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16. ABSTRACT

In March of 2001, the California Department of Transportation (Caltrans) initiated the North Coast Pilot Research Study to identify State Highway System culverts that blocked or impeded upstream or downstream passage of anadromous salmonids. The geographic limits of the pilot study were the coastal counties of Del Norte, Humboldt, and Mendocino in Caltrans District 1. More than 800 miles of State Highway were evaluated and 411 potential fish passage sites were identified. Consultation with fisheries professionals subsequently eliminated 78 of these sites because they did not support fish. As of December 1, 2004, 312 of these sites have been surveyed and analyzed using the California Department of Fish and Game's assessment protocol (Taylor and Love, 2003) to identify potential impediments to fish passage including high water velocities, low water depths and excessive leaps over the range of fish passage flows. The remaining 21 sites were not surveyed because landowners denied access to the sites. Fish passage analysis of the 312 surveyed sites shows that 186 or 60% do not meet current fish passage guidelines for existing culverts and present a severe impediment to fish passage, 99 sites (32%) are likely to present difficult passage conditions under some conditions or for some of the target fish; and 27 sites (9%) provide good passage conditions for all species and lifestages of fish over the full range of fish passage flows.

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California Department of Transportation (Caltrans) District 1 Pilot Fish Passage Assessment Study: Volume 1 – Overall Results

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Margaret M. Lang

Environmental Resources Engineering
Humboldt State University

Final Report For Project:
F 2001 EN 10
Researching State Highway Culverts to Determine Impacts on Threatened and Endangered Salmon

California Department of Transportation (Caltrans) District 1 Pilot Fish Passage Assessment Study: Volume 1 – Overall Results

Margaret M. Lang

Environmental Resources Engineering
Humboldt State University

February 14, 2005

FINAL TECHNICAL REPORT
Submitted to California Department of Transportation for the project: F 2001 EN 10 Researching State Highway Culverts to Determine Impacts on Threatened and Endangered Salmonids

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Disclaimer

The contents of this report reflect the views of the authors who are responsible for the facts and accuracy of the data presented herein. The contents do not necessarily reflect the official views or policies of the State of California or the Federal Highway Administration. This report does not constitute a standard, specification, or regulation.

EXECUTIVE SUMMARY

In March of 2001, the California Department of Transportation (Caltrans) initiated the North Coast Pilot Research Study to identify State Highway System culverts that blocked or impeded upstream or downstream passage of anadromous salmonids. The geographic limits of the pilot study were the coastal counties of Del Norte, Humboldt, and Mendocino in Caltrans District 1. More than 800 miles of State Highway were evaluated and 411 potential fish passage sites were identified. Consultation with fisheries professionals subsequently eliminated 78 of these sites because they did not support fish. As of December 1, 2004, 312 of these sites have been surveyed and analyzed using the California Department of Fish and Game's assessment protocol (Taylor and Love, 2003) to identify potential impediments to fish passage including high water velocities, low water depths and excessive leaps over the range of fish passage flows. The fish passage assessment at all surveyed sites was used to develop a prioritized list of stream crossing sites needing remediation for fish passage in Caltrans District 1.

The prioritization list for stream crossing remediation on State Highways in Caltrans District 1 is not a definitive order for which remediation projects should be planned and addressed but a guidance document identifying sites needing remediation and ranking high for either species diversity, extent of barrier, habitat or some combination of these conditions. The data upon which the prioritizations are based is very reliable with the exception of the upstream habitat quantity and quality values for those sites lacking on the ground habitat surveys and relying on habitat estimates using topographic maps. The habitat quality and quantity is a major factor in the prioritization process but given the access requirements for stream habitat surveys currently in place in California these values cannot be easily obtained or confirmed. Full-scale habitat surveys are recommended for those sites ranking high on the prioritization list and having only map estimates of habitat quantity.

While the opportunity for remediation will strongly influence the order of remediation, the cost is also a major factor and the cost and effort for remediation can vary greatly from site to site. Passage problems at low slope or slightly perched outlet sites can likely be addressed by in-barrel and outlet modification without complete crossing replacement. These sites will likely present more opportunities for remediation than sites requiring full replacement. The site summaries for each of the top 25 sites in District 1 (Appendix C) indicate whether the site fish passage problems are likely to be addressed by moderate or extensive modifications. Site summaries and similar recommendations for lower ranking sites are available in the separate route report volumes.

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The Caltrans project managers, Shawna Abafo and Deborah McKee, provided assistance with project coordination and connecting with District personnel. Tim Ash and the District 1 Right of Way engineers assisted with training needs, background information and land access.

1 INTRODUCTION

The California Department of Transportation (Caltrans) initiated the Pilot Fish Passage Assessment Study in March 2001. The study area consisted of northern California State Highway routes in Del Norte, Humboldt and Mendocino counties (Caltrans District 1). The purpose of this study was to identify State Highway stream crossings on fish-bearing streams and to assess these sites to determine whether they meet the California Department of Fish and Game and the NOAA-Fisheries requirements for passage of resident and anadromous salmonids at road-stream crossings (California Department of Fish and Game 2002; NOAA-Fisheries 2001). Note, that throughout this report the term **stream crossing** is used to refer to human-made structures that cross over or through a stream channel. For the purpose of this study, the stream crossing structures that were evaluated consisted of culverts and bridges. Emphasis was given to those streams that historically or presently support State and federally-listed [California and Federal Endangered Species Act(s)] anadromous and non-anadromous salmonid populations. Specific study objectives were to:

1) Identify State Highway culverts that block passage of threatened or endangered salmonids in California.
2) Estimate the stream length of salmonid habitat that could be recovered by restoring fish passage at State Highway culverts.
3) Develop a prioritized list of State Highway culverts needing to be replaced or repaired to facilitate passage of threatened and endangered salmonids.
4) Develop a GPS database and a GIS application for identifying and spatially locating State Highway culverts that potentially impact passage for endangered and threatened salmonids.
5) Use the GPS database and GIS application in the planning stages of STIP, SHOPP and Maintenance projects to determine which projects may impact threatened and endangered salmonids, to identify remediation projects that could restore fish passage, and to facilitate the environmental study and mitigation process.

It is well established that resident and anadromous salmonids need to have free access to and from streams as well as unimpaired movement within a stream in order to access suitable habitat. Barriers to migration affect the ease and extent to which these fish can reach required habitat conditions that in turn, affect an individual's likelihood for survival and ultimately, a population's viability. Barriers are defined as any obstacle that prevents or impedes fish from successful passage upstream or downstream (Evans and Johnson 1972), and can be natural or man-made. Some examples of natural barriers are waterfalls, debris jams, or temperature barriers. Artificial, or man-made, barriers to salmonid migration include stream crossings, irrigation diversions and dams. Culverts are a major category of stream crossing structures that can impede or block the movement of fish within a stream. Culverts that are not properly sized, installed, or maintained can cause passage problems such as excessive water velocities through the culvert, downstream channel scour, perched culvert outlets, lack of water depth within a culvert and debris accumulation. These kinds of changes in stream channel morphology and

channel / culvert hydraulic conditions can cause severe impediments to fish migration and movement within a stream or watershed.

The identification, prioritization, and treatment of migration barriers is considered a vital step towards recovering salmonid populations by restoring ecological connectivity (Roni et al. 2002). Most culverts are located on small streams (with larger rivers crossed by span-bridges). Individually, an impassable culvert may block no more than a mile or less of habitat. However, culverts are widely distributed over the landscape. Stream crossings by transportation systems, primarily roads and railroads, influence thousands of water-courses with the cumulative potential to block many miles of habitat. Additionally, many road systems follow major rivers; as such, a single road can cross many of the river's rearing and /or spawning tributaries, thus affecting a major portion of the watershed's salmonid population(s).

Design and installation of road culverts that provide unimpaired fish passage is not a new issue. Efforts to develop and incorporate fish passage criteria have been ongoing for many decades, with two early studies published during the 1950's (McKinley and Webb 1956; Shoemaker 1956). In the 1970's, Caltrans (formerly the Division of Highways) implemented its own research project in collaboration with the California Department of Fish and Game for the express purpose of developing design criteria for passing anadromous salmonids through State Highway drainage structures (Kay and Lewis 1970). During this same era, the U.S. Forest Service began a series of systematic culvert inventories and corrections on National Forest lands in California (Evans and Johnson 1972). The basis for fish passage criteria remained relatively similar to these early works until recently when the California Department of Fish and Game (2002) and NOAA-Fisheries (NMFS 2001) updated and published new criteria for meeting fish passage requirements in California. In support of these updated criteria, Caltrans is developing special design guidance for road drainage structures that will comply with State and Federal fish passage criteria.

Caltrans has and continues to incorporate fish passage design requirements during project development for routine maintenance activities, road rehabilitation projects, and for major road construction projects. Despite improvements in design practices, the Department's ability to systematically rehabilitate its road drainage system to meet fish passage requirements has been limited by its lack of a systematic assessment and inventory of its highway drainage system for passage rehabilitation needs. As a result, the Department has been unable to include priorities for fish passage needs during development and prioritization of routine maintenance and rehabilitation projects.

The North Coast pilot study begins the process of locating and assessing culvert sites along the State Highway System that impede or block salmonid fish passage and creating a prioritized inventory for remediation that can be expanded to include the rest of the coastal highway system and even the entire State. In addition to assisting Caltrans planning efforts, the prioritization of State Highway stream crossings contributes to a collaborative effort on a watershed scale with landowners, agencies, and restoration groups that are similarly working to correct barriers and restore habitat within the same

watershed in order to maximize resource benefits. As an example, Del Norte, Humboldt and Mendocino counties have completed similar assessments and inventories of their road drainage systems for fish passage needs. These assessments have already been used to identify priority sites where complementary projects between Caltrans and the counties would be desirable.

1.1 Project Justification

Improving fish passage at stream crossings is recognized as a key component of salmon and steelhead restoration efforts. A United States Government Accounting Office report noted that recent inventories identified over 2,600 culverts that block migrating fish on Federal Lands in Oregon and Washington, and inventories are not yet complete (GAO, 2001). Surveys conducted in Oregon and northern California have identified thousands of stream crossings which act as total or partial barriers to fish passage (Mirati, 1999; Taylor, 2000, 2001a, b). The Oregon Department of Fish and Wildlife survey estimates that more than half of 4,370 State and County culverts on natural water courses pose fish passage problems (Mirati, 1999).

A variety of passage problems may exist at a stream crossing to affect the ability of fish and other aquatic species to migrate. Common problems include:

- Perched culvert outlets,
- Shallow jump pools or outflow that cascades over riprap,
- Insufficient water depth within the culvert barrel,
- Excessive water velocities,
- Debris accumulation at the inlet or within the culvert barrel, and
- Steep channel bed just upstream of the culvert inlet due to deposition upstream of an undersized culvert.

The effects of these stream crossing conditions can be either temporal, partial or total blockage (Table 1.1). For adult salmonids, passage problems include disruption of spawning migrations, under-utilization of tributary habitat, over-crowding in available spawning habitat, increasing the likelihood of stress, injury, or predation/poaching during migration delays, and limiting the spatial separation of competing species.

Table 1.1. Definitions of barrier types and their potential impacts (Taylor and Love, 2003).

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

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

The effects on juvenile salmonids include limiting fish to downstream stream reaches which increases competition for food and shelter; cuts off over-wintering habitat in tributaries; increases predation in culvert outlet pools; or prevents summer migration from thermally-stressed mainstem channels to cool-water refugia in smaller tributaries. Current guidelines for new culvert installation aim to provide unimpeded passage for both adult and juvenile salmonids (CDFG 2002, NMFS 2001).

Instream movements of juvenile and non-anadromous salmonids are highly variable and still poorly understood. 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 before out-migration; one to two years is common in California. Because much of their life history is spent in freshwater, juveniles of both species are highly dependent on instream habitat. For over-wintering juvenile coho, a common strategy is to migrate out of larger river systems into smaller streams, during late-fall and early-winter storms. Although reasons for this behavior are not certain, juvenile coho may migrate upstream to find more suitable overwintering habitat, away from higher flows and potentially higher turbidity levels found 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). During summer months in western Washington State, juvenile salmonids that moved upstream grew faster than both non-moving and downstream moving juveniles, demonstrating that this behavior may play an important role in the overall heath of the population (Kahler et al. 2001).

Culvert designs that are intended to provide passage for all anadromous life stages have been presented in several detailed design manuals developed by various government agencies that oversee fisheries and road construction and maintenance (e.g., Bates et al.

1999; Poulin 1998; Baker and Votapka 1990). However, culverts continue to act as barriers to fish passage because:

- Earlier designs tended to target passage of only adult anadromous salmonids, failing to address the needs of migrating juvenile or non-anadromous salmonids,
- Culverts designed to provide fish passage have frequently been incorrectly installed and improperly maintained,
- Changes in stream morphology often create conditions that hinder fish passage at culverts, and
- Opportunities for improving fish passage are lost due to the "emergency" status of culvert replacements following flood events.

1.2 Project Description

Assessing fish passage at stream crossings on State Highways in Caltrans District 1 required the following steps:

1. Locating stream crossings using the Caltrans District 1 Excel culvert database, USGS topographic maps, and other available information,
2. Visiting each crossing to perform a First Pass Survey to determine whether a site was a potential fish passage site,
3. Obtaining Permits to Enter to access those sites where entry to private land was needed to complete the fish passage assessment,
4. Returning to the site to perform a Second Pass Survey and collect all necessary measurements needed for the fish passage assessment,
5. Performing a preliminary fish passage assessment using culvert specifications and passage criteria for juvenile, non-anadromous and adult salmonids employing the California Department of Fish and Game's (CDFG) ranking filter (Taylor and Love, 2003),
6. Applying the computer software program, FishXing V2.2, (Love et al., 1999) on the subset of sites defined as partial/temporal barriers by the ranking filter to determine the percent of passage provided,
7. Determining fish species presence/absence and the quality and quantity of stream habitat above each culvert, and

8. Prioritizing the sites using CDFG's numerical ranking process to identify which sites have the highest priority for replacement on each State Highway.

