenzo R	3.0	14.1	**0%**	2.0	3.9	**0%**	1.0	1.8	**0%**	Severely undersized ~6 yr peak flow. Low amount of fill ~268 yd^3.	Raising tailwater elevation will increase passage but is not recommended due to limited hydraulic capacity and minimal amount of fill making replacement relatively inexpensive. Recommend installing an open arch with at least 12 ft span.
SC-011	Redwood Creek #3	Redwood Drive	Glen Canyon-Branciforte Cr-Carbonera Cr-San Lorenzo R	3.0	13.7	**57%**	2.0	3.8	**0%**	1.0	1.7	**0%**	Very sloped (>5%). Undersized ~7yr peak flow. Low amount of fill ~265 yd^3. Poor shape.	Full replacement best option due to limited hydraulic capacity. Recommend installing open arch with 12 ft span.
SC-012	Redwood Creek #4	Redwood Drive	Glen Canyon-Branciforte Cr-Carbonera Cr-San Lorenzo R	3.0	15.6	**68%**	2.0	1.6	**0%**	1.0	0.7	**0%**	Undersized ~7yr peak flow. Low amount of fill ~90 yd^3.	Full replacement best option due to limited hydraulic capacity. Could install embedded circular pipe with 7 ft diameter.
SC-013	Redwood Creek #5	Redwood Drive	Glen Canyon-Branciforte Cr-Carbonera Cr-San Lorenzo R	3.0	11.5	**22%**	2.0	1.1	**0%**	1.0	0.5	**0%**	Extremely undersized <5 yr peak flow. Poor inlet alignment.	Full replacement best option due to limited hydraulic capacity. Recommend installing embedded circular pipe with 6 ft diameter.
SC-014	Redwood Creek #6	Redwood Drive	Glen Canyon-Branciforte Cr-Carbonera Cr-San Lorenzo R	3.0	3.4	**0%**	2.0	0.9	**0%**	1.0	0.4	**0%**	Sized <25 yr peak flow. Very perched 5.2 ft. Steep slope ~5.5%.	Full replacement relatively inexpensive due to size of stream and low amount of fill (~112 yd^3). Recommend installing embedded 6 ft circular pipe.
SC-015	Redwood Creek #7	Redwood Drive	Glen Canyon-Branciforte Cr-Carbonera Cr-San Lorenzo R	3.0	8.2	**88%**	2.0	0.8	**0%**	1.0	0.4	**0%**	Assumed Q1%=Active Channel flow in outlet pool. Numerous barriers downstream. Very poor condition, rusted through. Extremely undersized ~6 yr peak flow. No passage window determined from criteria used. Extremely poor condition and prone to failure.	Full replacement recommended due to condition and size. Could install embedded 6 ft circular pipe.
SC-016	Granite Creek	Granite Road	Branciforte Cr-Carbonera Cr-San Lorenzo R	3.0	22.6	**20%**	2.0	6.2	**0%**	1.0	2.8	**0%**	Extremely undersized <5 yr peak flow. Steep drop in channel profile upstream (9.4%). Perched ~1.8 ft. Large bedload aggrading at inlet.	Full replacement best option due to limited hydraulic capacity. Recommend Installing open arch with 16 ft span to accommodate active channel migration and allow bedload transport.
SC-017	Crystal Creek #1	Branciforte Drive	Branciforte Cr-Carbonera Cr-San Lorenzo R	3.0	16.3	**100%**	2.0	4.5	**100%**	1.0	2.0	**100%**	Highly undersized <5yr peak flow. Backwatered 0.6 ft deep when Q=0 cfs.	Do nothing for fish passage. In order to increase flood capacity install a natural bottom crossing with a 12 ft width.
SC-018	Crystal Creek #2	Happy Valley Road	Branciforte Cr-Carbonera Cr-San Lorenzo R	3.0	16.0	**100%**	2.0	4.4	**100%**	1.0	2.0	**100%**	Highly undersized ~5yr peak flow. Backwatered 0.33 ft when Q=0 cfs. Passage does not seem to be a problem. 400 ft upstream of previous crossing.	Do nothing for fish passage. In order to increase flood capacity install a natural bottom crossing with a 12 ft width.
SC-019	Crystal Creek #3	Happy Valley Road	Branciforte Cr-Carbonera Cr-San Lorenzo R	3.0	15.7	**100%**	2.0	4.3	**100%**	1.0	2.0	**0%**	Extremely undersized ~5 yr peak flow. Culvert is backwatered however data does not account for this, possibly inaccurate data.	Interim fix, raise tailwater elevation 0.5 ft with one rock weir. Due to limited hydraulic capacity recommend full replacement with embedded 10 ft diameter circular pipe or an open arch with a 13 ft span.