The methods used to complete all of these steps are described in detail in Section 2 of this report.

1.3 Project Products

A number of products result from this research effort and each should assist Caltrans in incorporating maintenance and fish passage improvement on State Highways. In addition, all data collected is being transferred to Caltrans in forms suitable for use in database development. The products resulting from this project include:

1. An inventory and location description of all stream crossings identified as potential fish passage sites in Caltrans District 1. Site locations were identified by stream name; State Highway number and postmile; watershed name; USGS Quad name; CalWater Hydrologic Units and latitude and longitude (NAD83 datum) collected by a Global Positioning System (GPS).

2. For each site, a detailed description of the stream crossing was collected including: crossing type, length, diameter or height and width, construction materials, inlet and outlet type, presence and type of additional structures (e.g. fish ladders, baffles, trash racks, weirs, etc.), alignment with the stream channel, an estimate of fill volume, position relative to flow and more.

3. Two surveys were conducted. A longitudinal profile survey through the culvert including the adjacent stream channel was measured to determine the culvert and channel slopes and a survey of the culvert's tailwater cross-section.

4. Information regarding culvert age, wear, and performance was noted, including the overall condition of the pipe and other site structures.

5. Digital photographs were taken at each stream crossing of the upstream channel, downstream channel, culvert inlet, culvert outlet and any other unique site features to provide a visual summary for each site.

6. An evaluation of fish passage at each culvert location using two methods. Fish passage was assessed at all sites using the ranking filter developed for Part IX 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**). For those sites ranking GREEN or GRAY, FishXing V2.2 (Love et al. 1999) was used to conduct in-depth passage evaluations 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.

7. The quantity and quality of fish habitat above and below each stream crossing was obtained from habitat surveys conducted by CDFG and other agencies where available. If no habitat surveys had been conducted, lengths of potential anadromous habitat were estimated from USGS topographic maps.

8. A prioritized list of stream crossings that need modification or replacement to meet current design standards for fish passage. General recommendations for providing unimpeded fish passage for these sites are also provided.

1.4 Report Organization

Results from this assessment effort are extensive and, thus, are not contained in a single document. This report volume provides the background needed to understand the project, describes the procedures used to complete fish passage assessment of stream crossings, and summarizes the overall results of fish passage assessments for Caltrans District 1. Prioritization results for all District 1 fish passage sites are included and the top 25 priority sites are described in detail. A comparison of assessment results for State Highways and recent county road surveys in Del Norte, Humboldt, and Mendocino counties is also included.

Supplementary report volumes for each county/route (e.g. Humboldt 101) within District 1 provide more detailed analyses and a site-by-site condition description.

2 METHODS AND BACKGROUND

Site identification and fish passage analysis followed the same procedures for each State Highway in District 1. The tasks required to complete the analyses included:

1. Identify potential fish passage sites,
2. Complete a First Pass Survey to confirm potential fish passage stream crossings,
3. Gain site access permission through Caltrans Right of Way office,
4. Conduct a Second Pass Survey to measure each site's physical characteristics,
5. Determine site-specific hydrology and low and high fish passage design flow for all fish passage sites,
6. Process site data,
7. Perform a fish passage assessment using CDFG's "Green-Gray-Red" ranking filter (Taylor and Love, 2003),
8. Analyze hydraulic conditions using FishXing V2 (Love et al., 1999) for those sites ranking Green or Gray using CDFG's ranking filter,
9. Obtain additional fish presence and habitat data from State agencies, tribes, or local expertise, and
10. Prioritize sites by route for modification or replacement.

Tasks 1 through 3 are unique to assessment of Caltrans' stream crossings and are described in detail below. The Second Pass Surveys, passage analyses, and prioritization (Tasks 5 through 10) were conducted using the methods outlined in Part IX of CDFG's *California Salmonid Stream Habitat Restoration Manual* (Taylor and Love, 2003). These methods are briefly described below. Fish passage analyses following the CDFG protocols are consistent with the current State and Federal guidelines for passage of anadromous salmonids through existing stream crossings (CDFG 2002, NMFS 2001).

2.1 Identifying Potential Fish Passage Sites

Several sources of information were used to identify potential fish passage sites on Caltrans ownership. Caltrans' District 1 maintenance division provided an Excel database listing all known culverts on District 1 routes. This database included each culvert's postmile, construction and size. The database was used during the First Pass Survey to identify sites. All culverts greater than 0.6 m (24 inches) in size were visually assessed for the presence of a natural stream channel meeting the criteria:

- Water courses having ordinary high-water widths in excess of 0.6 m (2 feet) provided the stream gradient is less than 20 percent,

- Water courses with documented salmonid use determined by visual observation, electrofishing, or verification by local biologists,

- Water courses on NOAA Fisheries or CDFG's lists of historic coho- and steelhead-bearing streams, or

- Water courses indicated on 1:24,000 USGS topographic maps should initially be assumed fish bearing.

In addition, Caltrans classifies large box culverts as bridges (bridge type 19). The District 1 bridge list was used to locate these structures (Caltrans, 2003).

Assessment of stream crossings for county roads has been completed for Del Norte, Humboldt and Mendocino Counties (Taylor 2000, Taylor 2001a, Taylor 2001b). Many county roads cross the same drainages as State Highways; thus, many State Highway stream crossings were identified in the county reports and fish presence/absence, additional barriers and habitat quantity and quality information were taken from the county reports where available.

Caltrans also works closely with CDFG in restoration projects and CDFG visually assesses passage problems during habitat surveys. Sites known to have passage problems or of special concern because of fish species present or active restoration work are well known to Caltrans biologists. These sites were identified by both Caltrans and CDFG biologists.

2.2 First Pass Surveys

The First Pass Survey (FPS) protocol for fish passage assessment is a quick site assessment to differentiate drainage culverts from those culverts that convey a natural stream. The original FPS protocol was developed in April 2001. Recognizing that obtaining access permission for site surveys can be a long process, and that access may be denied by landowners, the original first pass procedure was modified in 2003 to collect more site data on the first visit. Stream crossings on District 1 routes, with the exception of Del Norte 199, were evaluated using the April 2001 version of the First Pass Survey. Both FPS procedures are described here.

The datasheet used for the April 2001 version of the First Pass Survey is attached (Appendix A). Data collected for the April 2001 FPS included the site location, basic culvert characteristics (size, shape, construction), upstream and downstream channel slope measured using a clinometer, a brief assessment of habitat and fish presence adjacent to the stream crossing, access information, and a description of nearby land ownership. These data were selected to provide planning information to crews returning to perform the Second Pass Surveys and for Permit to Enter (PTE) needs.

The information used to conduct the FPS included the District 1 culvert database for the route of interest, the route bridge list, and a 1:24,000 USGS topographic map of the region. The route was driven and all culverts over 0.6 m (24 inches) were visually

assessed. If the stream channel matched the criteria for a potential fish passage culvert, a first pass datasheet was completed. If the site was determined to be a drainage culvert or it did not meet the potential fish passage criteria, the reason it was not considered a fish passage culvert was recorded on a copy of the culvert database. Location information for all sites identified as potential fish passage culverts was sent to Caltrans Right of Way engineers to obtain site access permission to conduct a Second Pass Survey.

The current version of the FPS was developed in 2003 to include additional site information by moving data previously collected during the Second Pass Survey to the First Pass Survey. A copy of the current first pass data sheet is also included in Appendix A. The data added or moved to the FPS included:

- Site selection criteria questions were included on the datasheet,
- More comprehensive site physical data (tables of culvert materials and construction),
- Site photographs,
- GPS determination of site location, and
- Additional site data analysis (drainage area, hydrology).

All routes and sites assessed after May 1, 2003 used the 2003 version of the FPS.

2.3 Site Access

Permission to enter land adjacent to each stream crossing is needed to complete the Second Pass Survey. Access needs are limited to no more than 50 m directly upstream and downstream of the crossing in the stream channel; however, this distance generally extends beyond Caltrans right of way. HSU provided site locations and assisted Caltrans ROW office in obtaining landowner contact information. Caltrans District 1 ROW office contacted landowners, tracked landowner responses, and provided HSU with Permit to Enter letters. For large landowners, such as state and national parks, national forests, timber companies, etc., access was easily obtained and these sites were surveyed with little or no delays. Obtaining access permission from small, private landowners proved to be a long and tedious process and introduced significant delays to the Second Pass Surveys.

2.4 Second Pass Surveys

The objective of the Second Pass Survey (SPS) is to measure the physical characteristics of the stream crossing and the adjacent stream channel needed to assess the site's fish passage using CDFG's ranking filter and, if needed, to perform hydraulic analysis with FishXing. Most of this data is collected by performing a longitudinal survey through the culvert that includes the adjacent stream channel. To perform hydraulic modeling, the

site's tailwater control (the location that controls the water elevation at the culvert outlet) must also be identified and, if possible, surveyed. The condition of each crossing and any comments concerning fish observations and stream habitat adjacent to the site were also noted. At all sites, a minimum of four digital photographs was taken: upstream and downstream channel and inlet and outlet of the stream crossing. Additional photos were taken, if needed, to capture unique site features. The latitude and longitude of each site was determined using GPS. The methods and procedures for making these measurements are described below and copies of the original (2001) and the updated (2003) SPS datasheets are included in Appendix A.

2.4.1 Site Surveys

Surveys at each culvert used a Topcon GTS-226 total station and all surveys were conducted in units of meters. The total station's data logger was used to store survey coordinates in data files uniquely named to match the site location, e.g. MEN001_M001-44 for Mendocino County, State Highway 1, postmile 1.44. All survey notes and site information was recorded in water-proof notebooks. Copies of the survey notes are stored in binders with each site's first and second pass datasheets.

The total station was setup in a location that minimized the number of resections needed to complete the survey. This site was most often located just below the culvert outlet on the stream channel margin. To begin a survey, an arbitrary temporary benchmark, usually an easily reoccupied point on the culvert, was assigned the coordinates: 0m N, 0m E, and 100m Z. All points were collected relative to this arbitrary coordinate system and temporary benchmarks (survey pins) were used to perform resections when needed.

The primary survey was a longitudinal profile beginning in the adjacent stream channel and proceeding either upstream or downstream through the length of the culvert. The elevation of the following points were measured along the longitudinal profile at all sites (Figure 2.1):

1. culvert inlet invert (bottom),
2. culvert outlet invert (bottom),
3. maximum pool depth within 1.52 m (5 ft) of the outlet,
4. outlet pool tailwater control (TWC),
5. two points in the stream channel upstream of the culvert, and
6. two points in the stream channel downstream of the TWC.

At most sites, additional points along the culvert invert were also measured to detect any breaks in slope present in the culvert. A break in the culvert slope may create a barrier within a culvert that is not detected using the average culvert slope. Interior culvert invert elevations were collected at all sites where a clear view through the culvert could not determine the absence of breaks in slope.

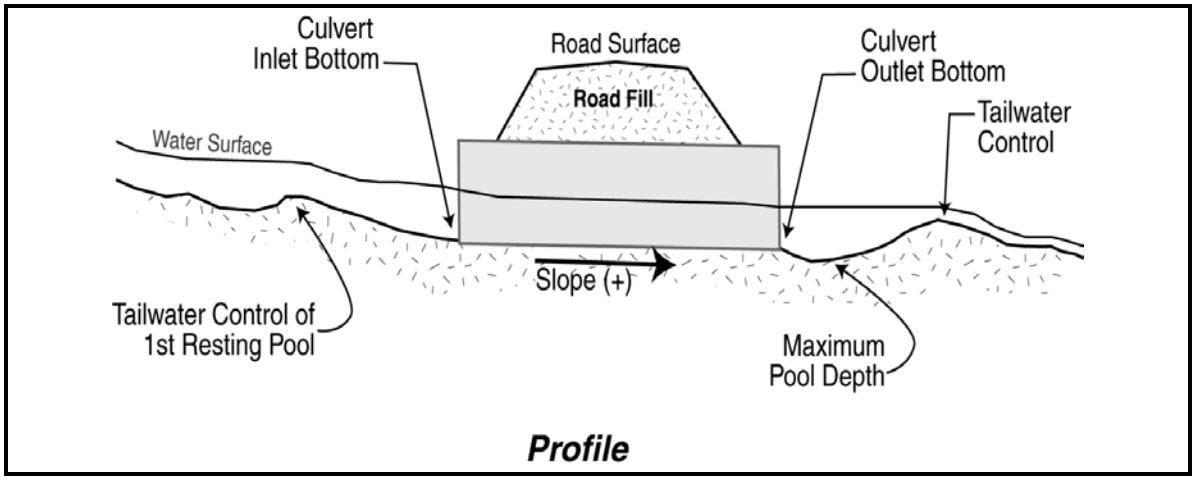


Figure 2.1. Diagram of required survey points through a culvert at a typical stream crossing (Taylor and Love, 2003).

In addition to the longitudinal profile, a survey of the channel cross section at the tailwater control (TWC) was also collected. If hydraulic analysis is needed, the TWC cross section is used in FishXing to develop a rating curve (flow versus water depth) at the TWC. Locating the TWC is straight forward for those sites with a pool at the outlet. In this case, the TWC is the channel structure (log, riffle, boulders, etc.) that controls the outlet pool water elevation (Figure 2.1). The TWC cross section is measured perpendicular to the stream channel at this location. For sites lacking a clear TWC, i.e. the culvert outlet is at stream grade, a channel cross section within 1.5 – 3 m (5 - 10 ft) of the outlet is measured.

The site survey is also used to obtain an order of magnitude estimate of the fill volume. This rough estimate of fill volume is used in prioritization of site replacement or remediation and has two purposes. First, the replacement cost for a culvert site is highly influenced by the fill volume that must be moved and replaced to access the culvert. Second, the fill volume can also be an indication of potential consequences should a culvert fail due to plugging or being undersized allowing flow to overtop the road. The fill volume represents the potential volume of sediment delivered to the downstream channel when a crossing fails. Fill elevation can also be used to estimate the culvert flood capacity or the flow rate through the culvert when the culvert is submerged with an upstream water depth approaching the top of the fill. These uses of fill volume and elevation are appropriate for small to moderate fill volumes. Many fill volumes on Caltrans ownership, especially on State Highway 101, are extremely large and would not fail by overtopping. For these sites, the fill volume was noted as extremely large and not surveyed.

At minimum, 10 survey points were used to estimate the fill volume. The five points, FB_1, FB_2, FT_1, FT_2, and FT_3 (Figure 2.2) were measured on both the upstream and downstream fill slope. These ten points were then used to calculate the lengths (L_d, L_u,

W_r, W_f, and W_c) and slopes (S_d and S_u) indicated in Figure 2.2. The fill volume is calculated using these values and equations 1 through 4 as outlined on page 12 of the *California Salmonid Stream Habitat Restoration Manual* (Taylor and Love, 2003). These fill estimates are order of magnitude only and not meant to be used for design or construction purposes.

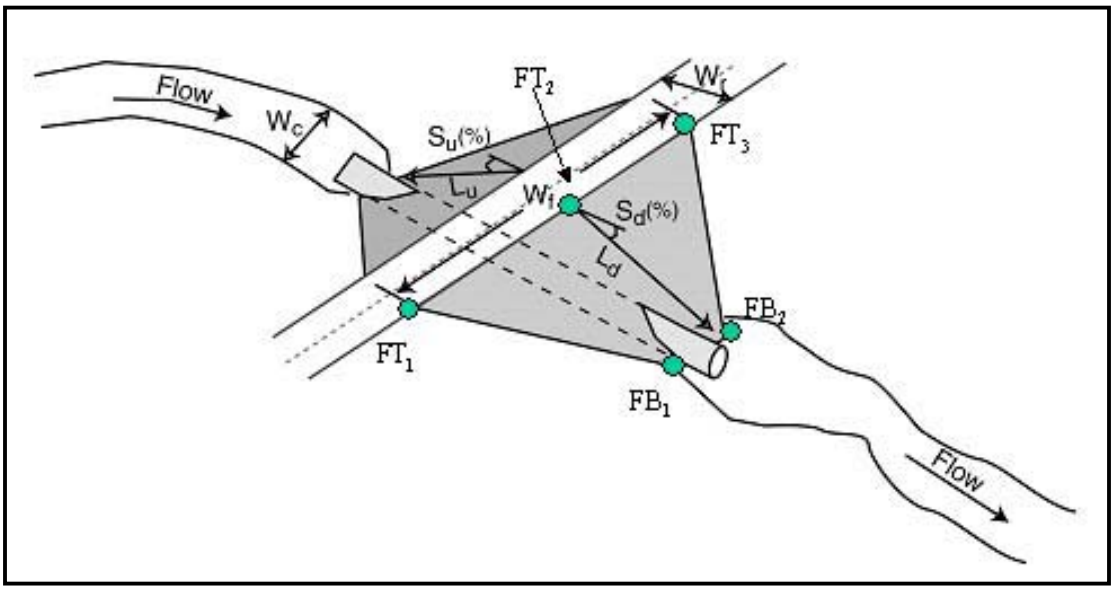


Figure 2.2. Road fill measurements (modified from Taylor and Love, 2003).

Additional site characteristics such as aprons, weirs, fish ladders, headwalls, and wingwalls, are also surveyed when present. Aprons are concrete structures extending upstream or downstream from a culvert at the channel culvert interface to control the flow transition into or out of the culvert (Figure 2.3). Aprons often have a different slope than the culvert itself. If the apron is much steeper than the culvert, then it may be the limiting factor preventing fish passage.

Weirs constructed of concrete or placed boulders (Figure 2.4) are common at the outlet or in the stream channel below a culvert outlet. These structures can control water levels through the culvert and may decrease velocity or outlet pool erosion. Weirs may also act as barriers to fish passage by requiring fish to leap over the weir for entry into the culvert. Fish ladders are present at a number of sites to overcome steep outlet slopes or perched outlets and allow fish access to the culvert (Figure 2.5). When fish ladders are present, a longitudinal profile of the ladder is surveyed to determine the slope, length and whether breaks in slope are present in the ladder.

Headwalls and wingwalls (Figure 2.6) are typically vertical, concrete structures designed to guide water into or out of the culvert and to protect the fill slope from erosion. When present, the boundaries of the headwalls and wingwalls are surveyed to capture their height, length and alignment with respect to the culvert and channel.

Figure 2. 3. Concrete arch culvert with a concrete inlet apron and debris wall. If the apron has a steeper slope than the culvert, the apron may cause a velocity barrier to fish passage.

Figure 2.4. The picture on the left shows a concrete outlet weir with a low flow notch. The picture on the right shows multiple boulder weirs installed to mitigate a perched outlet.

Figure 2. 5. Fish ladder added to a culvert outlet to enhance fish passage.

Figure 2.6. Wingwalls and headwalls guide flow into culverts and protect fill slopes from erosion.

2.4.2 Culvert Measurements and Characterization

In addition to the surveyed points, measurements and characterization of culvert construction are also collected during the Second Pass Survey. The culvert length does not need to be measured with a tape (as described in the CDFG protocols) when using a total station and was determined from the longitudinal survey coordinates. The culvert size (diameter-D or height-H and width-W) was measured to the nearest 0.03 m (0.1 ft) using a tape measure. The type of culvert and the construction materials were confirmed with the values recorded during the First Pass Survey. The culvert condition was assessed and any maintenance problems noted and photographed. For metal pipes, the rustline height is measured using a tape. The rustline height correlates to the winter base flow water depth through the culvert and can be used as an indicator for undersized culverts. Rustline heights approaching half the total culvert height often indicate an undersized culvert.

2.4.3 Culvert Site Location

Each culvert location was defined using the county, route, and postmile and located by GPS where possible. The latitude and longitude of each site was determined using a Trimble Pathfinder Pro XR receiver. GPS measurements were collected at the inlet postmile marker if the culvert was visible from this location. If the culvert was not visible from the inlet postmile marker, a GPS measurement at the culvert inlet was attempted. In some cases, the presence of dense trees or a steep canyon prevented a GPS measurement. In these locations, the site's latitude and longitude were determined using Terrain Navigator 2001 by Maptech, Inc. All latitude and longitudes were provided to Caltrans in the North American 1983 datum (NAD83).

2.4.4 Channel widths

Comparison of the active channel width to the culvert inlet width indicates whether the culvert restricts the channel or is undersized. Culverts with widths much less than the active channel width restrict higher flows causing increased velocities and poor fish passage conditions. The average active channel width is determined by making five measurements of active channel width upstream of the culvert, beyond the influence of any backwatering by the culvert. The active channel is that portion of channel commonly wetted during most winter storm flows and is identified by a break in rooted vegetation or moss growth on rocks along the stream margins (Figure 2.7). Many culvert design guidelines utilize active channel widths to determine the appropriate widths of new culvert installations (CDFG 2002; NMFS 2001; Robison et al. 2000; Bates et al. 1999).

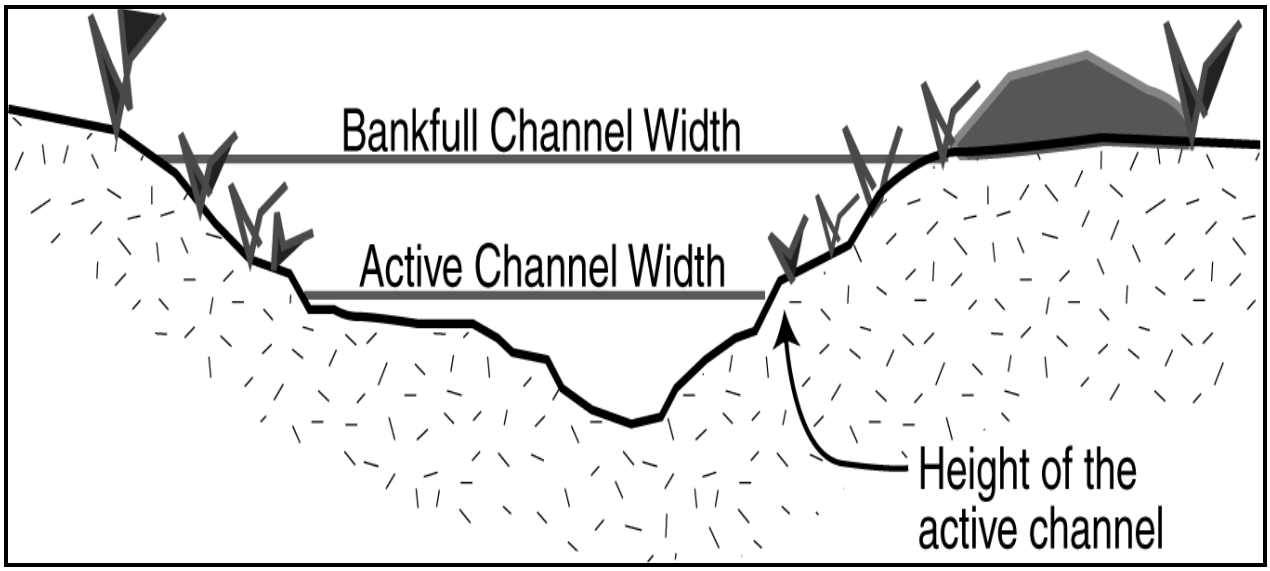


Figure 2.7. Active channel width versus bankfull channel width (Taylor and Love, 2003).

2.5 Site Data Processing

All site and survey data (FPS and SPS datasheets, surveying notes) were collected on waterproof paper or notebooks. Original datasheets are stored by county, route and postmile in binders. An identical binder with copies of all datasheets and notes exists for each route and is available for off-site analysis.

Much of the data collected during the Second Pass Survey is in electronic form. After return from the field, the total station and GPS files are downloaded to computer, given unique names reflecting the county, route and postmile for the site, and converted to usable formats. The survey data is processed in Excel to calculate the physical characteristics needed to perform a fish passage assessment using the CDFG ranking filter (Section 2.6) and, if needed, hydraulic analysis (Section 2.8). The GPS files are checked and stored for later use to develop GIS layers of fish passage culvert locations and assessment results.

2.6 Fish Passage Analysis using the CDFG Filter

In collaboration with NOAA Fisheries, CDFG developed a ranking filter to quickly assess fish passage at stream crossings (Taylor and Love, 2003). The ranking filter compares the crossing's physical characteristics (length, slope, outlet perch, and water depth) with criteria determined to meet current guidelines for fish passage at existing stream crossings. The ranking filter was developed for assessment of fish passage for adult anadromous, adult non-anadromous and juvenile salmonids in California.

Comparison of the crossings' characteristics to the guidelines determines the ranking level for the site. The ranking levels are:

- **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. Additional analyses required to determine the extent of barrier for each species and lifestage.

- **RED**: Conditions do not meet passage criteria at all flows for the weakest individuals of the strongest swimming species presumed present.

Passage criteria were selected for the ranking filter by CDFG and NOAA Fisheries and are intended to accommodate passage of the weaker swimming individuals within each species and life stage. A culvert ranking RED is not necessarily a complete barrier, particularly if it barely fails the criteria; however, this culvert does not meet current fish passage design guidelines (CDFG 2002; NMFS 2001) and will likely pose a significant and unacceptable impediment to both adult and juvenile salmonids. Use of the ranking filter in assessing Caltrans stream crossings is described below. Additional details concerning the ranking filter are available in the *California Salmonid Stream Habitat Restoration Manual* (Taylor and Love, 2003).

Figure 2.8 shows the ranking filter flow chart. The ranking filter requires five onsite measurements: average active channel width, culvert inlet width, culvert slope, residual inlet depth and residual outlet depth. The first two measurements are collected using a tape measure during the First Pass Survey. The other three measures are calculated from the longitudinal profile survey conducted during the Second Pass Survey.

The residual inlet and outlet depths (Figure 2.9) are measures of the minimum water depth throughout the culvert and whether the outlet is perched, respectively. A positive residual inlet depth indicates the depth of water that exists throughout the culvert at very low flows. The residual inlet depth is positive only when the culvert is backwatered, meaning that the tailwater control elevation is greater than the elevation of the culvert invert at the inlet. The residual inlet depth is a direct measure of the water depth in the culvert under very low flow conditions that, if sufficient, allows unimpeded passage for juveniles during summer low flows. The residual outlet depth measures either the water depth at the outlet during low flow conditions (positive residual outlet depth) or the extent of the outlet perch, or leap, that exists under low flow conditions (negative outlet depth). Outlets perched more than 0.6 m (2 ft) have been shown to significantly diminish the ability of adult salmonids to successfully pass through culverts and introduce significant delay in upstream passage (Lang et al. 2004).

The ranking filter has two decision pathways that differentiate culverts by the presence or absence of streambed substrate throughout the culvert. Natural streambed substrate can improve fish passage by increasing roughness and slowing velocities through the culvert.