Culvert Location Information				Adult Salmon & Steelhead Fish Passage Criteria Flows (cfs)			Resident Trout Fish Passage Criteria Flows (cfs)			Juvenile Salmonids - Young of the Year Fish Passage Criteria Flows (cfs)				
ID#	Stream Name	Road Name	Drainage	Lower Q50% or 3 cfs	Upper Q1%	%Passable	Lower Q90% or 2 cfs	Upper Q5%	%Passable	Lower Q95% or 1 cfs	Upper Q10%	%Passable	Comments	Recommendations from interpreting model output
SC-020	Branciforte Creek #1	Branciforte Drive	Carbonera Cr-San Lorenzo R	3.0	55.2	**0%**	2.0	15.2	**0%**	1.0	6.9	**0%**	Culvert is GREEN from weir however there is a shallow pool with an excessive jump to get over the weir. Moderately sized ~70 yr peak flow. Weir makes culvert inaccessible to fish. Ample amount of upstream habitat.	Raising tailwater elevation 3 ft with 3 rock weirs to allow adult passage. In order to facilitate passage of all life stages the weir and culvert should be removed and install a 20 ft wide bridge.
SC-021	Tie Gulch	Branciforte Drive	Branciforte Cr-Carbonera Cr-San Lorenzo R	3.0	15.3	**0%**	2.0	1.5	**0%**	1.0	0.7	**0%**	Cross section appears to not accurately capture tailwater condition. Undersized <40 yr peak flow.	Interim fix raise tailwater elevation 1 ft with 1 rock weir. Full replacement relatively inexpensive due to low amount of fill <200 yd^3. An embedded circular pipe with an 8 ft diameter would be adequate.
SC-022	Branciforte Creek #2	Branciforte Drive	Carbonera Cr-San Lorenzo R	3.0	42.2	**100%**	2.0	11.6	**100%**	1.0	5.3	**100%**	Undersized ~60 yr peak flow.	Do nothing for fish passage.
SC-023	Mountain View Creek #1	Vine Hill Road	Branciforte Cr-Carbonera Cr-San Lorenzo R	3.0	9.3	**53%**	2.0	2.6	**0%**	1.0	1.2	**0%**	Due to outlet directly into Branciforte Creek migration flows were adjusted according to the drainage area contributing to the tailwater control in Branciforte Cr (2.40 mi^2). Undersized <20 yr peak flow.	Interim fix install corner baffles to reduce velocities and provide depth. Full replacement would increase hydraulic capacity. Recommend open arch with 12 ft span.
SC-024	Mountain View Creek #2	Mountain View Road	Branciforte Cr-Carbonera Cr-San Lorenzo R	3.0	10.4	**58%**	2.0	0.6	**0%**	1.0	0.3	**0%**	Low priority due to little habitat to open (850 ft), pipe is sized properly for peak flows (>100 yr), however culvert width constricts active channel width. Small creek. Pipe in poor shape.	Recommend full replacement with 6 ft embedded circular pipe.
SC-025	Blackburn Gulch	Vine Hill Road	Branciforte Cr-Carbonera Cr-San Lorenzo R	3.0	24.7	**100%**	2.0	6.8	**100%**	1.0	3.1	**100%**	Properly sized >100 yr peak flow.	Do nothing for fish passage.
SC-026	UNT to Carbonera	La Madrona Drive	Carbonera Cr-San Lorenzo R	3.0	7.4	**0%**	2.0	0.7	**0%**	1.0	0.3	**0%**	Undersized <60 yr peak flow. Large debris jam at outlet. Small Creek.	Recommend full replacement with 10 ft wide open arch.
SC-027	Gold Gulch	Brookside Way	San Lorenzo R	3.0	30.4	**35%**	2.0	8.4	**0%**	1.0	3.8	**0%**	Extremely undersized ~5 yr peak flow. Culvert is in extremely poor condition, floor is pried up and dangerous to fish. Fair amount of habitat to open (~1.5 mi).	Recommend full replacement due to condition and size with an open arch or bridge with a 16 ft span.
SC-028	Shingle Mill Creek	Redwood Drive	San Lorenzo R	3.0	4.5	**0%**	2.0	1.2	**0%**	1.0	0.6	**0%**	Outlet is extremely perched over riprap, 11.88 ft. 50 ft upstream of culvert is a weir with a 5.5 ft drop creating an additional barrier. Undersized <10 yr peak flow.	Recommend full replacement with 7 ft embedded circular pipe.
SC-029	Bean Creek #1	Mt. Hermon Road	Zayante Cr-San Lorenzo R	3.0	149.2	**95%**	2.0	41.1	**0%**	1.0	18.7	**0%**	Crossing modeled as a pipe arch due to shape of bottom and sides. Baffles pointing downstream will actually increase velocities hindering passage, fishXing can not model this therefore velocity outputs may be lower than predicted. Properly sized >100 yr flow.	Fill in gap between baffle sets with concrete creating weirs with a 0.3' notch set in them to create pools. Install a 2 ft high notched weir at the outlet. Raise tailwater elevation 2 ft with 2 weirs.
SC-030	Lockhart Gulch	Lockhart Gulch Road	Bean Creek-Zayante Cr-San Lorenzo R	3.0	32.9	**80%**	2.0	9.1	**64%**	1.0	4.1	**90%**	Velocities through culvert diminish lower flows tailwater effects on depth ie high velocities push out the depth created by the tailwater conditions at low flow. Assumed fish could swim through low depth at inlet. Model probably underestimates adult passage. Extremely undersized <5 yr peak flow.	Current passage conditions are fairly adequate. To improve passage full replacement with an open arch or bridge is recommended.
SC-031	Bean Creek #2	Bean Creek Road	Zayante Cr-San Lorenzo R	3.0	57.5	**100%**	2.0	15.8	**100%**	1.0	7.2	**97%**	Culvert permits adequate passage. Large outlet pool. Sized ~50 yr peak flow. Bottom of culvert lined with concrete which is worn to rebar.	Raise tailwater elevation 0.5 ft with 1 rock weir to provide full passage.
SC-032	Lompico Creek #1	Lompico Road	Zayante Cr-San Lorenzo R	3.0	42.5	**100%**	2.0	11.7	**0%**	1.0	5.3	**0%**	5 concrete sac weirs after outlet with a max of 1.17 ft jump creating barrier to residents and juveniles. 9 baffles installed probably for higher flows. Increased roughness to 0.045 n due to baffles. Extremely undersized <5yr peak flow.	Full replacement best option due to undersizing. Recommend installing an open arch or bridge with an 18 ft span. Due to current weirs downstream and steep drop in channel profile upstream and downstream grade control weirs will probably need to be installed.
SC-033	Lompico Creek #2	Lompico Road	Zayante Cr-San Lorenzo R	3.0	41.8	**0%**	2.0	11.5	**0%**	1.0	5.2	**0%**	Shallow jump pool for weir. First weir has a 2.22 ft jump. 8 baffles installed probably for higher flows. Undersized for peak flows plus baffles reduce flood capacity. Culvert width 60% smaller then active channel width.	Interim fix, raise tailwater elevation 1 ft with 1 rock weir. Full replacement best option due to undersizing. Recommend installing an open arch or bridge with an 18 ft span. Due to current weirs downstream and steep drop in channel profile upstream and downstream grade control weirs will probably need to be installed.
SC-034	Lompico Creek #3	Lompico Road	Zayante Cr-San Lorenzo R	3.0	26.8	**0%**	2.0	7.4	**0%**	1.0	3.4	**0%**	Undersized ~15 yr peak flow.	Full replacement relatively inexpensive due to low amount of fill ~94 yd^3. Recommend installing an open arch or bridge with an 18 ft span.
SC-035	Cobble Creek	East Zayante Road	Zayante Cr-San Lorenzo R	3.0	13.4	**0%**	2.0	1.6	**0%**	1.0	0.7	**0%**	Extremely sloped (7%) and perched 3 ft. Undersized <10 yr peak flow. Heavily riprapped at outlet. 50 ft from mainstem Zayante Creek.	Full replacement only feasible option. Recommend embedded 8 ft circular pipe.
SC-036	Mountain Charlie Gulch	East Zayante Road	Zayante Cr-San Lorenzo R	3.0	46.0	**100%**	2.0	12.7	**100%**	1.0	5.8	**100%**	Undersized ~10 yr peak flow.	Do nothing for fish passage. To accommodate 100 yr peak flow recommend an open arch or bridge with an 18 ft span.
SC-037	UNT to Zayante Cr	East Zayante Road	Zayante Cr-San Lorenzo R	3.0	10.5	**89%**	2.0	2.9	**0%**	1.0	1.3	**0%**	Extremely undersized <5 yr peak flow.	Recommend full replacement with 8 ft embedded circular pipe.