If the culvert inlet width is much less than the average active channel width, then the culvert is constricting flow in the channel. This flow constriction causes higher velocities in the culvert than the adjacent channel and can increase outlet scour or prevent channel substrate from remaining in the culvert. Culverts with natural streambed substrate and a culvert inlet width greater than or equal to the active channel width are assumed to have similar hydraulic conditions to the nearby stream channel at fish passage flows. In the ranking filter, the culvert inlet width is used to determine whether culverts with natural substrate bottoms are likely to retain their substrate and how similar culvert velocities will be to adjacent channel velocities.

In addition to the culvert inlet width, the other factors influencing the ranking of a culvert with streambed substrate throughout is the presence of an outlet perched greater than 0.6 m (2 ft) and sufficient water depth. An outlet perched greater than two feet receives an automatic Red ranking for any type of culvert and a residual inlet depth less than 0.15 m (0.5 ft) will result in a Gray ranking if no outlet perch exists.

For sites without streambed substrate, the culvert slope is one of the primary controls on the water velocity through the culvert. At slopes greater than 3%, culverts without baffles or natural substrate to provide roughness are likely to have average velocities greater than the fishes' swimming velocities. Culverts with slope greater than 3% and no fish passage retrofits are ranked Red. Sites with outlets perched greater than 0.6 m (2 ft) or insufficient water depth will rank Red and Gray, respectively, the same as the natural streambed culvert rankings.

The ranking filter is designed as a quick assessment tool assuming typical construction and conditions at a stream crossing. If culverts have unique characteristics that could hinder fish passage other than the criteria used in the ranking filter, these characteristics should be thoroughly evaluated before adopting the ranking filter result. Additional assessment is especially important for those sites ranking Green that may subsequently be interpreted as providing 100% passage.

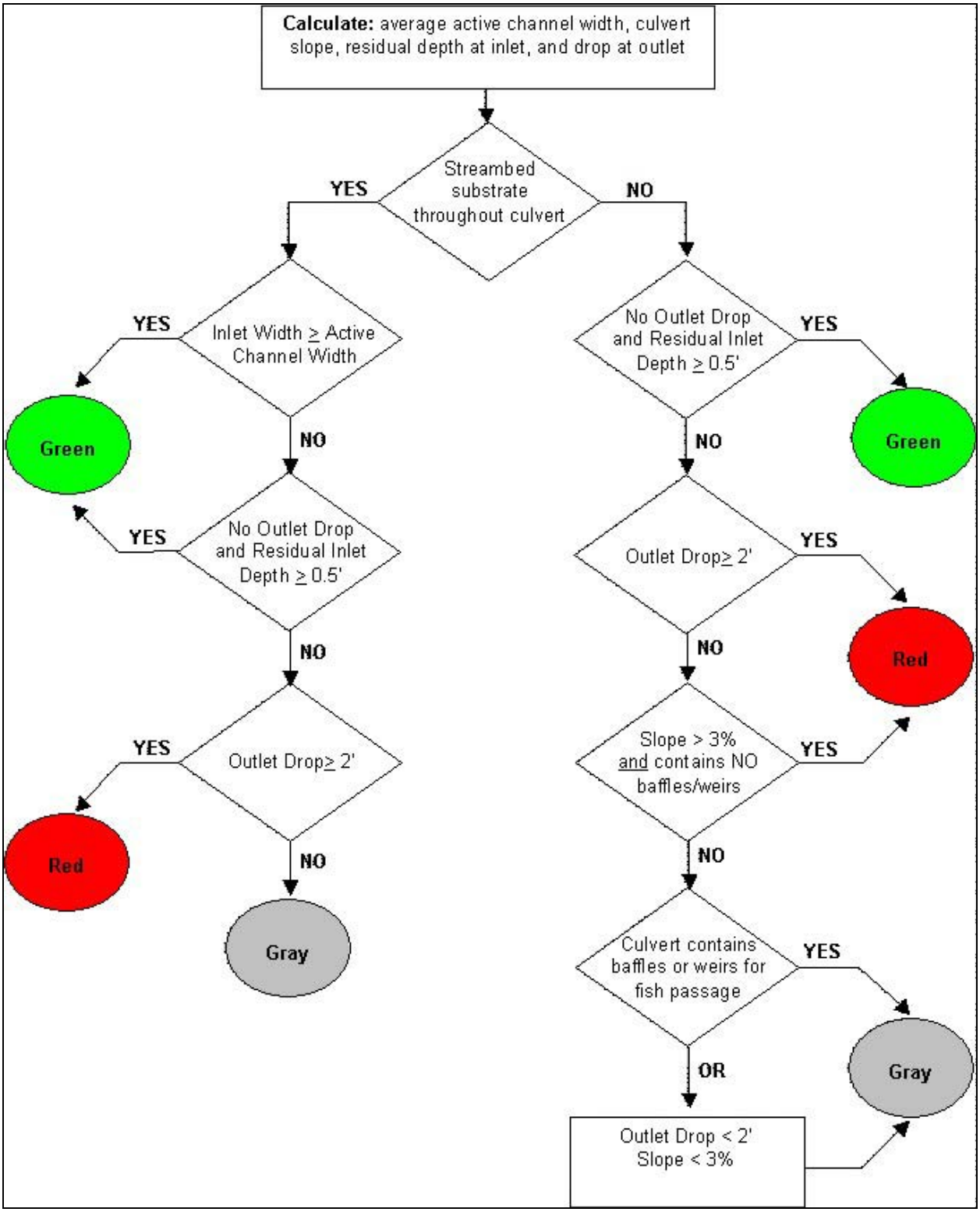
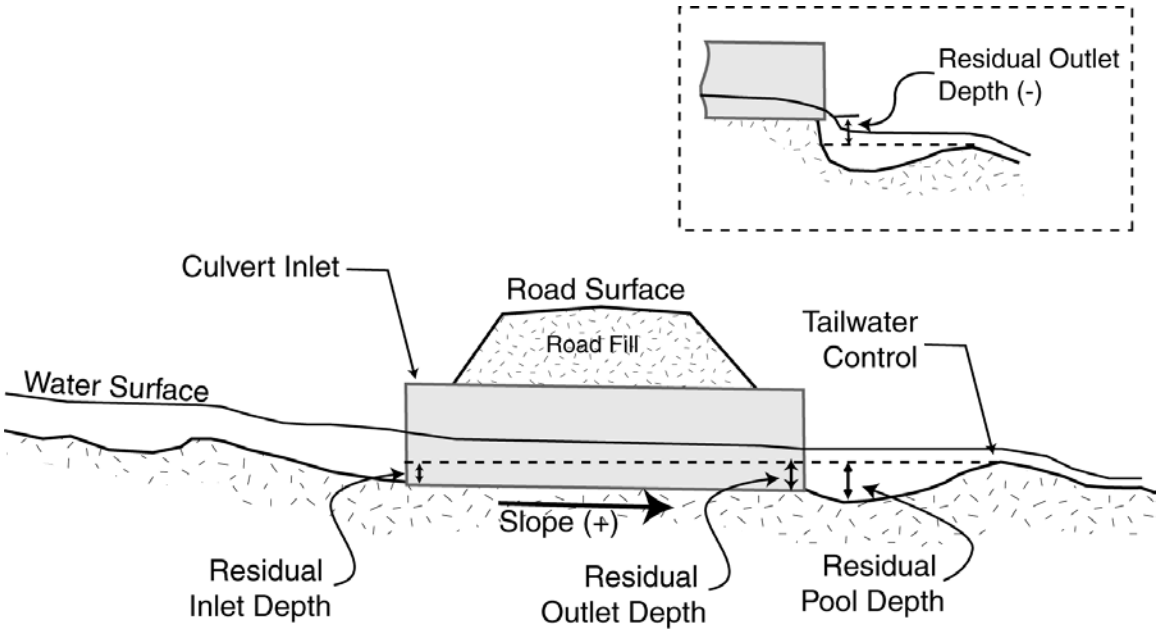


Figure 2.8. GREEN-GRAY-RED CDFG fish passage assessment ranking filter (Taylor and Love, 2003).



Residual Pool Depth = (Elev $_{\text{Tailwater Control}}$ – Elev $_{\text{Pool Bottom}}$)

Residual Outlet Depth = (Elev $_{\text{Tailwater Control}}$ – Elev $_{\text{Culvert Outlet}}$)
(No outlet drop if Outlet Depth $\geq$ 0)

Residual Inlet Depth = (Elev $_{\text{Tailwater Control}}$ – Elev $_{\text{Culvert Inlet}}$)

Figure 2.9. Measurements used in Green-Gray-Red filtering criteria (Taylor and Love, 2003).

2.7 Site-Specific Hydrology: Fish Passage Design Flows and Peak Flows

Assessing stream crossings for fish passage requires estimating several stream flow rates: the lower and upper fish passage design flows for each species and lifestage, and the peak flow capacity of the crossing. Designing stream crossings to pass all fish at all flows is widely recognized as technically and economically infeasible (CDFG 2002; NMFS 2001; Bates et al. 1999). The flows at which different fish species and lifestages require access to particular habitats are fish passage design flows. In California fish passage design flows are defined for adult anadromous, and adult non-anadromous, and juvenile salmonids (CDFG 2002, NMFS 2001).

The peak flow capacity of the crossing is used to evaluate a site's design level and risk of failure at high flows. 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 culverts should accommodate the 100-year flood with an upstream water depth less than or equal to the culvert's inlet height. CDFG guidelines require the upstream water surface elevation to not exceed the top of the culvert inlet for the 10-yr peak flood and headwater should not be greater than 50% of the culvert height or diameter above the top of the culvert inlet for the 100-yr peak flood (CDFG, 2002). The CFDG guidelines match Caltrans' design criteria.

2.7.1 Fish Passage Design Flows

The fish passage design flows (Table 2.1) are intended to encompass the range of flows expected to occur during periods when the target fish migrates upstream. At flows below an upper fish passage design flow, the water velocities must not exceed the fish's swimming ability. At flows above a lower fish passage design flow, water depths within the stream crossing must be adequate for the fish to swim through. These design flows are commonly defined in terms of exceedance flows derived from flow duration curves (e.g. Vogel and Fennessey, 1994). An exceedance flow defines the average percent of time the stream flow exceeds a specified flow. For example, in 1970 the California Department of Transportation, in conjunction with California Department of Fish and Game, defined an upper fish passage design flow for adult salmon and steelhead as that flow which was equaled or exceeded 10% of the time during the period of upstream migration (Kay and Lewis, 1970).

Table 2.1. California fish passage design flows (CDFG 2002, NMFS 2001).

Fish Species or Lifestage	Lower Fish Passage Design Flow	Upper Fish Passage Design Flow
Adult Anadromous Salmonids	50% exceedance flow or 3 cfs whichever is greater	1% exceedance flow or 50% of the 2-year return period flow
Adult Non-Anadromous Salmonids	90% exceedance flow or 2 cfs whichever is greater	5% exceedance flow or 30% of the 2-year return period flow
Juvenile Salmonids	95% exceedance flow or 1 cfs whichever is greater	10% exceedance flow or 10% of the 2-year return period flow

Ideally, exceedance flows and the fish passage design flows are determined from long term flow gaging records at the site of interest. Long-term flow records are rarely available for the small streams likely to have culverts and other common stream crossings other than bridges. Therefore, hydrologic estimation techniques are used to determine the exceedance flows for small watersheds. These estimation techniques use the watershed drainage area, mean annual precipitation (MAP), and mean annual evapotranspiration (PET) to correlate the flows in ungaged watersheds to those in nearby gaged watersheds. The estimation procedure is outlined below and additional details and an example are available in *Improving Fish Passage at Road Crossings* (Lang et al. 2004).

For streams in a region of interest, stream flow gages meeting the following criteria are identified:

- At least 5, and preferably greater than 10, years of continuous daily flow record,
- Drainage area less than 259 km^2 (100 sq mi) with smaller drainage areas preferentially selected when available, and
- The gaged watersheds have similar orographic influences on rainfall to the sites of interest, e.g. FDCs for coastal sites are developed from coastal stream gage records.

The mean annual discharge for each of the gaged streams is estimated using the regional runoff regression equation developed by Rantz (1968) for coastal streams in northern California:

$$R = MAP - 0.4(PET) - 9.1 \quad (1)$$

$$Q_{ave} = 0.07362[ft^3\text{-}yr/(s\text{-}in\text{-}mi^2)]*R*A \quad (2)$$

Where:

Q_{ave} = mean annual discharge [ft^3/s]
MAP = mean annual precipitation [in/yr]
PET = potential evapotranspiration [in/yr]
R = mean annual runoff [in/yr]
A = drainage area [mi^2]

For the gaged streams, the basin wide mean annual precipitation (MAP) was obtained from PRISM GIS layers (Oregon Climate Service 2002) and the potential evapotranspiration (PET) was obtained from isohyetal maps and tables produced by Rantz (1964). Next, FDCs were constructed for the annual flows in each gaged stream. The gaged stream flows were then normalized by the mean annual discharge to develop a single, regional flow duration curve (Figure 2.10). Regional flow duration curves were developed for subregions within District 1 having the same climate and were generally developed for each State Highway or, where needed, a subsection of a State Highway.