Culvert Location Information				Adult Salmon & Steelhead Fish Passage Criteria Flows (cfs)			Resident Trout Fish Passage Criteria Flows (cfs)			Juvenile Salmonids - Young of the Year Fish Passage Criteria Flows (cfs)				
ID#	Stream Name	Road Name	Drainage	Lower Q50% or 3 cfs	Upper Q1%	%Passable	Lower Q90% or 2 cfs	Upper Q5%	%Passable	Lower Q95% or 1 cfs	Upper Q10%	%Passable	Comments	Recommendations from interpreting model output
SC-038	South Fall Creek #1	Felton Empire Road	San Lorenzo R	3.0	8.1	**0%**	2.0	2.2	**0%**	1.0	1.0	**0%**	Questionable if fish bearing. Poor inlet alignment. Severely sloped (7.8%). Extremely undersized <5 yr peak flow.	Full replacement only feasible option. Recommend embedded 8 ft circular pipe.
SC-039	South Fall Creek #2	Felton Empire Road	San Lorenzo R	3.0	5.2	**14%**	2.0	0.7	**0%**	1.0	0.3	**0%**	Questionable if fish bearing. Extremely undersized <5 yr peak flow. Pipe in very poor condition. Severely sloped 8.5% and perched 3.6 ft.	Full replacement only feasible option. Recommend embedded 6 ft circular pipe.
SC-040	Love Creek #1	Love Creek Road	San Lorenzo R	3.0	43.9	**100%**	2.0	12.1	**100%**	1.0	5.5	**100%**	Undersized ~10 yr peak flow.	Do nothing for fish passage. Full replacement required to increase hydraulic capacity.
SC-041	Love Creek #2	Love Creek Road	San Lorenzo R	3.0	36.5	**91%**	2.0	10.1	**88%**	1.0	4.6	**100%**	Assumed Q1%=Active Channel flow in outlet pool. Highly undersized, <5 yr peak flow. Passes about 90% of all lifestages. 3 corner baffles.	Seems adequate for fish passage. To increase hydraulic capacity full replacement with bridge or open arch with a 20 ft span would be required.
SC-042	Love Creek #3	Love Creek Road	San Lorenzo R	3.0	32.9	**82%**	2.0	9.1	**46%**	1.0	4.1	**51%**	Assumed depth criteria met for juveniles due to shape of streambed through pipe. Properly sized for peak flows but constricts active channel movement.	Due to large boulders retained within pipe passage conditions are possibly greater then estimated. Recommend raising tailwater elevation 0.5 ft with one rock weir.
SC-043	Hubbard Gulch	Hubbard Gulch Road	Marshall Cr-San Lorenzo R	3.0	26.8	**0%**	2.0	2.0	**0%**	1.0	0.9	**0%**	Extremely sloped >10%. Questionable if fish bearing. Undersized <20 yr peak flow. Channel profile steep.	Full replacement only feasible option. Recommend installing embedded circular pipe with a 8 ft diameter.
SC-044	Marshall Creek	Hubbard Gulch Road	San Lorenzo R	3.0	11.1	**0%**	2.0	3.1	**0%**	1.0	1.4	**0%**	Extremely sloped >8%. Questionable if fish bearing. Extremely undersized <3 yr peak flow. Very steep channel profile.	Full replacement only feasible option. Due to slope of channel recommend installing a bridge or open arch with at least a 12 ft span.
SC-045	Clear Creek	Clear Creek Road	San Lorenzo R	3.0	23.3	**100%**	2.0	6.4	**100%**	1.0	2.9	**100%**	Downstream crossing 15 ft from outlet, appears very undersized and is probably a barrier. Undersized <10yr peak flow, however hydraulic capacity seems to be diminished due to amount of bedload retained within crossing.	Do nothing for fish passage.
SC-046	UNT to Jamison Cr	Jamison Creek Road	Jamison Cr-Boulder Cr-San Lorenzo R	3.0	21.8	**0%**	2.0	1.6	**0%**	1.0	0.7	**0%**	Extremely undersize <3 yr peak flow. Steep drop in channel profile at inlet. Bedload aggrading at inlet. Limited habitat upstream.	Full replacement only feasible option. Recommend installing natural bottom structure or embedded pipe with at least a 10 ft span.
SC-047	Hare Creek	Hare Way	Boulder Cr-San Lorenzo R	3.0	13.7	**0%**	2.0	3.8	**0%**	1.0	1.7	**0%**	Pipe is in extremely poor shape and has a break in slope. Severely undersized <5yr peak flow.	Recommend full replacement with a 10 ft wide structure.
SC-048	Hopkins Gulch	Bear Creek Road	Bear Cr-San Lorenzo R	3.0	8.4	**0%**	2.0	2.3	**0%**	1.0	1.0	**0%**	Undersized <10 yr peak flow. Severely perched, 9 ft. Fairly long pipe at 170 ft. Relatively large amount of road fill >7,000 ft.	Modification may be difficult due to amount pipe is perched, length and slope of pipe. Full replacement may be relatively expensive due to amount of fill but is probably best option. Recommend replacement with open arch with a 12 ft span.
SC-049	Two Bar Creek #1	Two Bar Road	San Lorenzo R	3.0	37.1	**100%**	2.0	10.2	**100%**	1.0	4.6	**100%**	Slightly undersized ~38 yr peak flow.	Do nothing for fish passage. Replace with bridge with 18 ft span to increase hydraulic capacity.
SC-050	Two Bar Creek #2	Two Bar Road	San Lorenzo R	3.0	33.6	**92%**	2.0	9.3	**0%**	1.0	4.2	**0%**	Culvert in extremely poor condition. Road fill ~1,200 yd^3. Passage impeded by 1 ft leap.	Recommend full replacement due to condition, with natural bottom structure.
SC-051	Two Bar Creek #3	Two Bar Road	San Lorenzo R	3.0	29.9	**55%**	2.0	2.0	**0%**	1.0	0.9	**0%**	Weir at outlet requires 4.5 ft leap, upstream weir requires 3.21 ft leap. Adequately sized.	Removal of weirs would be the most desirable situation. However weir removal may lead to additional scour of bridge footings and therefore recommend installing additional weirs to decrease leaps over current weirs.
SC-052	Logan Creek	Kings Creek Road	Kings Cr-San Lorenzo R	3.0	21.2	**61%**	2.0	5.8	**0%**	1.0	2.6	**0%**	Depth is limiting factor, however the natural substrate of boulders may provide depth not accounted for in fishXing model. 4 upstream weirs with the first weirs leap >3 ft. Undersized <20 yr peak flow. Crossing is new according to local.	interim fix, raise tailwater elevation 1 ft with 1 rock weir. This should provide adequate leap conditions for the 1st weir. To provide full passage and increase hydraulic capacity recommend full replacement with a 15 ft span bridge.
SC-053	Debris Flow Creek	Kings Creek Road	Kings Cr-San Lorenzo R	3.0	6.1	**100%**	2.0	0.2	**0%**	1.0	0.1	**0%**	Very small creek with very limited habitat. Eventhough site was deemed as GRAY there was not passage window indicated due to the size of the watershed. Questionable if fish bearing. Severely undersized <5 yr peak flow.	Low priority due to minimal habitat. Recommend installing embedded 5 ft circular pipe.
SC-054	Arana Gulch #1 1of2	Capitola Road	Coastal	3.0	51.2	**100%**	2.0	14.1	**100%**	1.0	6.4	**0%**	Assumed all flow enters pipe 1of2 until 8 cfs then flow is assumed to be split evenly. Old slumped weir at outlet which seems fairly functional. Undersized <10 yr peak flow.	Fairly adequate fish passage in current condition. Full replacement best option due to size. Recommend installing a bridge with a 16 ft span.
SC-054	Arana Gulch #1 2of2	Capitola Road	Coastal	3.0	51.2	**76%**	2.0	14.1	**0%**	1.0	6.4	**0%**	Due to difference in inlet elevations it was assumed that pipe 2of2 does not receive 3 cfs until the creek is flowing at 14 cfs. Assumed all flow enters pipe 1of2 until 8 cfs then flow is assumed to be split evenly. Old slumped weir at outlet which is fairly functional at low and high flows. Undersized <10 yr peak flow.	Fairly adequate passage in pipe 1of2. Full replacement best option due to size. Recommend installing a bridge with a 16 ft span.
SC-055	Arana Gulch #2	Soquel Avenue	Coastal	3.0	49.4	**100%**	2.0	13.6	**100%**	1.0	6.2	**100%**	Undersized ~11 yr peak flow.	Do nothing for fish passage. Increase pipe size to accommodate larger flows.
SC-056	Arana Gulch #3 1of2	Brookwood Drive	Coastal	3.0	35.7	**100%**	2.0	9.8	**100%**	1.0	4.5	**100%**	Highly embedded and severely undersized <5 yr peak flow. Minimal fill <100 yd^3.	Do nothing for fish passage. Full replacement required to increase hydraulic capacity.

Culvert Location Information				Adult Salmon & Steelhead Fish Passage Criteria Flows (cfs)			Resident Trout Fish Passage Criteria Flows (cfs)			Juvenile Salmonids - Young of the Year Fish Passage Criteria Flows (cfs)				
ID#	Stream Name	Road Name	Drainage	Lower Q50% or 3 cfs	Upper Q1%	%Passable	Lower Q90% or 2 cfs	Upper Q5%	%Passable	Lower Q95% or 1 cfs	Upper Q10%	%Passable	Comments	Recommendations from interpreting model output
SC-056	Arana Gulch #3 2of2	Brookwood Drive	Coastal	3.0	35.7	**100%**	2.0	9.8	**100%**	1.0	4.5	**100%**	Highly embedded and severely undersized <5 yr peak flow. Minimal fill <100 yd^3.	Do nothing for fish passage. Full replacement required to increase hydraulic capacity.
SC-057	Arana Gulch #4	Paul Sweet Road	Coastal	3.0	10.9	**0%**	2.0	3.0	**0%**	1.0	1.4	**0%**	Severely undersized ~1 yr peak flow. Perched 4 ft.	Full replacement only feasible option. Recommend an open arch with a 12 ft span.
SC-058	Bates Creek	Main Street	Soquel Creek	3.0	49.6	**99%**	2.0	13.7	**18%**	1.0	6.2	**0%**	Severely undersized <5 yr peak flow. Pipe rusted through.	Due to condition and size recommend full replacement with bridge with 15 ft span.
SC-059	Moores Gulch	Soquel San Jose Road	Soquel Creek	3.0	33.9	**0%**	2.0	9.3	**0%**	1.0	4.2	**0%**	Undersized <10 yr peak flow. Eventhough filter determined site to be RED adult passage may be greater due to fish ladder at outlet and baffles within pipe, however fishXing can not model these modifications. Enormous amount of fill ~13,750 yd^3.	Field observation should be done to investigate effectiveness of ladder and baffles to determine extent of barrier. Since the pipe is undersized and a barrier to some degree it should be replaced. Recommend installing an open arch with an 18 ft span.
SC-060	Hester Creek	Soquel San Jose Road	West Branch Soquel Cr-Soquel Cr	3.0	38.0	**0%**	2.0	10.5	**0%**	1.0	4.7	**0%**	Properly sized for peak flows but constricts active channel migration. Shape of concrete floor provides additional depth.	Recommend raising tailwater elevation 1 ft with 1 or 2 rock weirs. Install notched weirs within pipe to provide jump pools for adult salmonids.
SC-061	West Branch Soquel Creek	Redwood Lodge Road	Soquel Cr	3.0	69.0	**0%**	2.0	19.0	**0%**	1.0	8.6	**0%**	Two lowhead dams downstream should be removed. Pipe in extremely poor condition lined with concrete. Slightly undersized <30 yr peak flow. Fairly large amount of fill ~5320 yd^3.	Replace with bridge with 25 ft span.
SC-062	Laurel Creek #1	Morrell Road	West Branch Soquel Cr-Soquel Cr	3.0	21.5	**0%**	2.0	5.9	**0%**	1.0	2.7	**0%**	Deposition occurring at inlet. Culvert extremely sloped, 12.71%. Adequately sized.	Low priority due to location above anadromous habitat. Modifying culvert with an effective structure would be very difficult. Recommend full replacement with a bridge.
SC-063	Laurel Creek #2	Soquel San Jose Road	West Branch Soquel Cr-Soquel Cr	3.0	11.7	**0%**	2.0	3.2	**0%**	1.0	1.5	**0%**	Perched 10.5 ft. Very steep outlet apron. Enormous amount of fill ~24,810 yd^3. Culvert is extremely sloped at 10%	Low priority due to location above anadromous habitat. Recommend full replacement with a bridge.
SC-064	Valencia Creek #1	Soquel Drive	Aptos Cr	3.2	193.6	**0%**	2.0	53.4	**0%**	1.0	24.2	**0%**	Undersized <10 yr peak flow. Large amount of fill ~10,100 yd^3. Offset baffles with low flow partition wall. Perched 3.7 ft.	High priority due to large amount of habitat to open. Full replacement best option. Replace with 22 ft wide bridge.
SC-065	Valencia Creek #2	Valencia Road	Aptos Cr	3.0	53.9	**0%**	2.0	14.9	**0%**	1.0	6.7	**0%**	Lack of pool depth. Increased roughness to 0.052 n due to steel ramp baffles. Inlet apron will pose some difficulty when exiting pipe. Perched 1.98 ft. Undersized <20 yr peak flow. Outlet apron has sloped weir creating little pool.	Interim fix: Raising the jump pool elevation 2.5 ft with 3-4 rock weirs will greatly increase adult passage. Full replacement is best option due to size and current passage conditions.
SC-066	Browns Creek #1	Browns Valley Road	Corralitos Cr-Salsipuedes Cr-Pajaro R	3.0	81.2	**93%**	2.0	22.4	**0%**	1.0	10.2	**0%**	Depth affected by 0.6 ft high low flow partition wall. Large outlet pool. Undersized ~15 yr peak flow. Lots of habitat to open.	Replace with bridge with a 25 ft span.
SC-067	Browns Creek #2	Browns Valley Road	Corralitos Cr-Salsipuedes Cr-Pajaro R	3.0	70.9	**28%**	2.0	19.5	**0%**	1.0	8.9	**0%**	Very small low flow partition down center of box. Undersized ~20 yr peak flow. Large bedload in stream.	Full replacement relatively inexpensive with ample amount of habitat to open. Replace with bridge with a 24 ft span.
SC-068	Gamecock Canyon	Hazel Dell Road	Browns Cr-Corralitos Cr-Salsipuedes Cr-Pajaro R	3.0	33.1	**93%**	2.0	9.1	**86%**	1.0	4.1	**0%**	The inlet elevation was set above the outlet elevation due to FishXings inability to model adverse slopes. CuvertMaster software was used to determine depth criteria. Concrete chunk at outlet backwaters crossing. Undersized ~15 yr peak flow.	Interim fix raise tailwater elevation 1 ft with 1 rock weir. Due to size recommend full replacement with open arch with a 17 ft span.
SC-069	Rider Creek	Rider Road	Corralitos Cr-Salsipuedes Cr-Pajaro R	3.0	24.9	**0%**	2.0	6.9	**0%**	1.0	3.1	**0%**	Perched and sloped combination create 100% barrier. Undersized <10 yr peak flow.	Replacement could be an embedded 9 ft circular pipe.
SC-070	Corralitos Creek	Eureka Canyon Road	Salsipuedes Cr-Pajaro R	3.0	120.6	**14%**	2.0	33.2	**0%**	1.0	15.1	**0%**	Large outlet pool. Undersized. Lots of habitat to open. Steep drop in channel profile at inlet.	Modifying culvert will further reduce the hydraulic capacity. Interim fix install corner baffles and raise tailwater elevation 2 ft with 2 rock weirs. Full replacement required for full passage and to increase hydraulic capacity.
SC-071	Shingle Mill Gulch #1	Eureka Canyon Road	Corralitos Cr-Salsipuedes Cr-Pajaro R	3.0	35.4	**0%**	2.0	9.7	**0%**	1.0	4.4	**0%**	2.5 ft high concrete outlet beam and outlet apron act as barrier. Undersized <15 yr peak flow. Sediment aggrading at inlet.	Low priority due to minimal habitat to open. Full replacement best option. Replace with open arch or bridge with a 16 ft span.
SC-072	Shingle Mill Gulch #2	Eureka Canyon Road	Corralitos Cr-Salsipuedes Cr-Pajaro R	3.0	30.8	**85%**	2.0	8.5	**0%**	1.0	3.9	**0%**	Steep slope. Pipe in extremely poor condition. Questionable if fish bearing. Undersized ~10 yr peak flow.	Low priority due to minimal habitat to open. Full replacement best option. Replace with open arch or bridge with a 16 ft span.
SC-073	Casserly Creek #1	Casserly Road	Salsipuedes Cr-Pajaro R	3.0	39.1	**100%**	2.0	10.8	**100%**	1.0	4.9	**100%**	Undersized <15 yr peak flow.	Do nothing for fish passage.
SC-074	Casserly Creek #2	Casserly Road	Salsipuedes Cr-Pajaro R	3.0	31.2	**78%**	2.0	8.6	**0%**	1.0	3.9	**0%**	Perched 3 ft. Undersized <10 yr peak flow. Pipe is in extremely poor condition. Steep drop in channel profile at inlet.	Full replacement best option. Replace with open arch with at least 12 ft width.
SC-075	Green Valley Creek #1 1of2	Casserly Road	Salsipuedes Cr-Pajaro R	3.0	121.4	**0%**	2.0	33.5	**0%**	1.0	15.2	**0%**	Assumed flow split evenly between 2 bays. Perched 1.98 ft. Completer barrier. Properly sized. 5 more barriers upstream. Lots of habitat to open but habitat seems fairly poor.	Recommend raising tailwater elevation 2.5 ft with 3 rock weirs. Install 1 ft high low flow partition wall in front of bay 2of2 and install corner baffles in bay 1of2. Bay 1of2 may also need to be divided with a low flow partition wall.