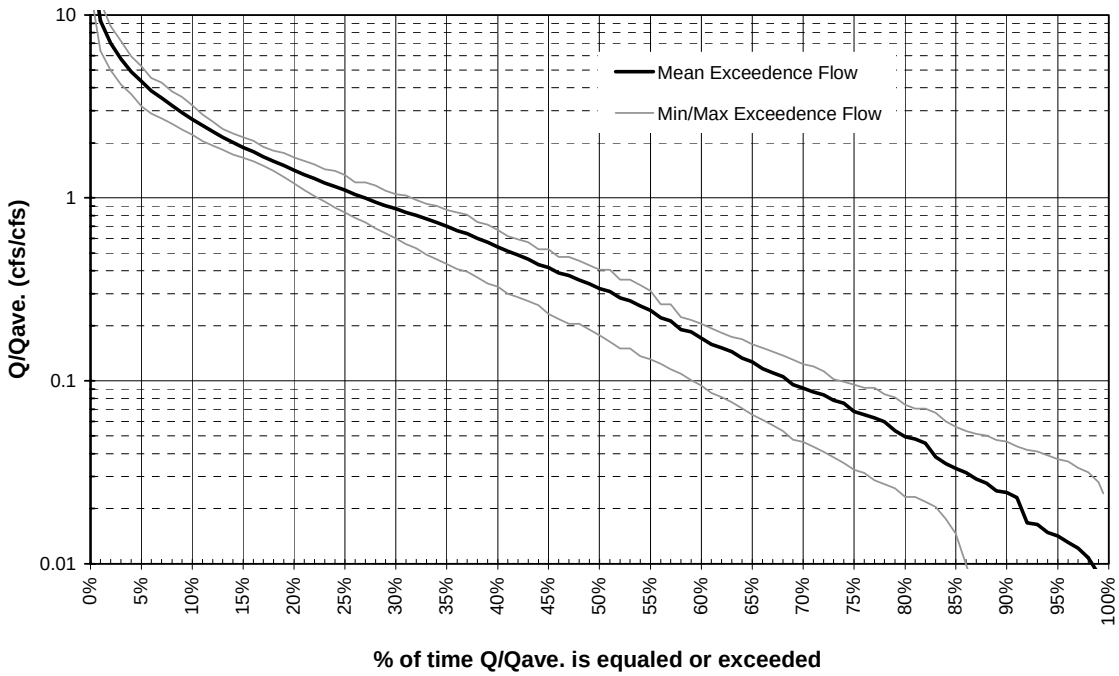


Figure 2.10. Sample regional flow duration curve (FDC) for Del Norte 101.

To determine the fish passage design flows for a particular site, Q_{ave} was calculated for each of the study sites using equations (1) and (2) and then multiplied by the exceedance flows on the normalized regional flow duration curve to develop an individual site FDC. The fish passage design flows are the flow rates matching the particular exceedance percentage for the site of interest. Regional FDCs and the stream gage data used to create them are presented in the report volumes summarizing results for each route.

2.7.2 Peak Flow Capacity

Peak flows are typically defined in terms of a recurrence interval, or the time interval matching the probability of a single occurrence of this flow magnitude. A crossing's peak flow or flood capacity is used to rank sites for remediation or replacement by recognizing that undersized crossings have a higher risk of failure. Undersized stream crossings can also hinder fish passage by concentrating flows and adversely affect sediment transport and erosion rates in the adjacent stream channel.

To assess peak flow capacity, the culvert's hydraulic capacity is compared to the site's estimated peak flow at recurrence intervals of 2-, 5-, 10-, 25-, 50- and 100-years. The culvert hydraulic capacity is a function of the shape and cross-sectional area of the culvert inlet. Culvert capacity was calculated at each site for a headwater depth (HW) equal to the culvert inlet height (D) (HW/D = 1). Tables presented in the US Federal Highways Administration's *Hydraulic Design of Highway Culverts* (Normann et al.,

2001) were used to determine peak flow capacity for circular metal culverts, concrete box culverts, and metal pipe arch culverts. Peak flow capacities of other culvert shapes and embedded culverts were determined using either FishXing V2.2 (Love et al. 1999) or CulvertMaster V2.0 (Haestad Methods 2002).

The estimated peak flows for recurrence intervals of 2-, 5-, 10-, 25-, 50-, and 100-years was determined for each site using regional regression equations (Waananen and Crippen 1977) (Figure 2.11). The regression equations are defined for different regions throughout California and are functions of watershed area, mean annual precipitation and a watershed altitude index. These regression equations are also included in Caltrans' Highway Design Manual as Figure 819.2C (Caltrans 2001).

Use of regression equations inherently assumes that any watershed for which the recurrence flows are being predicted is similar to those gaged sites from which the regression equations were developed. Because of these inherent assumptions, regression method estimates of flow can be subject to large errors. In design analysis, multiple methods (e.g. regression equations, rational method, rainfall-runoff models, etc.) are used to estimate recurrence interval flows. Regression equation estimates are appropriate for assessment level analyses and screening where the goal is collection and estimation of reasonable data at minimal costs to evaluate numerous sites. However, these estimates of recurrence interval flows should not be used exclusively for design level analyses.

The stream crossing's capacity and estimated peak flows are compared to determine the crossing's current capacity. Sites are assigned one of five size 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 5-year and 10-year flows,
6. less than the 5-year storm flow

This information is used in prioritization (see Section 2.10) for replacement or remediation with undersized culverts receiving higher priority for replacement (all other criteria being equal).

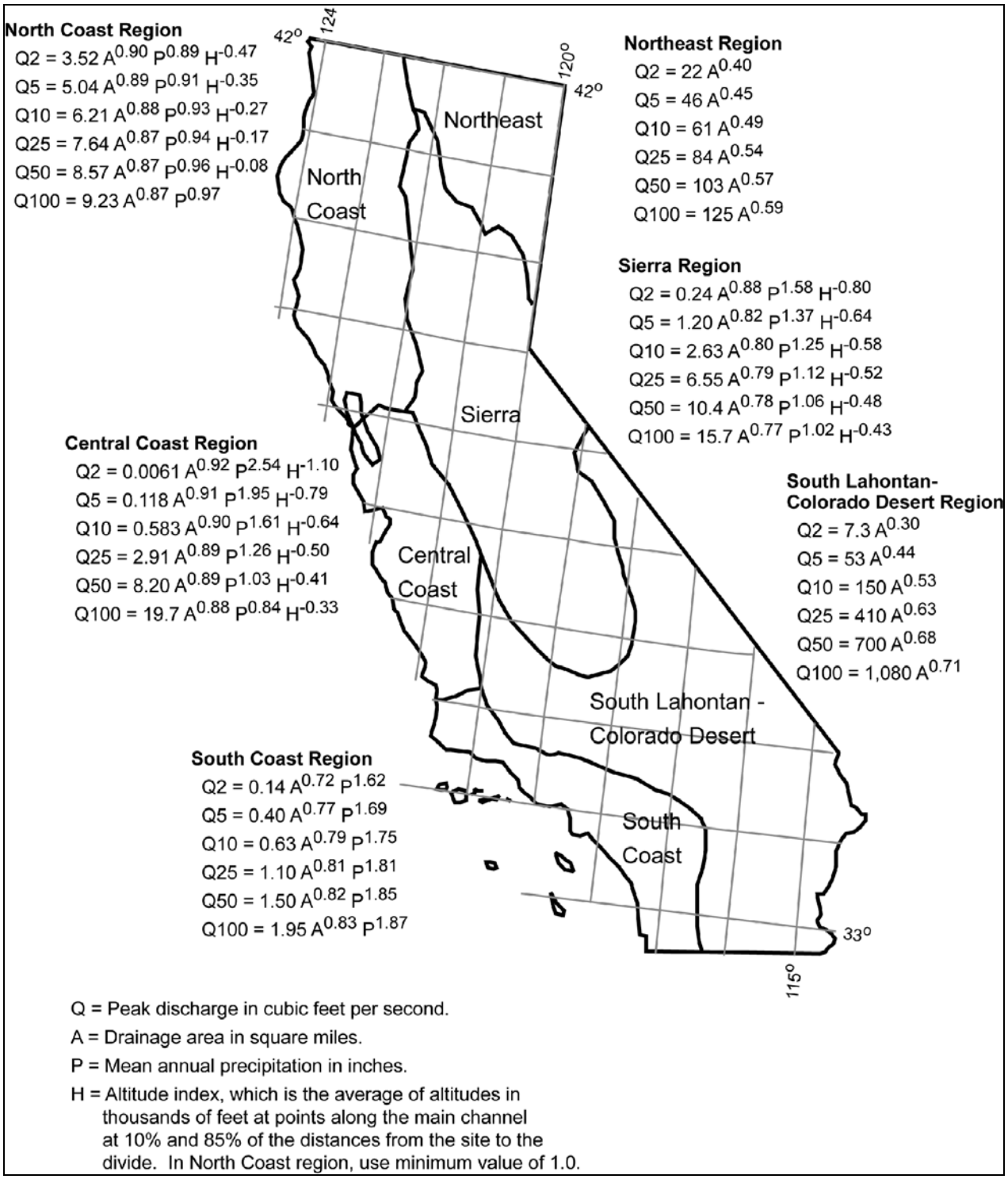


Figure 2.11. California regional regression equations for estimating peak flows associated with a 2-year, 5-year, 10-year, 25-year, 50-year, and 100-year recurrence interval (Waananen and Crippen, 1977).

2.8 FishXing Analyses

FishXing is an interactive software package, developed by the Six Rivers National Forest, that integrates a culvert design and assessment model for fish passage nested within a multimedia educational setting (Love et al. 1999). The model simulates steady-state, non-uniform hydraulics through a culvert or similar stream crossing predicting a profile of water depth through the culvert. These water depths and the culvert's cross-sectional area are used to calculate the average velocities throughout the culvert. These simulations are repeated for all the flows of interest, typically the full range of fish passage design flows. The program also incorporates fisheries inputs including fish species, life stages, body lengths, and leaping and swimming abilities. FishXing uses the swimming abilities to determine whether a culvert (existing or proposed) will accommodate fish passage over the required range of fish passage design flows. The simulation results identify specific locations and conditions 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.

In addition to the in-culvert conditions, FishXing also predicts the leap heights occurring over a given range of flows and whether the fish can negotiate these leaps. A fish's ability to successfully negotiate a leap is determined by considering the fish's maximum leap velocity and the availability of appropriate leap conditions. To make a leap, the maximum velocity must be great enough to clear the leap height assuming a perfect leap trajectory. In addition, a pool with sufficient water depth must be present to ensure that the maximum leap velocity can be attained. Stuart (1962) concluded that a pool depth of at least 1.25 times the leap height is needed to reach swim speeds fast enough to make a successful leap.

FishXing used the survey elevations and culvert specifications to evaluate passage at sites defined as "GRAY" by the CDFG ranking filter for each species and life-stages of salmonids known to currently or historically reside in the Caltrans District 1. Table 2.2 shows the values used for fish passage assessment with FishXing. These values are the recommended values from CDFG fish-passage protocol (Taylor and Love, 2003) and are 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 species and 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 can result in many sites that allow some the passage of adult salmonids being identified as total barriers.

Table 2.2 Fish species and life stages used in the fish passage along with associated swimming abilities and passage criteria.

Fish Species/Age Class	Adult Anadromous Salmonids	Adult Non-Anadromous Salmonids	Juvenile Salmonids
Fish Length	500 mm	200 mm	80 mm
Prolonged Mode			
Swim Speed	5 ft/sec	4 ft/s	1.5 ft/s
Time to Exhaustion	30 min	30 min	30 min
Burst Mode			
Swim Speed	10 ft/sec	5.0 ft/s	3.0 ft/s
Time to Exhaustion	5 sec	5 s	5 s
Maximum Leaping Speed	15 ft/sec	6.0ft/s	4.0 ft/s
Minimum Required Water Depth	0.8 ft	0.5 ft	0.3 ft

2.9 Fish Presence and Habitat Information

Confirmed presence of fish species of concern and suitable habitat are the dominant factors for prioritizing sites for remediation or replacement. Fish presence and habitat quantity and quality is established using all available information including California Department of Fish and Game surveys, research studies, local fisheries biologists' expertise and survey crew observations.

2.9.1 Fish Presence

Confirmed presence of fish species of concern in a stream with a crossing is the most important information when prioritizing sites or replacement or remediation. Fish presence was verified or assumed using the following sources:

- CDFG reports or files where available
- County reports developed by Ross Taylor and Associates (Taylor 2000, 2001a and 2001b)
- Tribal fisheries biologists
- Timber company biologists
- Local knowledge (CalTrout, watershed groups, interested residents, etc.)
- Presumed fish presence because of easy access from a downstream known fish bearing water course

Streams with culverts are generally small and few CDFG surveys have been conducted in streams of this size, especially in regions away from the coast. The *NMFS California Anadromous Fish Distributions* (Jones 2000) report for Mendocino and Sonoma counties summarizes fish presence surveys conducted by CDFG up to 2000 and provided a great deal of current and historic data. CDFG files were also searched in the Ukiah, Fortuna and Arcata offices for fish and habitat survey data.

2.9.2 Habitat Information

Because access to stream channels was limited to the immediate vicinity of the stream crossings, quantitative habitat surveys were not conducted as part of this study. Habitat quality and quantity is an important factor for prioritizing sites for remediation or replacement. Therefore, habitat quality information was collected or determined, in order of preference, from:

- Habitat surveys collected by CDFG, tribal fisheries biologists, timber company biologists, or other reputable sources,
- County fish passage assessment reports where county-owned stream crossings are present on the same watersheds as Caltrans-owned crossings,
- Professional judgement of biologists or local restoration groups familiar with the watershed, or

Habitat quantity values were determined from:

- Habitat surveys collected by CDFG, tribal fisheries biologists, timber company biologists, or other reputable sources,
- Locations of known barriers, such as dams, waterfalls, etc., or
- Topographic maps used to identify the upper limit of anadromous habitat. The upper limit of anadromy was defined at the point where the channel exceeded an eight percent slope for at least a 300-foot channel reach.

Specific sources or assumptions made for all habitat quality and quantity values used for assessment or prioritization are clearly referenced whenever these values are presented or used.

2.10 Prioritization

Prioritization is used to rank sites in order from high to low priority for remediation or replacement to meet fish passage objectives. Prioritization begins by “scoring” sites based on their species diversity, extent of barrier present, flood capacity and maintenance condition, habitat quantity and habitat quality. Prioritization rankings for all routes are determined in the same manner so the numerical scores can be merged or combined to rank sites on a county, watershed or other basis. These prioritization scores are not meant

for making the final decisions regarding fish passage remediation. Professional judgment, opportunities created by scheduled maintenance or construction or restoration emphasis in a particular watershed by multiple agencies or stakeholders must also factor into these decisions. Thus, these prioritization rankings should be viewed as a first cut at developing a remediation strategy rather than a strict order for remediation actions.

The criteria and scoring for ranking stream crossings were taken from Part IX of CDFG's *California Salmonid Stream Habitat Restoration Manual* (Taylor and Love, 2003) with one exception. A "Crossing Score" is used instead of distinct scores for "Size (risk of failure)" and "Current Condition." Taylor (2003) first introduced this modification in assessment of Marin County stream crossings. Combining the "Size " and "Current Condition" scores to a "Crossing Score" reduces the total weight given to a stream crossing's condition from 26% to ~15% of the site's ranking score. This reduction in weight of the size/condition increases the weight of the species diversity and habitat characteristics of each site; thus, preventing very small culverts with minimal habitat or fish from being ranked too high.

Undersized crossings in poor condition have a high risk of failure and should be a concern to road managers. However, the primary purpose of this prioritization is to identify sites needing fish passage remediation; thus, more weight should be put on the biological criteria to identify crossings which are serious impediments to migration and that have significant reaches with suitable upstream habitat.

The prioritization method used for site ranking for each route 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. A brief description of each score (taken from Taylor and Love, 2003) is given here:

1. **Species diversity:** number of salmonid species currently or historically present in the stream reach at the culvert location. **Score:** Endangered species = **4 points,** Threatened species (coho salmon and steelhead) = **2 points**, Species of Concern, unlisted and resident salmonids = **1 point.**

2. **Extent of barrier:** This value is determined for each species and age class of salmonid (adult, resident trout or 2+age class, and juvenile). Over the range of fish passage design flows for each fish type, assign one of the following values. **Score: 0** = 80-100% passable (GREEN ranked sites using CDFG ranking filter and GRAY ranked sites determined passable using FishXing); **1** = 60-80% passable; **2** = 40-60% passable; **3** = 20-40% passable; **4** = less than 20% passable; **5** = 0% passable (RED ranked sites using CDFG ranking filter and GRAY ranked sites determined impassable using FishXing). The total extent of barrier score is the sum of the three scores. **Maximum score = 15 points.**

3. **Crossing Score:** For each crossing determine the sizing (risk of failure) and condition scores as defined below and compute the average value. **Maximum score = 5 points.**

   Sizing (risk of failure): For each culvert, assign one of the following values for the capacity of the culvert flowing full. **Score: 0 =** sized to NMFS standards, passes the 100-year flow at less than or equal to 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 5-year event, extreme risk of failure.

   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.

4. **Habitat quantity:** Determine the habitat quantity above each crossing in units of feet. **Score:** Starting at a 500' minimum; 0.5 points for each 500' length (**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.**

5. **Habitat quality:** For each stream, assign a "multiplier" of quality after reviewing available habitat information. The habitat quality score should be assigned relative to other streams on the route.

   - **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 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), 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.

6. **Total habitat score:** Multiply #4 by #5 to obtain a total 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.**

Total Stream Crossing Score = Species Diversity Score + Extent of Barrier Score + 0.5*(Sizing Score + Current Condition Score) + Total Habitat Score

For each culvert location, the five ranking criteria were entered into a prioritization spreadsheet and the total scores computed. The list of sites is then sorted by the "Total Score" in a descending order to determine an initial prioritization ranking for crossing remediation. Further review of this ranking is always required as professional judgment and socioeconomic, political or other factors will also influence the selection of sites for replacement or remediation.

Several additional factors also need to be considered to develop the final site rankings. These include:

- Current fish presence or usage – maintaining access to current fish stocks should get higher priority than providing access to historic habitat.
- Presence, status, and location of additional barriers on the stream – sites with additional barriers will have higher or lower priority depending on the current efforts by other owners to remove their barriers
- Scheduled or emergency construction and maintenance – opportunities arise for site remediation and replacement and fish passage needs to considered
- Remediation or replacement cost - available funding will influence project feasibility
- Amount of road fill – a site's fill volume will greatly influence the project cost and effort needed to improve fish passage.

After considering these factors, and with input from agencies and interested stakeholders, the prioritization list can then be divided subjectively into groups defined as "high", "medium", or "low" priority for remediation and planning to obtain funding or develop designs for modification can be initiated.

3 RESULTS

The final result of the fish passage assessment for State Highway culverts is a prioritized list of sites needing remediation or replacement. This prioritized site list is developed using the methods described in Section 2. There are also some preliminary findings that are significant because they indicate the magnitude of the problem and the potential for fish and aquatic organism passage at stream crossings. These preliminary findings, the first pass summary to identify potential fish passage sites and the CDFG ranking matrix results, are presented here along with the list of sites identified as having the highest priority for remediation.

In addition to presenting the findings of Caltrans District 1 fish passage assessment, a comparison of Caltrans and county assessment results for Del Norte, Humboldt and Mendocino County is also included. Many streams have multiple crossings requiring watershed-scale assessment of barriers and cooperation between landowners to eliminate barriers to fish passage. Identifying watersheds affected by two major road owners, Caltrans and the counties, is a major first step to watershed-based fish passage assessment.

3.1 Survey Summaries

The First Pass Summary identified the potential fish passage sites on State Highways in Caltrans District 1. Crews drove the greater than 800 miles of State Highway stopping at all culverts greater than or equal to 0.6 m (24 inches) in diameter to evaluate whether the sites met the potential fish passage culvert criteria (Section 2.1). The first pass identified 411 potential fish passage sites and, as of December 1, 2004, 312 of these sites have been surveyed and analyzed for fish passage using the protocols outlined in Section 2 of this report. Seventy-eight of the identified potential fish passage sites were not surveyed because they were not believed to be streams with fish present. These sites were confirmed in a meeting with fisheries professionals held November 4, 2004 at the NOAA Fisheries office in Arcata, California. Twenty-one sites likely to be important to fish were not surveyed because landowners denied access permission. The First Pass Summaries for each State Highway are included in each Highway's sub-report.

3.2 CDFG Ranking Matrix Results

The ranking matrix used by the California Department of Fish and Game was presented previously (Figure 2.8). Table 3.1 summarizes the ranking results for all the potential fish passage sites, 186 or 60% of the surveyed sites ranked RED. A RED ranking indicates that the site does not meet current fish passage guidelines for existing culverts. The RED ranking does not necessarily mean that the culvert is completely impassable but that the culvert is unlikely to allow passage for the range of swimming or leaping abilities expected for all individuals of the target fish species. At many RED-ranked sites, strong

Table 3.1. CDFG ranking matrix summary for Caltrans District 1 potential fish passage stream crossings.

County/Route	Total Miles	Total Culverts	Potential Fish Passage Culverts (PFCs)	Red Ranked Crossings	Gray Ranked Crossings	Green Ranked Crossings	Number of PFCs not surveyed	Survey Status
Del Norte 101	46	359	25	5	13	4	3	Complete. Unsurveyed sites are not fish streams.
Del Norte 197	12	62	7	4	3	0	0	Complete
Del Norte 199	36	306	27	13	4	2	8	Complete. Unsurveyed sites are not fish streams.
Humboldt 36	46	339	25	8	5	4	8	Complete. Unsurveyed sites are not fish streams.
Humboldt 96	45	411	11	5	0	0	6	Second pass survey and data analysis of 5 sites east of Weitchepec completed. 2 of the remaining sites are east of these sites and unlikely to be fish bearing streams. The other 4 sites are on Hoopa land.
Humboldt 101	135	1304	69	34	21	2	12	Complete. Unsurveyed sites are not fish streams.
Humboldt 169	34	214	9	5	1	0	3	Complete. Unsurveyed sites are not fish streams.
Humboldt 254	46	359	22	12	5	3	2	Complete. Unsurveyed sites are not fish streams.
Humboldt 299	43	396	22	17	1	0	4	Complete. Unsurveyed sites are not fish streams.
Mendocino 1	106	761	29	14	11	4	0	Complete
Mendocino 20	44	331	16	11	3	0	2	Complete. Unsurveyed sites are not fish streams.
Mendocino 101	107	1102	61	16	8	1	36	21 of the unsurveyed sites were determined not to be fish streams. A Permit to Enter was not granted for 15 sites known or very likely to support fish. These sites were included in prioritization using the First Pass Survey results
Mendocino 128	51	539	63	29	23	6	5	Complete. Three of the 5 unsurveyed sites are unlikely to have fish and the 2 remaining sites were denied a Permit to Enter.
Mendocino 162	34	360	14	6	0	1	7	Complete. Remaining sites unlikely to be fish bearing.
Mendocino 253	17	148	11	7	1	0	3	Complete. Remaining sites unlikely to be fish bearing.
Totals	**802**	**6991**	**411**	**186**	**99**	**27**	**99**	

individuals may be able to pass through the crossing under ideal conditions but the majority of fish are being blocked or significantly delayed.

Thirty-two percent (99 sites) ranked GRAY, indicating that these sites are likely to present difficult passage conditions under some conditions or for some of the target fish. The GRAY-ranked sites are often those sites that can be made passable without complete replacement, and perhaps with only minor modifications.

The remaining sites ranked GREEN (27 sites or 9% of sites), meaning that these sites provide good passage conditions for all species and lifestages of fish.

3.3 Prioritization

Following the prioritization procedure described in Section 2.10, and taking into account the recommendations of fisheries and watershed professionals at the November 4, 2004 meeting, sites were ranked by score to identify the top sites for remediation or replacement. In some cases, a site was moved up in the ranking because of additional information such as current restoration or barrier removal activities in the watershed; these sites are identified by additional comments.

The current prioritization ranking for all surveyed sites in Caltrans District 1 is included as Table B.1 in Appendix B. Green-ranked stream crossings were not included in the prioritization list; their characteristics and locations are listed in Table B.2. All sites that remain unsurveyed are described in Table B.3. Appendix B also contains additional tables listing the prioritization of Red and Gray-ranking sites by county and describing all Green-ranked and unsurveyed sites in Del Norte, Humboldt and Mendocino counties.

3.3.1 Top Twenty-five Priority Sites

The top 25 priority sites (Table 3.2) were identified through application of CDFG's prioritization protocol and input from fisheries and watershed professionals. Detailed descriptions of and preliminary recommendations for each of the 25 sites are included as Appendix C. This prioritized list should not be considered static. Stream crossings often change gradually over time and may change drastically following major floods or in responding to rapidly changing watershed characteristics. Opportunities for restoration will also modify the order in which sites are remediated to take advantage of cooperative efforts by multiple landowners. Periodic re-evaluation of fish passage sites and updating as sites are remediated is required to maintain a current priority list that can incorporate stream crossings into project planning efforts.

In addition to the prioritization uncertainty introduced by changing conditions, many of the streams have not had detailed habitat surveys. When a habitat survey was not available, the length of upstream habitat was estimated using USGS 1:24K topographic maps to identify the length of channel upstream before a sustained eight percent channel

gradient existed. These maps provide a good estimate of overall channel slope but often fail to capture abrupt natural barriers such as small falls and rarely include man-made barriers, such as diversions and instream alterations. The upstream habitat quantity is a major uncertainty in the prioritization process that cannot be easily checked or corrected given current access permission requirements.

Recognizing that project planning is often initiated at scales smaller than District wide, the prioritization results are also presented at the county level. Tables 3.3–5 summarize the top 10 sites for each county in District 1. Because Mendocino County had 12 sites ranking in the top 25 district-wide sites, all of its top ten sites are on both lists. Humboldt County with seven of the top 25 has an additional 3 sites on its top ten list and Del Norte County, with only six sites in the top 25 district-wide sites has 4 additional sites. Additional combinations for prioritization (e.g. on a State Highway or County/ State Highway basis) are available electronically.

Table 3.2. Top 25 Priority Sites for Fish Passage Remediation in Caltrans District 1

RANK	County	Route	Post Mile	Stream Name	Calwater Unit Hydrologic Subarea (HSA)	Presumed Species Diversity	Length of Upstream Habitat	TOTAL SCORE	References	Comments
1	**Humboldt**	**254**	4.18	Fish Creek	Weott	Coho, Chinook, Steelhead	8,600	29.00	A, B	
2	**Mendocino**	**101**	52.25	Ryan Creek	Outlet Creek	Coho, Chinook, Steelhead	9,000	28.00	A, D	Access was denied for site survey. Culvert is a 5-ft diameter corrugated metal pipe with outlet at stream grade and a concrete bottom lining but slope is unknown. Assumed some minimal adult passage for a barrier score of 14.
3	**Mendocino**	**101**	81.46	Rattlesnake Creek	Benbow	Coho, Chinook, Steelhead	41,000	27.50	A, B	
4	**Del Norte**	**197**	5.00	Sultan Creek	Smith River Plain	Coho, Chinook, Steelhead, Coastal Cutthroat Trout	4,500	27.38	A, D	
5	**Mendocino**	**101**	48.14	Upp Creek	Outlet Creek	Coho, Chinook, Steelhead	7,600	27.30	A, B	
6	**Mendocino**	**101**	83.99	Rattlesnake Creek	Benbow	Coho, Chinook, Steelhead	67,700	27.00	A, B	
6	**Mendocino**	**101**	89.04	Cedar Creek	Benbow	Coho, Chinook, Steelhead	42,200	27.00	A, B	
8	**Mendocino**	**101**	52.36	Ryan Creek	Outlet Creek	Coho, Chinook, Steelhead	6,800	26.90	A, D	Access was denied for site survey. Culvert is a 5-ft diameter corrugated metal pipe with a 2.5 - 3 ft outlet perch at low flow and a concrete bottom lining but slope is unknown. Assumed no passage for a barrier score of 15.