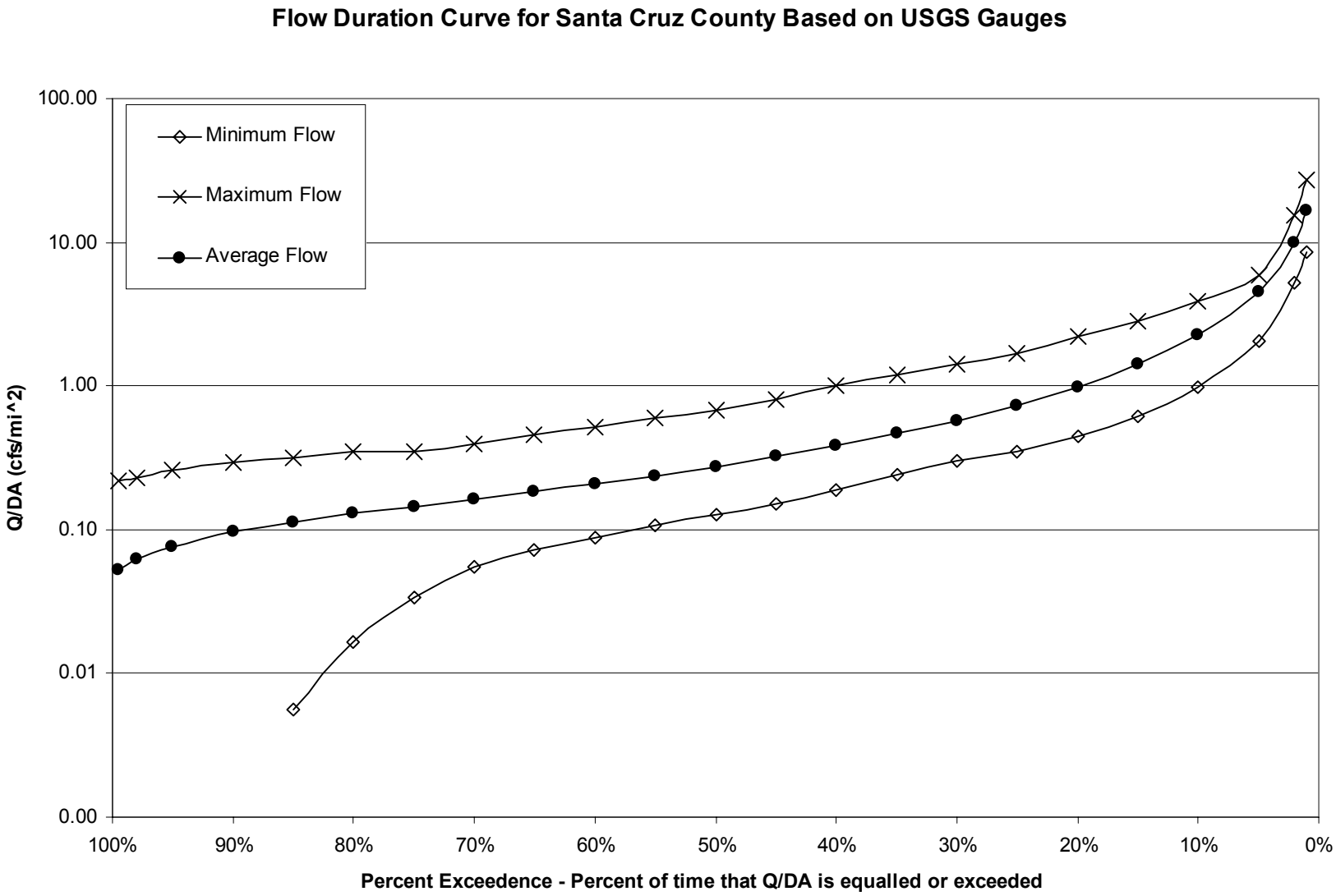
Culvert Location Information				Adult Salmon & Steelhead Fish Passage Criteria Flows (cfs)			Resident Trout Fish Passage Criteria Flows (cfs)			Juvenile Salmonids - Young of the Year Fish Passage Criteria Flows (cfs)				
ID#	Stream Name	Road Name	Drainage	Lower Q50% or 3 cfs	Upper Q1%	%Passable	Lower Q90% or 2 cfs	Upper Q5%	%Passable	Lower Q95% or 1 cfs	Upper Q10%	%Passable	Comments	Recommendations from interpreting model output
SC-075	Green Valley Creek #1 2of2	Casserly Road	Salsipuedes Cr-Pajaro R	3.0	121.4	**0%**	2.0	33.5	**0%**	1.0	15.2	**0%**	Assumed flow split evenly between 2 bays. Perched 1.98 ft. Completer barrier. Properly sized. 5 more barriers upstream. Lots of habitat to open but habitat seems fairly poor.	Recommend raising tailwater elevation 2.5 ft with 3 rock weirs. Install 1 ft high low flow partition wall in front of bay 2of2 and install corner baffles in bay 1of2. Bay 1of2 may also need to be divided with a low flow partition wall.
SC-076	Green Valley Creek #2	Green Valley Road	Salsipuedes Cr-Pajaro R	3.0	114.5	**0%**	2.0	31.6	**0%**	1.0	14.3	**0%**	Severely perched 6.3 ft. Slightly undersized <35 yr peak flow. Inlet elevation above stream bed elevation creating an inlet pool. Inlet beam present possibly to keep channel from downcutting.	Full replacement desirable due to outlet conditions and to allow the streambed to downcut. Recommend a bridge with a 20 ft span.
SC-077	Green Valley Creek #3	Green Valley Road	Salsipuedes Cr-Pajaro R	3.0	106.4	**74%**	2.0	29.3	**0%**	1.0	13.3	**0%**	Crossing is an open arch, however the barrier is created at the outlet by a 2.1 ft beam and a concrete apron. Undersized <25 yr peak flow.	If the outlet beam and apron can be removed then remove them. Interim fix raise tailwater elevation 2 ft with 2 rock weirs to allow adult passage and partial passage of other lifestages. For complete passage and to increase the hydraulic capacity replace with a 20 ft wide bridge.
SC-078	Green Valley Creek #4	Green Valley Road	Salsipuedes Cr-Pajaro R	3.0	77.0	**0%**	2.0	21.2	**0%**	1.0	9.6	**0%**	Severely perched 8.8 ft. Notched outlet beam possibly installed to stabilize stream bed so the bridge/box is not undercut diminishing the structural integrity.	Installing weirs to raise the water surface elevation to allow fish passage will probably create an unsuitable stream slope for fish migration. Removing the outlet beam would be desirable, however it seems the weir was placed to maintain a constant streambed elevation. Therefore full replacement may be the best solution.
SC-079	Green Valley Creek #5	Green Valley Road	Salsipuedes Cr-Pajaro R	3.0	54.7	**100%**	2.0	15.1	**100%**	1.0	6.8	**100%**	Properly sized.	Do nothing for fish passage.
SC-080	Green Valley Creek #6	Green Valley Road	Salsipuedes Cr-Pajaro R	3.0	53.1	**100%**	2.0	14.6	**0%**	1.0	6.6	**0%**	Assumed adult fish could burst into pipe. Pipe in extremely poor condition. Undersized <15 yr peak flow.	Full replacement best option. Replace with open arch or bridge with at least 16 ft span.

Santa Cruz County USGS Gauged Stream Summaries

Station Number	Stream Name	Latitude	Longitude	Record Length (years)	Coverage (WY)	Drainage Area (sq. miles)	MAP (in/yr)	PET (in/yr)
11160020	SAN LORENZO R NR BOULDER C CA	37°12'24"	122°08'38"	24	1969-1992	6.17		
11160060	BEAR C A BOULDER C CA	37°07'40"	122°06'57"	15	1978-1992	16.00		
11160070	BOULDER C AT BOULDER CREEK CA	37°07'36"	122°07'18"	16	1977-1992	11.30		
11160300	ZAYANTE C A ZAYANTE CA	37°05'10"	122°02'45"	35	1958-1992	11.10		
11161900	SCOTT C AB LITTLE C NR DAVENPORT CA	37°03'51"	122°13'42"	15	1959-1973	25.10		
11160430	BEAN C NR SCOTTS VALLEY CA	37°03'19"	122°02'25"	13	1989-2001	8.81		
11161800	SAN VICENTE C NR DAVENPORT CA	37°03'19"	122°10'52"	16	1970-1985	6.07		
11159800	WB SOQUEL C NR SOQUEL CA	37°03'05"	121°56'17"	14	1959-1972	12.20		
11161300	CARBONERA C A SCOTTS VALLEY CA	37°03'02"	122°00'45"	17	1985-2001	3.60		
11161590	LAGUNA C NR DAVENPORT CA	37°01'32"	122°07'48"	7	1970-1976	3.07		
11159690	APTOS C NR APTOS CA	37°00'06"	121°54'18"	14	1972-1985	10.20		
11161570	MAJORS C NR SANTA CRUZ CA	36°59'55"	122°07'13"	7	1970-1976	3.77		
11160000	SOQUEL C A SOQUEL CA	36°59'29"	121°57'17"	50	1952-2001	40.20		
11161500	BRANCIFORTE C A SANTA CRUZ CA	36°59'10"	122°00'48"	28	1941-1968	17.30		
11159700	APTOS C A APTOS CA	36°58'35"	121°54'05"	14	1959-1972	12.30		
Summary - Average exceedence discharge values were used				**7-50**	**3.07-40.20**			

Exceedence flows for stream gauges used in identified hydrologic regions. The average of the exceedence flows was used to estimate the fish passage flows for stream crossings within the region.