Reference Codes

A – Species diversity taken from CDFG surveys or direct observations from local fisheries biologists. See Appendix B - Site Summaries for sources
B – Length of habitat taken from CDFG surveys
C – Species diversity assumed by presence in downstream confluence channel, size and slope of creek or observation upon site visit
D – Length of habitat estimated using USGS topographic maps
E – Presumed not a significant anadromous fish stream
R – Obtained species diversity and habitat information from Ross Taylor & Associates, Humboldt County Culvert Inventory and Fish Passage Evaluation (2000), Del Norte County Culvert Inventory and Fish Passage Evaluation (2001), or Mendocino County Culvert Inventory and Fish Passage Evaluation (2001) reports

Table 3.2. Top 25 Priority Sites for Fish Passage Remediation in Caltrans District 1, cont'd.

Rank	County	Route	Post Mile	Stream Name	Calwater Unit Hydrologic Subarea (HSA)	Presumed Species Diversity	Length of Upstream Habitat	TOTAL SCORE	References	Comments
9	**Mendocino**	**1**	58.78	Digger Creek	Noyo River	Coho, Steelhead	11,000	26.50	A, D	
10	**Del Norte**	**197**	6.15	Little Mill Creek	Smith River Plain	Coho, Chinook, Steelhead, Coastal Cutthroat Trout	4,900	26.45	A, D	Score increased from 23.45 to 26.45 to adjust Del Norte rankings to match professional consensus. Little Mill Creek has had significant restoration activity in recent years.
11	**Humboldt**	**299**	2.97	Essex Gulch	Blue Lake	Coho, Steelhead, Coastal Cutthroat Trout	6,000	26.00	C, D	A county culvert currently blocks Essex Gulch approximately 100 feet downstream of the State Highway culvert. The county culvert is perched about 5 feet. A joint project will be important if/when the county culvert is altered, as any fix to the county culvert will influence the fish passage and hydraulics of the State Highway culvert.
12	**Del Norte**	**101**	39.78	Dominie Creek	Smith River Plain	Coho, Steelhead, Coastal Cutthroat Trout	8,400	25.70	A, D	Maintenance work is needed to repair exposed and corroding rebar.
13	**Humboldt**	**101**	124.49	Little Lost Man Cr.	Orick	Coho, Chinook, Steelhead, Coastal Cutthroat Trout	4,200	25.65	A, D	
14	**Humboldt**	**101**	59.94	Strongs Creek	Ferndale	Coho, Steelhead, Coastal Cutthroat Trout	19,000	25.50	A, D	Site is likely ranked too high. Passage through this low slope, concrete box culvert is predicted to be impeded primarily by water depth.

Reference Codes

A – Species diversity taken from CDFG surveys or direct observations from local fisheries biologists. See Appendix B - Site Summaries for sources
B – Length of habitat taken from CDFG surveys
C – Species diversity assumed by presence in downstream confluence channel, size and slope of creek or observation upon site visit
D – Length of habitat estimated using USGS topographic maps
E – Presumed not a significant anadromous fish stream
R – Obtained species diversity and habitat information from Ross Taylor & Associates, Humboldt County Culvert Inventory and Fish Passage Evaluation (2000), Del Norte County Culvert Inventory and Fish Passage Evaluation (2001), or Mendocino County Culvert Inventory and Fish Passage Evaluation (2001) reports

Table 3.2. Top 25 Priority Sites for Fish Passage Remediation in Caltrans District 1, cont'd.

RANK	County	Route	Post Mile	Stream Name	Calwater Unit Hydrologic Subarea (HSA)	Presumed Species Diversity	Length of Upstream Habitat	TOTAL SCORE	References	Comments
15	**Del Norte**	**199**	31.31	Griffin Creek	Middle Fork Smith River	Coho, Chinook, Steelhead, Coastal Cutthroat Trout	9,700	25.48	A, B	Score increased from 24.28 to 25.48 to adjust Del Norte rankings to match professional consensus. Site needs in channel work to improve rock weirs at the outlet to provide passage. Consider fixing earlier as this stream crossing fix is low cost and provides a good return for the effort.
16	**Mendocino**	**101**	44.51	Unnamed Trib to Haehl Ck	Outlet Creek	Coho, Chinook, Steelhead	8,600	25.30	C, D	
17	**Mendocino**	**1**	54.62	Doyle Creek	Big River	Coho, Steelhead	12,500	25.00	A, D	
17	**Mendocino**	**1**	57.81	Mitchell Creek	Noyo River	Coho, Steelhead	13,000	25.00	A, B	
17	**Del Norte**	**197**	2.12	Peacock Creek	Smith River Plain	Coho, Chinook, Steelhead, Coastal Cutthroat Trout	6,000	25.00	A, D	Score increased from 21.50 to 25.00 to adjust Del Norte rankings to match professional consensus.
20	**Mendocino**	**1**	4.64	Fish Rock Gulch	Garcia River	Coho, Steelhead	2,900	24.68	A, D	

Reference Codes

A – Species diversity taken from CDFG surveys or direct observations from local fisheries biologists. See Appendix B - Site Summaries for sources
B – Length of habitat taken from CDFG surveys
C – Species diversity assumed by presence in downstream confluence channel, size and slope of creek or observation upon site visit
D – Length of habitat estimated using USGS topographic maps
E – Presumed not a significant anadromous fish stream
R – Obtained species diversity and habitat information from Ross Taylor & Associates, Humboldt County Culvert Inventory and Fish Passage Evaluation (2000), Del Norte County Culvert Inventory and Fish Passage Evaluation (2001), or Mendocino County Culvert Inventory and Fish Passage Evaluation (2001) reports

Table 3.2. Top 25 Priority Sites for Fish Passage Remediation in Caltrans District 1, cont'd.

RANK	County	Route	Post Mile	Stream Name	Calwater Unit Hydrologic Subarea (HSA)	Presumed Species Diversity	Length of Upstream Habitat	TOTAL SCORE	References	Comments
21	**Del Norte**	**101**	2.22	Waukell Creek	Klamath Glen	Coho, Steelhead, Coastal Cutthroat Trout	5,000	24.00	A, D	The highest priority barrier on Waukell Ck is the concrete channel (a > 25% slope) just downstream of the stream crossing at PM 2.22. The stream crossing should only be addressed before the concrete channel is passable to provide upstream passage for resident coastal cutthroat trout into the Waukell Creek headwaters.
22	**Humboldt**	**101**	95.60	Strawberry Creek	Blue Lake	Coho, Steelhead, Coastal Cutthroat Trout	18,000	24.00	A, R	Just upstream of this culvert, the stream is channelized in a trapezoidal, concrete channel along Central Avenue through McKinleyville. Fish access into the Strawberry Creek watershed requires remediation of the State Highway culvert and the concrete channel both of which are Caltrans property.
22	**Humboldt**	**36**	9.92	Flannigan Creek	Hydesville	Chinook, Coho, Steelhead	3,800	23.90	B, C	
24	**Mendocino**	**20**	30.87	Unnamed Trib to Broaddus Creek	Outlet Creek	Coho, Chinook, Steelhead	3,700	23.85	C, D	
25	**Humboldt**	**101**	99.03	Luffenholtz Creek	Big Lagoon	Steelhead, Coastal Cutthroat Trout	37,000	23.50	A, R	Site is likely ranked too high. Downstream barriers, both natural and road culverts, prevent anadromous fish access (Taylor, 2000). Luffenholtz Creek provides very good resident salmonid habitat but anadromous use is unlikely.

Reference Codes
A – Species diversity taken from CDFG surveys or direct observations from local fisheries biologists. See Appendix B - Site Summaries for sources
B – Length of habitat taken from CDFG surveys
C – Species diversity assumed by presence in downstream confluence channel, size and slope of creek or observation upon site visit
D – Length of habitat estimated using USGS topographic maps
E – Presumed not a significant anadromous fish stream
R – Obtained species diversity and habitat information from Ross Taylor & Associates, Humboldt County Culvert Inventory and Fish Passage Evaluation (2000), Del Norte County Culvert Inventory and Fish Passage Evaluation (2001), or Mendocino County Culvert Inventory and Fish Passage Evaluation (2001) reports

Table 3.3. Top 10 Priority Sites for Fish Passage Remediation in Del Norte County. Ranks are rank within Del Norte County, not District 1.

RANK	County	Route	Post Mile	Stream Name	Calwater Unit Hydrologic Subarea (HSA)	Presumed Species Diversity	Length of Upstream Habitat	TOTAL SCORE	References	Comments
1	**Del Norte**	**197**	5.00	Sultan Creek	Smith River Plain	Coho, Chinook, Steelhead, Coastal Cutthroat Trout	4,500	27.38	A, D	
2	**Del Norte**	**197**	6.15	Little Mill Creek	Smith River Plain	Coho, Chinook, Steelhead, Coastal Cutthroat Trout	4,900	26.45	A, D	Score increased from 23.45 to 26.45 to adjust Del Norte rankings to match professional consensus. Little Mill Creek has had significant restoration activity in recent years.
3	**Del Norte**	**101**	39.78	Dominie Creek	Smith River Plain	Coho, Steelhead, Coastal Cutthroat Trout	8,400	25.70	A, D	Maintenance work is needed to repair exposed and corroding rebar.
4	**Del Norte**	**199**	31.31	Griffin Creek	Middle Fork Smith River	Coho, Chinook, Steelhead, Coastal Cutthroat Trout	9,700	25.48	A, B	Score increased from 24.28 to 25.48 to adjust Del Norte rankings to match professional consensus. Site needs in channel work to improve rock weirs at the outlet to provide passage. Consider fixing earlier as this stream crossing fix is low cost and provides a good return for the effort.
5	**Del Norte**	**197**	2.12	Peacock Creek	Smith River Plain	Coho, Chinook, Steelhead, Coastal Cutthroat Trout	6,000	25.00	A, D	Score increased from 21.50 to 25.00 to adjust Del Norte rankings to match professional consensus.
6	**Del Norte**	**101**	2.22	Waukell Creek	Klamath Glen	Coho, Steelhead, Coastal Cutthroat Trout	5,000	24.00	A, D	The highest priority barrier on Waukell Ck is the concrete channel (a > 25% slope) just downstream of the stream crossing at PM 2.22. The stream crossing should only be addressed before the concrete channel is passable to provide upstream passage for resident coastal cutthroat trout into the Waukell Creek headwaters.
7	**Del Norte**	**197**	0.36	Rock Creek	Smith River Plain	Coho, Chinook, Steelhead, Coastal Cutthroat Trout	600	23.30	A, D	

Table 3.3. Top 10 Priority Sites for Fish Passage Remediation in Del Norte County, cont'd. Ranks are rank within Del Norte County, not District 1.

RANK	County	Route	Post Mile	Stream Name	Calwater Unit Hydrologic Subarea (HSA)	Presumed Species Diversity	Length of Upstream Habitat	TOTAL SCORE	References	Comments
8	**Del Norte**	**199**	2.56	Clarks Creek	Lower Smith River	Coho, Chinook, Steelhead, Coastal Cutthroat Trout	6,100	27.10	A, B, R	Clarks Creek has the most pristine habitat of any of the Del Norte County streams and is a high priority for fish access. The crossing has baffles and is predicted to pass adult salmonids but not resident or juvenile salmoinds.
9	**Del Norte**	**101**	35.56	Tryon Creek	Lower Smith River	Coho, Steelhead, Coastal Cutthroat Trout	1,400	22.20	A, D	Tryon Creek is likely ranked too high. Habitat is poor and tide gate barriers downstream limit access to Tryon Creek.
10	**Del Norte**	**101**	31.75	Brush or Bush Creek (local name)	Lower Smith River	Coho, Steelhead, Coastal Cutthroat Trout	1,800	21.90	A, R	

Reference Codes
A – Species diversity taken from CDFG surveys or direct observations from local fisheries biologists. See Appendix B - Site Summaries for sources
B – Length of habitat taken from CDFG surveys
C – Species diversity assumed by presence in downstream confluence channel, size and slope of creek or observation upon site visit
D – Length of habitat estimated using USGS topographic maps
E – Presumed not a significant anadromous fish stream
R – Obtained species diversity and habitat information from Ross Taylor & Associates, Humboldt County Culvert Inventory and Fish Passage Evaluation (2000), Del Norte County Culvert Inventory and Fish Passage Evaluation (2001), or Mendocino County Culvert Inventory and Fish Passage Evaluation (2001) reports

Table 3.4. Top 10 Priority Sites for Fish Passage Remediation in Humboldt County. Ranks are rank within Humboldt County, not District 1.