Percent Time Flow is Equalled or Exceeded	Santa Cruz																	
	San Lorenzo R	Bear C	Boulder Cr	Zayante Cr	Scott Cr1	Bean Cr	San Vicente Cr	WB Soquel Cr	Carbonera Cr	Laguna Cr	Aptos Cr1	Majors Cr	Soquel Cr	Branciforte Cr	Aptos Cr2	**Minimum Flow**	**Maximum Flow**	**Average Flow**
	(cfs/mi^2)	(cfs/mi^2)	(cfs/mi^2)	(cfs/mi^2)	(cfs/mi^2)	(cfs/mi^2)	(cfs/mi^2)	(cfs/mi^2)	(cfs/mi^2)	(cfs/mi^2)	(cfs/mi^2)	(cfs/mi^2)	(cfs/mi^2)	(cfs/mi^2)	(cfs/mi^2)	**(cfs/mi^2)**	**(cfs/mi^2)**	**(cfs/mi^2)**
1%	15.13	17.28	22.35	17.79	16.26	18.16	14.17	14.33	27.18	13.17	16.15	11.41	15.85	19.57	8.62	**8.62**	**27.18**	**16.49**
2%	8.75	10.03	14.07	9.10	10.84	10.78	9.88	8.65	15.56	9.73	9.19	7.13	10.07	11.28	5.26	**5.26**	**15.56**	**10.02**
5%	4.05	4.06	5.93	3.51	5.38	5.33	5.27	3.44	5.83	5.86	3.63	3.71	4.60	4.45	2.03	**2.03**	**5.93**	**4.47**
10%	1.94	1.81	2.92	1.59	2.84	2.72	3.29	1.64	2.53	3.91	1.83	2.02	2.16	1.79	0.98	**0.98**	**3.91**	**2.27**
15%	1.13	1.00	1.73	0.90	1.75	1.59	2.47	0.98	1.36	2.80	1.08	1.41	1.27	0.98	0.62	**0.62**	**2.80**	**1.41**
20%	0.78	0.65	1.06	0.62	1.24	0.94	1.98	0.66	0.81	2.21	0.76	1.09	0.82	0.64	0.45	**0.45**	**2.21**	**0.98**
25%	0.58	0.49	0.77	0.44	0.92	0.67	1.45	0.52	0.53	1.69	0.57	0.93	0.60	0.45	0.35	**0.35**	**1.69**	**0.73**
30%	0.45	0.36	0.56	0.33	0.72	0.52	1.15	0.42	0.36	1.43	0.46	0.75	0.45	0.35	0.30	**0.30**	**1.43**	**0.57**
35%	0.36	0.28	0.43	0.26	0.56	0.44	0.96	0.35	0.26	1.21	0.38	0.64	0.35	0.28	0.24	**0.24**	**1.21**	**0.47**
40%	0.29	0.22	0.34	0.21	0.44	0.39	0.79	0.30	0.19	1.01	0.31	0.56	0.27	0.23	0.20	**0.19**	**1.01**	**0.38**
45%	0.24	0.17	0.27	0.17	0.35	0.34	0.66	0.25	0.15	0.81	0.26	0.53	0.23	0.19	0.19	**0.15**	**0.81**	**0.32**
50%	0.21	0.13	0.22	0.14	0.27	0.32	0.54	0.22	0.13	0.68	0.23	0.48	0.19	0.17	0.16	**0.13**	**0.68**	**0.27**
55%	0.18	0.11	0.19	0.12	0.22	0.30	0.48	0.19	0.11	0.59	0.20	0.45	0.16	0.14	0.15	**0.11**	**0.59**	**0.24**
60%	0.16	0.09	0.16	0.10	0.18	0.27	0.41	0.17	0.09	0.52	0.18	0.42	0.14	0.13	0.13	**0.09**	**0.52**	**0.21**
65%	0.15	0.08	0.14	0.09	0.13	0.26	0.35	0.15	0.07	0.46	0.16	0.40	0.12	0.12	0.11	**0.07**	**0.46**	**0.18**
70%	0.13	0.06	0.12	0.08	0.10	0.25	0.31	0.13	0.06	0.39	0.14	0.37	0.10	0.10	0.11	**0.06**	**0.39**	**0.16**
75%	0.12	0.05	0.11	0.07	0.09	0.24	0.28	0.12	0.03	0.33	0.12	0.34	0.09	0.10	0.10	**0.03**	**0.34**	**0.14**
80%	0.10	0.04	0.10	0.05	0.07	0.23	0.25	0.11	0.02	0.30	0.11	0.34	0.07	0.09	0.08	**0.02**	**0.34**	**0.13**
85%	0.08	0.03	0.08	0.04	0.06	0.23	0.20	0.09	0.01	0.26	0.10	0.32	0.05	0.08	0.07	**0.01**	**0.32**	**0.11**
90%	0.07	0.02	0.07	0.03	0.04	0.22	0.15	0.08	0.00	0.21	0.09	0.29	0.04	0.07	0.07	**0.00**	**0.29**	**0.10**
95%	0.05	0.01	0.06	0.02	0.03	0.20	0.11	0.07	0.00	0.12	0.07	0.26	0.02	0.06	0.06	**0.00**	**0.26**	**0.08**
98%	0.04	0.01	0.05	0.01	0.02	0.19	0.08	0.07	0.00	0.10	0.05	0.23	0.01	0.05	0.04	**0.00**	**0.23**	**0.06**
99.5%	0.02	0.01	0.04	0.00	0.01	0.17	0.04	0.05	0.00	0.09	0.05	0.22	0.00	0.04	0.03	**0.00**	**0.22**	**0.05**


Flow Duration Curve for Santa Cruz County Based on USGS Gauges
Minimum Flow
Maximum Flow
Average Flow
100.00
10.00
1.00
0.10
0.01
0.00
Q/DA (cfs/mi^2)
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
Percent Exceedence - Percent of time that Q/DA is equalled or exceeded

APPENDIX D:

COUNTY OF SANTA CRUZ STREAM CROSSING INVENTORY AND FISH PASSAGE EVALUATION PROJECT –

RANKING MATRIX

RANKING MATRIX FOR SANTA CRUZ COUNTY CULVERTS - GRAY SHADING IDENTIFIES SITES DROPPED FROM FINAL RANKING BECAUSE STREAM REACH WAS CONSIDERED NON-FISH BEARING.

RANK WITH NEW CRITERIA	INITIAL RANK	Site ID#	Stream Name	Road Name	Presumed Species Diversity	Species Diversity Score	Extent of Barrier Score	Extent of Barrier Score 8-16-16 ft/sec	Current Sizing Score	Current Condition Score	Crossing Score (average of sizing and condition).	Length of Upstream Habitat	Habitat Quantity Score	Habitat Quality Modifier	Total Habitat Score	TOTAL SCORE - Conservative Criteria	TOTAL SCORE - WITH 8-16-16 FT/SEC CRITERIA	Comments and Factors to Consider for Final Ranking
#1	**#1**	None	West Liddell Creek #1	Bonny Doon Road	Steelhead	2	15	**15**	4	3	3.5	9,500	9.5	0.75	7.125	27.6	**27.6**	Fails to meet passage criteria for perched outlet and lack-of-depth
#2	**#3**	14	Corralitos Creek	Eureka Canyon Road	Steelhead	2	15	**14**	2	1	1.5	25,300	10.0	0.75	7.50	26.0	**25.0**	Downstream boulder and log weirs are failing. Baffles within box culvert have totally failed.
Tie #3	**Tie #2**	13	Browns Creek #2	Browns Valley Road	Steelhead	2	15	**13**	3	0	1.5	11,200	10.0	0.75	7.50	26.0	**24.0**	
Tie #3	**Tie #4**	77	Lompico Creek #2	Lompico Road	Steelhead	2	15	**15**	4	0	2.0	15,900	10.0	0.5	5.00	24.0	**24.0**	
Tie #3	**Tie #4**	2	Valencia Creek #1	Soquel Drive	Steelhead	2	15	**15**	4	1	2.0	58,600	10.0	0.5	5.00	24.0	**24.0**	
#4	**#5**	103	Queseria Creek	Swanton Road	Coho, Steelhead	4	15	**15**	5	0	2.5	3,200	3.2	0.75	2.40	23.9	**23.9**	
#5	**#6**	None	West Liddell Creek #3	Bonny Doon Road	Steelhead	2	15	**15**	3	0	1.5	6,800	6.8	0.75	5.1	23.6	**23.6**	
Tie #6	**#7**	4	Valencia Creek #2	Valencia Road	Steelhead	2	15	**15**	3	0	1.5	11,900	10.0	0.5	5.00	23.5	**23.5**	
Tie #6	**#8**	191	Lompico Creek #3	Lompico Road	Steelhead	2	15	**15**	3	1	2.0	8,900	8.9	0.5	4.45	23.5	**23.5**	Fails to meet passage criteria only for lack-of-depth
#7	**#9**	None	West Liddell Creek #2	Bonny Doon Road	Steelhead	2	10	**10**	4	5	4.5	9,000	9.0	0.75	6.75	23.3	**23.3**	
#8	**#10**	141	Green Valley Creek #2	Green Valley Road	Steelhead	2	15	**15**	2	0	1.0	46,700	10.0	0.5	5.00	23.0	**23.0**	Leap barrier - no depth to execute leap. Also lack-of-depth
#9	**#13**	155	Branciforte Creek #1	Branciforte Drive	Steelhead	2	15	**15**	1	0	0.5	16,300	10.0	0.5	5.00	22.5	**22.5**	Downstream weir still a problem with no depth below it for entry leap, but is probably partially passable for adult steelhead.
Tie #10	**Tie #15**	88	Redwood Creek #2	Redwood Drive	Steelhead	2	15	**15**	4	1	2.5	10,200	10.0	0.25	2.50	22.0	**22.0**	Strictly lack-of-depth for adults. Probably allows partial adult passage. Drop in final ranking.
Tie #10	**Tie #15**	136	Green Valley Creek #1 - 2 Bays	Casserly Road	Steelhead	2	15	**15**	0	0	0.0	51,000	10.0	0.5	5.00	22.0	**22.0**	Problems with perched outlet and no depth to execute entry leap. Lack-of-depth too.
Tie #10	**Tie #15**	40	Green Valley Creek #4	Green Valley Road	Steelhead	2	15	**15**	0	0	0.0	27,600	10.0	0.5	5.00	22.0	**22.0**	Extremely perched outlet is the main problem.
#11	**#17**	62	Hare Creek	Hare Way	Steelhead	2	15	**15**	5	3	4.0	2,100	2.1	0.25	0.53	21.5	**21.5**	Strictly a lack-of-depth violation. Impassable dam 2,100' upstream.
Tie #12	**#36**	15	Shingle Mill Gulch #1	Eureka Canyon Road	Steelhead	2	15	**15**	3	0	1.5	5,400	5.4	0.5	2.70	21.2	**21.2**	Lower in final ranking because a steep section of channel 500 feet upstream may limit actual length of available habitat.
Tie #12	**#19**	115	Bates Creek	Main Street	Steelhead	2	9	**9**	5	5	5.0	6,900	6.9	0.75	5.18	21.2	**21.2**	
Tie #13	**Tie #2**	12	Browns Creek #1	Browns Valley Road	Steelhead	2	15	**10**	3	0	1.5	12,000	10.0	0.75	7.50	26.0	**21.0**	
Tie #13	**Tie #15**	307	South Fall Creek #2	Felton Empire Road	Steelhead	2	15	**14**	5	5	5.0	<500	0.0	0.25	0.00	22.0	**21.0**	Drop from ranking - probably not fish-bearing. Still in need of replacement.
Tie #13	**Tie #21**	306	South Fall Creek #1	Felton Empire Road	Steelhead	2	15	**15**	5	3	4.0	<500	0.0	0.25	0.00	21.0	**21.0**	Probably not a fish-bearing stream reach, but culvert is due for replacement.

RANK WITH NEW CRITERIA	INITIAL RANK	Site ID#	Stream Name	Road Name	Presumed Species Diversity	Species Diversity Score	Extent of Barrier Score	Extent of Barrier Score 8-16-16 ft/sec	Current Sizing Score	Current Condition Score	Crossing Score (average of sizing and condition).	Length of Upstream Habitat	Habitat Quantity Score	Habitat Quality Modifier	Total Habitat Score	TOTAL SCORE - Conservative Criteria	TOTAL SCORE - WITH 8-16-16 FT/SEC CRITERIA	Comments and Factors to Consider for Final Ranking
Tie #13	**Tie #21**	64	Marshall Creek	Hubbard Gulch Road	Steelhead	2	15	**15**	5	3	4.0	Too Steep Below Culvert	0.0	0.25	0.00	21.0	**21.0**	Probably not a fish-bearing stream reach, but culvert is due for replacement.
Tie #13	**Tie #21**	76	Lompico Creek #1	Lompico Road	Steelhead	2	10	**10**	5	3	4.0	16,200	10.0	0.5	5.00	21.0	**21.0**	Although crossing allows 100% adult passage, culvert is due for replacement.
#14	**#11**	304	Gold Gulch	Brookside Way	Steelhead	2	15	**13**	5	5	5.0	3,700	3.7	0.25	0.93	22.9	**20.9**	Lack-of-depth and excessive velocities. Culvert is in poor condition and due for replacement.
#15	**#23**	305	Shingle Mill Creek	Redwood Drive	Steelhead	2	15	**15**	4	3	3.5	700	0.7	0.25	0.18	20.7	**20.7**	Outlet perched >10ft over riprap and u.s. weirs are bariers too. May not be fish-bearing.
Tie #16	**Tie #24**	55	Redwood Creek #1	Glen Canyon Road	Steelhead	2	14	**14**	4	0	2.0	10,700	10.0	0.25	2.50	20.5	**20.5**	Strictly lack-of-depth violation of passage criteria.
Tie #16	**#25**	8	Arana Gulch #4	Paul Sweet Road	Steelhead	2	15	**15**	5	1	3.0	1,900	1.9	0.25	0.48	20.5	**20.5**	Outlet perched 4ft. Natural barrier fairly close upstream of xing.
Tie #16	**#14**	302	Granite Creek	Granite Road	Steelhead	2	15	**13**	5	1	3.0	4,900	4.9	0.5	2.45	22.5	**20.5**	Lack-of-depth and excessive velocities. Also 9% channel drop above inlet.
Tie #17	**Tie #26**	37	Hopkins Gulch	Bear Creek Road	Steelhead	2	15	**15**	4	1	2.5	3,700	3.7	0.25	0.93	20.4	**20.4**	Outlet perched 9ft. Poor quality habitat and Hopkins Gulch may not be fish-bearing.
Tie #17	**#18**	26	Molino Creek	Swanton Road	Steelhead	2	15	**14**	3	3	3.0	2,700	2.7	0.5	1.35	21.4	**20.4**	Even with perched outlet of 2.4 ft, the only criteria violation is lack-of-depth.
Tie #18	**#27**	110	West Branch Soquel Creek	Redwood Lodge Road	Steelhead	2	15	**15**	2	3	2.5	1,100	1.1	0.75	0.83	20.3	**20.3**	Downstream dam blocks anadromous fish to this site. But site has lots of problems and is due for replacement
Tie #19	**Tie #4**	39	Green Valley Creek #3	Green Valley Road	Steelhead	2	15	**11**	3	1	2.0	41,800	10.0	0.5	5.00	24.0	**20.0**	
Tie #19	**Tie #29**	63	Hubbard Gulch	Hubbard Gulch Road	Steelhead	2	15	**15**	3	3	3.0	Too Steep Below Culvert	0.0	0.25	0.00	20.0	**20.0**	Culvert slope >10%. Drop in final ranking because this reach is probably not fish-bearing
Tie #19	**Tie #29**	140	Green Valley Creek #6	Green Valley Road	Steelhead	2	10	**10**	3	3	3.0	10,300	10.0	0.5	5.00	20.0	**20.0**	
Tie #20	**#12**	89	Redwood Creek #3	Redwood Drive	Steelhead	2	15	**12**	4	3	3.5	9,600	9.6	0.25	2.40	22.9	**19.9**	Strictly lack-of-depth for adults.
Tie #20	**#30**	303	Tie Gulch	Branciforte Drive	Steelhead	2	15	**15**	2	0	1.0	3,700	3.7	0.5	1.85	19.9	**19.9**	Strictly a lack-of-depth violation, probably allows some adult steelhead passage.
#21	**#41**	112	Moores Gulch	Soquel San Jose Road	Steelhead	2	10	**12**	4	0	2.0	5,100	5.1	0.75	3.83	17.8	**19.8**	FishXing unable to model hydraulics w/ladder and baffles - assume only partial passage of adults.
Tie #23	**Tie #31**	18	Rider Creek	Rider Road	Steelhead	2	15	**15**	4	1	2.0	1,200	1.2	0.5	0.60	19.6	**19.6**	Perched w/no depth for leap. Breaks-in-slope = 3% and 4.4%. Natural barrier fairly close upstream of xing.
Tie #23	**Tie #31**	66	Unnamed tributary to Jamison Creek	Jamison Creek Road	Steelhead	2	15	**15**	5	0	2.5	400	0.4	0.25	0.10	19.6	**19.6**	Lack-of-depth at lower flows that overlaps w/excess. velocities over the upper range of migration flows.
Tie #24	**#28**	52	Cobble Creek	East Zayante Road	Steelhead	2	15	**15**	4	1	2.5	<500	0.0	0.25	0.00	19.5	**19.5**	Outlet perched 3ft with long cascade over riprap and culvert slope = 7%. Drop from final ranking - not fish-bearing.
Tie #24	**Tie #24**	82	Bean Creek #1	Mt. Hermon Road	Steelhead	2	11	**10**	0	0	0.0	60,900	10.0	0.75	7.50	20.5	**19.5**	
#25	**#32**	113	Hester Creek	Soquel San Jose Road	Steelhead	2	15	**15**	0	1	0.5	3,800	3.8	0.5	1.90	19.4	**19.4**	Lack-of-depth at lower flows that overlaps w/excess. velocities over the upper range of migration flows.
#22	**#22**	91	Redwood Creek #5	Redwood Drive	Steelhead	2	15	**14**	5	1	3.0	<500	0.0	0.25	0.00	20.0	**19.0**	Drop from final ranking because this xing is probably not within a fish-bearing stream reach.

RANK WITH NEW CRITERIA	INITIAL RANK	Site ID#	Stream Name	Road Name	Presumed Species Diversity	Species Diversity Score	Extent of Barrier Score	Extent of Barrier Score 8-16-16 ft/sec	Current Sizing Score	Current Condition Score	Crossing Score (average of sizing and condition).	Length of Upstream Habitat	Habitat Quantity Score	Habitat Quality Modifier	Total Habitat Score	TOTAL SCORE - Conservative Criteria	TOTAL SCORE - WITH 8-16-16 FT/SEC CRITERIA	Comments and Factors to Consider for Final Ranking
#26	**#33**	92	Redwood Creek #6	Redwood Drive	Steelhead	2	15	**15**	3	0	1.5	<500	0.0	0.25	0.00	18.5	**18.5**	Drop from final ranking because this xing is probably not within a fish-bearing stream reach.
#28	**#37**	96	Two Bar Creek #2	Two Bar Road	Steelhead	2	10	**10**	0	3	1.5	11,400	10.0	0.5	5.00	18.5	**18.5**	
#29	**#39**	74	Unnamed tributary to Carbonera	La Madrona Drive	Steelhead	2	15	**15**	1	0	0.5	<500	0.0	0.25	0.00	17.5	**17.5**	Drop from final ranking because this xing is probably not within a fish-bearing stream reach.
#30	**#42**	67	Logan Creek	Kings Creek Road	Steelhead	2	11	**11**	3	0	1.5	5,500	5.5	0.5	2.75	17.3	**17.3**	
#31	**#43**	42	Mountain View Creek #1	Vine Hill Road	Steelhead	2	12	**12**	3	0	1.5	3,400	3.4	0.5	1.70	17.2	**17.2**	
Tie #32	**Tie #44**	109	Laurel Creek #1	Morrell Road	Steelhead	2	15	**15**	0	0	0.0	<250	0.3	0.5	0.13	17.1	**17.1**	Culvert sloped >15%. Drop to near bottom of final ranking because of lack of fish habitat.
Tie #32	**Tie #44**	114	Laurel Creek #2	Soquel San Jose Road	Steelhead	2	15	**15**	0	0	0.0	<250	0.3	0.5	0.13	17.1	**17.1**	Outlet perched 10.5 ft. Drop to near bottom of final ranking because of lack of fish habitat.
Tie #32	**Tie #20**	33	Casserly Creek #2	Mt. Madonna Road	Steelhead	2	15	**11**	4	3	3.5	1,200	1.2	0.5	0.60	21.1	**17.1**	Outlet perched 2.96ft and is leap barrier until 10cfs. But fails to account for funky apron.
#32	**#46**	300	Unnamed tributary #1 to Scott Creek	Swanton Road	Steelhead	2	15	**15**	0	0	0.0	<500	0.0	0.25	0.00	17.0	**17.0**	Drop from final ranking because this xing is probably not within a fish-bearing stream reach.
#33	**#16**	93	Redwood Creek #7	Redwood Drive	Steelhead	2	15	**10**	4	5	4.5	<500	0.0	0.25	0.00	21.5	**16.5**	Probably not a fish-bearing stream reach, but culvert is due for replacement.
#36	**Tie #20**	68	Debris Flow Creek	Kings Creek Road	Steelhead	2	15	**10**	5	3	4.0	<500	0.0	0.25	0.00	21.0	**16.0**	Probably not a fish-bearing stream reach, but culvert is due for replacement.
Tie #37	**#34**	301	Unnamed tributary #2 to Scott Creek	Swanton Road	Steelhead	2	15	**12**	4	0	2.0	<500	0.0	0.25	0.00	19.0	**16.0**	Strictly lack-of-depth violation of passage criteria for adults.
Tie #37	**#35**	87	Mountain View Creek #2	Mountain View Road	Steelhead	2	15	**12**	0	3	1.5	900	0.9	0.5	0.45	19.0	**16.0**	
#38	**Tie #24**	16	Shingle Mill Gulch #2	Eureka Canyon Road	Steelhead	2	15	**10**	4	3	3.5	1,800	1.8	0.25	0.45	21.0	**16.0**	Very limited reach of resident fish-bearing habitat. Culvert is due for replacement based on condition.
#34	**Tie #26**	90	Redwood Creek #4	Redwood Drive	Steelhead	2	15	**11**	4	1	2.5	<500	0.0	0.25	0.00	19.5	**15.5**	FishXing identified only lack-of-depth, but riprap at outlet may impede passage too.
#35	**#38**	104	Archibald Creek	Swanton Road	Steelhead	2	13	**11**	5	0	2.5	<500	0.0	0.25	0.00	17.5	**15.5**	Drop from final ranking because this xing is probably not within a fish-bearing stream reach.
#39	**#40**	204	Two Bar Creek #3	Two Bar Road	Steelhead	2	15	**12**	0	1	0.5	1,200	1.2	0.5	0.60	18.1	**15.1**	Outlet leap analysis fails to account for the apron that may create confusing attraction flows.
Tie #32	**#45**	54	Unnamed tributary to Zayante Creek	East Zayante Road	Steelhead	2	10	**10**	5	1	3.0	<500	0.0	0.75	0.00	15.0	**15.0**	Drop from final ranking because this xing is probably not within a fish-bearing stream reach.
#40	**#47**	47	Crystal Creek #3	Happy Valley Road	Steelhead	2	7	**7**	5	1	3.0	5,200	5.2	0.5	2.60	14.6	**14.6**	
Tie #41	**Tie #48**	188	Lockhart Gulch	Lockhart Gulch Road	Steelhead	2	5	**5**	5	0	2.5	12,000	10.0	0.5	5.00	14.5	**14.5**	
Tie #41	**Tie #48**	6	Arana Gulch #1 - 2 Pipes	Capitola Road	Steelhead	2	5	**5**	4	1	2.5	19,600	10.0	0.5	5.00	14.5	**14.5**	
#42	**#49**	81	Love Creek #3	Love Creek Road	Steelhead	2	4	**4**	0	1	0.5	13,200	10.0	0.75	7.50	14.0	**14.0**	

RANK WITH NEW CRITERIA	INITIAL RANK	Site ID#	Stream Name	Road Name	Presumed Species Diversity	Species Diversity Score	Extent of Barrier Score	Extent of Barrier Score 8-16-16 ft/sec	Current Sizing Score	Current Condition Score	Crossing Score (average of sizing and condition).	Length of Upstream Habitat	Habitat Quantity Score	Habitat Quality Modifier	Total Habitat Score	TOTAL SCORE - Conservative Criteria	TOTAL SCORE - WITH 8-16-16 FT/SEC CRITERIA	Comments and Factors to Consider for Final Ranking
#43	**#50**	80	Love Creek #2	Love Creek Road	Steelhead	2	0	**0**	5	0	2.5	16,000	10.0	0.75	7.50	12.0	**12.0**	
#44	**#51**	17	Gamecock Canyon	Hazel Dell Road	Steelhead	2	4	**4**	3	0	1.5	5,700	5.7	0.75	4.28	11.8	**11.8**	
Tie #45	**Tie #52**	53	Mountain Charlie Gulch	East Zayante Road	Steelhead	2	0	**0**	4	0	2.0	16,700	10.0	0.75	7.50	11.5	**11.5**	
Tie #45	**Tie #52**	79	Love Creek #1	Love Creek Road	Steelhead	2	0	**0**	4	0	2.0	20,100	10.0	0.75	7.50	11.5	**11.5**	
#46	**#53**	5	Arana Gulch #3 - 2 Pipes	Brookwood Drive	Steelhead	2	0	**0**	5	1	3.0	15,600	10.0	0.5	5.00	10.0	**10.0**	
#47	**#54**	9	Arana Gulch #2	Soquel Avenue	Steelhead	2	0	**0**	3	1	2.0	19,000	10.0	0.5	5.00	9.0	**9.0**	
#48	**#55**	95	Two Bar Creek #1	Two Bar Road	Steelhead	2	0	**0**	2	0	1.0	12,600	10.0	0.5	5.00	8.0	**8.0**	
#49	**#56**	39	Crystal Creek #1	Branciforte Drive	Steelhead	2	0	**0**	5	0	2.5	6,100	6.1	0.5	3.05	7.6	**7.6**	
#53	**#61**	41	Branciforte Creek #2	Branciforte Drive	Steelhead	2	0	**0**	1	0	0.5	12,000	10.0	0.5	5.00	7.5	**7.5**	
#50	**#57**	35	Bean Creek #2	Bean Creek Road	Steelhead	2	1	**1**	1	1	1.0	4,600	4.6	0.75	3.45	7.5	**7.5**	
Tie #51	**#58**	27	Casserly Creek #1	Casserly Road	Steelhead	2	0	**0**	3	1	2.0	6,800	6.8	0.5	3.40	7.4	**7.4**	
Tie #51	**#59**	46	Crystal Creek #2	Happy Valley Road	Steelhead	2	0	**0**	5	0	2.5	5,700	5.7	0.5	2.85	7.4	**7.4**	
#52	**#60**	308	Green Valley Creek #5	Green Valley Road	Steelhead	2	0	**0**	0	0	0.0	11,500	10.0	0.5	5.00	7.0	**7.0**	
#55	**#63**	99	Blackburn Gulch	Vine Hill Road	Steelhead	2	0	**0**	0	0	0.0	9,000	9.0	0.5	4.50	6.5	**6.5**	Xing is located upstream of a significant partial barrier (dam on bedrock) that adult steelhead may pass on certain flows.
#54	**#62**	45	Clear Creek	Clear Creek Road	Steelhead	2	0	**0**	4	0	2.0	1,000	1.0	0.25	0.25	4.3	**4.3**	Limited length of poor-quality habitat

NOTE: Stream crossings with the gray shading are to be dropped from final ranking because they are located in non-fish-bearing stream reaches.