RANK	County	Route	Post Mile	Stream Name	Calwater Unit Hydrologic Subarea (HSA)	Presumed Species Diversity	Length of Upstream Habitat	TOTAL SCORE	References	Comments
1	**Humboldt**	**254**	4.18	Fish Creek	Weott	Coho, Chinook, Steelhead	8,600	29.00	A, B	
2	**Humboldt**	**299**	2.97	Essex Gulch	Blue Lake	Coho, Steelhead, Coastal Cutthroat Trout	6,000	26.00	C, D	A county culvert currently blocks Essex Gulch approximately 100 feet downstream of the State Highway culvert. The county culvert is perched about 5 feet. A joint project will be important if/when the county culvert is altered, as any fix to the county culvert will influence the fish passage and hydraulics of the State Highway culvert.
3	**Humboldt**	**101**	124.49	Little Lost Man Cr.	Orick	Coho, Chinook, Steelhead, Coastal Cutthroat Trout	4,200	25.65	A, D	
4	**Humboldt**	**101**	59.94	Strongs Creek	Ferndale	Coho, Steelhead, Coastal Cutthroat Trout	19,000	25.50	A, D	
5	**Humboldt**	**101**	95.60	Strawberry Creek	Blue Lake	Coho, Steelhead, Coastal Cutthroat Trout	18,000	24.00	A, R	Just upstream of this culvert, the stream is channelized in a trapezoidal, concrete channel along Central Avenue through McKinleyville. Fish access into the Strawberry Creek watershed requires remediation of the State Highway culvert and the concrete channel both of which are Caltrans property.
6	**Humboldt**	**36**	9.92	Flannigan Creek	Hydesville	Chinook, Coho, Steelhead	3,800	23.90	B, C	
7	**Humboldt**	**101**	99.03	Luffenholtz Creek	Big Lagoon	Steelhead, Coastal Cutthroat Trout	37,000	23.50	A, R	Site is likely ranked too high. Downstream barriers, both natural and road culverts, prevent anadromous fish access (Taylor, 2000). Luffenholtz Creek provides very good resident salmonid habitat but anadromous use is unlikely.
8	**Humboldt**	**254**	40.83	Chadd Creek	Scotia	Coho, Chinook, Steelhead	4,000	22.50	A, B	
9	**Humboldt**	**101**	40.12	Chadd Creek	Scotia	Chinook, Coho, Steelhead	900	22.45	A, B	

Table 3.4. Top 10 Priority Sites for Fish Passage Remediation in Humboldt County, cont'd. Ranks are rank within Humboldt County, not District 1.

RANK	County	Route	Post Mile	Stream Name	Calwater Unit Hydrologic Subarea (HSA)	Presumed Species Diversity	Length of Upstream Habitat	TOTAL SCORE	References	Comments
10	**Humboldt**	**96**	36.88	Crawford Creek	Orleans	Steelhead	7,000	22.25	K1, K2	
11	**Humboldt**	**36**	5.18	Wilson Creek (sign)	Hydesville	Chinook, Coho, Steelhead	5,400	22.20	A, D	
12	**Humboldt**	**96**	36.35	Ullathorne Creek	Orleans	Steelhead	6,000	21.50	K1, K2	

Reference Codes
A – Species diversity taken from CDFG surveys or direct observations from local fisheries biologists. See Appendix B - Site Summaries for sources
B – Length of habitat taken from CDFG surveys
C – Species diversity assumed by presence in downstream confluence channel, size and slope of creek or observation upon site visit
D – Length of habitat estimated using USGS topographic maps
E – Presumed not a significant anadromous fish stream
R – Obtained species diversity and habitat information from Ross Taylor & Associates, Humboldt County Culvert Inventory and Fish Passage Evaluation (2000), Del Norte County Culvert Inventory and Fish Passage Evaluation (2001), or Mendocino County Culvert Inventory and Fish Passage Evaluation (2001) reports
K1 – Species diversity from Karuk Tribal Fisheries
K2 – Habitat information from Karuk Tribal Fisheries

Table 3.5. Top 10 Priority Sites for Fish Passage Remediation in Mendocino County. Ranks are rank within Mendocino County, not District 1.

RANK	County	Route	Post Mile	Stream Name	Calwater Unit Hydrologic Subarea (HSA)	Presumed Species Diversity	Length of Upstream Habitat	TOTAL SCORE	References	Comments
1	**Mendocino**	**101**	52.25	Ryan Creek	Outlet Creek	Coho, Chinook, Steelhead	9,000	28.00	A, D	Access was denied for site survey. Culvert is a 5-ft diameter corrugated metal pipe with outlet at stream grade and a concrete bottom lining but slope is unknown. Assumed some minimal adult passage for a barrier score of 14.
2	**Mendocino**	**101**	81.46	Rattlesnake Creek	Benbow	Coho, Chinook, Steelhead	41,000	27.50	A, B	
3	**Mendocino**	**101**	48.14	Upp Creek	Outlet Creek	Coho, Chinook, Steelhead	7,600	27.30	A, B	
4	**Mendocino**	**101**	83.99	Rattlesnake Creek	Benbow	Coho, Chinook, Steelhead	67,700	27.00	A, B	
4	**Mendocino**	**101**	89.04	Cedar Creek	Benbow	Coho, Chinook, Steelhead	42,200	27.00	A, B	
6	**Mendocino**	**101**	52.36	Ryan Creek	Outlet Creek	Coho, Chinook, Steelhead	6,800	26.90	A, D	Access was denied for site survey. Culvert is a 5-ft diameter corrugated metal pipe with a 2.5 - 3 ft outlet perch at low flow and a concrete bottom lining but slope is unknown. Assumed no passage for a barrier score of 15.
7	**Mendocino**	**1**	58.78	Digger Creek	Noyo River	Coho, Steelhead	11,000	26.50	A, D	
8	**Mendocino**	**101**	44.51	Unnamed Trib to Haehl Ck	Outlet Creek	Coho, Chinook, Steelhead	8,600	25.30	C, D	
9	**Mendocino**	**1**	54.62	Doyle Creek	Big River	Coho, Steelhead	12,500	25.00	A, D	
10	**Mendocino**	**1**	57.81	Mitchell Creek	Noyo River	Coho, Steelhead	13,000	25.00	A, B	

Reference Codes

A – Species diversity taken from CDFG surveys or direct observations from local fisheries biologists. See Appendix B - Site Summaries for sources
B – Length of habitat taken from CDFG surveys
C – Species diversity assumed by presence in downstream confluence channel, size and slope of creek or observation upon site visit
D – Length of habitat estimated using USGS topographic maps

3.4 Comparison of Caltrans and County Prioritizations

In Caltrans District 1, the counties (Del Norte, Humboldt, and Mendocino) completed initial fish passage assessment of their stream crossings in 2000 (Humboldt County) and 2001 (Del Norte and coastal Mendocino County). Tables 3.6–8 describe stream crossing sites in watersheds where both County and Caltrans stream crossings exist. Del Norte County has significant overlap of watersheds with stream crossings of both County roads and State Highways so only streams with County sites ranking in the top 15 that also have State Highway crossings are included. In Del Norte County, the County's top five sites have been fixed but only two of these streams have Caltrans crossings that need remediation (Clarks Creek, DN199 PM 2.56 and Peacock Creek, DN 197 PM 2.12). The remaining sites are lower priority for remediation, generally due to limited habitat or fish presence.

Humboldt and Mendocino County's priority stream crossings had little overlap with the Caltrans sites so all sites are included in those comparison tables. Essex Gulch (HUM299, PM 2.97) and Strawberry Creek (HUM101, PM 95.60) are the highest-ranking sites with both County and Caltrans crossings in Humboldt County. The County and Caltrans crossings at Essex Gulch are adjacent with the County crossing just downstream of the State Highway crossing and currently creating a total barrier to fish passage due to an excessive outlet perch. Any modifications to either crossing would require cooperation between Humboldt County and Caltrans. At Strawberry Creek, the Caltrans crossing and its associated upstream channel are the most downstream barriers in the system.

In Mendocino County, the two Ryan Creek crossings on MEN101 (PM 52.25 and 52.36) are 500 feet upstream from a County crossing that is scheduled for replacement in 2005. Numerous anadromous salmonid species (T. Weseloh, Pers. Comm., 2004) have been observed blocked by the County culvert. When the County crossing is replaced, the MEN101 crossings will be the most downstream barriers. Because Ryan Creek splits into two forks just upstream of the County culvert, each of the Caltrans culverts blocks a significant length of upstream habitat to a fork of Ryan Creek.

Table 3.6. Comparison of Del Norte County Stream Crossings Prioritization to Caltrans.

County Stream Crossing Priority Rank	County Stream Crossing	Status of County Crossing[1]	Location of Caltrans Stream Crossing	Passage Status of Caltrans stream crossing	Caltrans Stream Crossing Priority Rank[2]
1	Jordan Creek at Parkway Dr	Crossing replaced with an open bottom, CON/SPAN arch in 2000.	DN101 crossing at PM 30.31 is 1500 feet downstream	The DN101 crossing of the mainstem Jordan Creek at PM 30.31 is a Green-ranked site that presents no barrier or hindrance to fish passage.	Does not need remediation. Not on priority list.
2	Clark's Creek at Walker Rd	Crossing replaced with a bridge in 2002.	DN199 crossing at PM 2.56 is 1400 ft upstream	The DN199 crossing is modified with baffles through one barrel so allows some adult passage. Site ranked high for remediation because of excellent habitat in Clark's Creek.	8
3	Peacock Creek at Tan Oak Dr	Crossing modified for fish passage by addition of fishway at the outlet in 2003	DN197 crossing at PM 2.12 is 1000 ft upstream	The DN197 crossing allows significant adult passage. Priority ranking increased because of significant watershed restoration efforts.	5
4	Jordan Creek at Elk Valley Rd	Crossing replaced with an open bottom, CON/SPAN arch in 2003.	DN101 crossing at PM 30.31 is 4500 feet downstream	The DN101 crossing of the mainstem Jordan Creek at PM 30.31 is a Green-ranked site that presents no barrier or hindrance to fish passage.	Does not need remediation. Not on priority list.
5	Mynot Creek at Mynot Creek Rd	Crossing replaced an open bottom, CON/SPAN arch in 2003.	Highway crossing at PM 8.14 is 700 ft downstream	Highway crossing is a natural bottom bridge and presents no barrier to fish passage.	Does not need remediation. Not on priority list.
6	Yonker's Creek at Wonderstump Rd	Submitted for treatment but	DN101 crossing at PM 32.24 is 1600 ft upstream	The DN101 crossing provides significant passage for all species and lifestages.	42

1 – Status of County road culverts taken from DEL NORTE COUNTY CULVERT INVENTORY AND FISH PASSAGE EVALUATION (Taylor, 2001) or personal communication with County personnel.

2 – This Caltrans priority rank considers only the State Highway fish passage sites in Del Norte County only, not all of District 1.

Table 3.6. Comparison of Del Norte County Stream Crossings Prioritization to Caltrans, cont'd.

County Stream Crossing Priority Rank	County Stream Crossing	Status of County Crossing[1]	Location of Caltrans Stream Crossing	Passage Status of Caltrans stream crossing	Caltrans Stream Crossing Priority Rank[2]
7	Nune's Creek at Elk Valley Rd	Moderate priority due to limited spawning and rearing habitat upstream of crossing. Coho salmon adults are able to pass on most flows.	DN101 crossing at PM 26.15 is 2.9 miles downstream right at the mouth of Elk Creek.	The DN101 Elk Creek crossing is a backwatered, low slope box culvert that does not block or hinder fish passage.	Does not need remediation. Not on priority list.
8	Lopez Creek at Oceanview Dr	Moderate-priority. A total barrier to all species and lifestages but there is limited upstream habitat (1,700'). Downstream habitat is of margin quality too.	DN101 crossing at PM 43.75 is 1100 ft downstream	The DN101 crossing is predicted to be a barrier due to water depth. May allow some passage.	16
9	Ritmer Creek at Oceanview Rd	Moderate-priority. A total barrier to all species and lifestages but there is limited upstream habitat. Downstream habitat is of marginal quality too.	DN101 crossing at PM 41.41 is 2800 ft downstream	The DN101 crossing is predicted to be a complete barrier due to leap height and water depth.	19
11	Elk Creek tributary at Elk Valley Rd	Moderate/low-priority due to: limited upstream habitat and partial passage of adults and older juveniles.	DN101 crossing at PM 26.15 is 2.5 miles downstream right at the mouth of Elk Creek.	The Elk Creek crossing is a backwatered, low slope box culvert that does not block or hinder fish passage.	Does not need remediation. Not on priority list.
12	Jordan Creek tributary #3 at Campground Loop in Keller Park	Moderate/low- priority due to: limited upstream habitat (900') and presence of numerous spawning cutthroat upstream of crossing.	DN101 crossing at PM 31.11 is 500 feet upstream	The DN101 crossing is predicted to be a barrier due to water depth. May allow some passage.	21
13	Jordan Creek tributary #2 at Cunningham Lane	Moderate/low-priority due to: limited amount of upstream habitat, and partial passage of adults and juveniles through current crossing.	DN101 crossing at PM 31.11 is 1300 feet upstream		
15	Brush Creek at Wonderstump Rd	Moderate/low-priority because current crossing allows adult migration on most flows and partial juvenile migration.	DN 101 crossing at PM 31.75 is 3000 feet upstream	Outlet is backwatered but culvert is predicted to be a complete barrier due to water depth and velocity. A hydraulic jump is predicted at fish passage design flows.	10

1 – Status of County road culverts taken from DEL NORTE COUNTY CULVERT INVENTORY AND FISH PASSAGE EVALUATION (Taylor, 2001) or personal communication with County personnel.

2 – This Caltrans priority rank considers only the State Highway fish passage sites in Del Norte County only, not all of District 1.

Table 3.7 Comparison of Humboldt County Stream Crossings Prioritization to Caltrans.

County Stream Crossing Priority Rank	County Stream Crossing	Status of County Crossing[1]	Location of Caltrans Stream Crossing	Passage Status of Caltrans stream crossing	Caltrans Stream Crossing Priority Rank[2]
Not yet determined	Essex Gulch	Just assessed in the Humboldt County cleanup. Will rank high (pers. comm. R. Taylor, Nov. 2004)	HUM299 crossing at PM 2.97 is 100 ft upstream	Essex Gulch is currently blocked by a county culvert approximately 100 feet downstream of the State Highway culvert. The county culvert is perched about 5 feet. A joint project will be important if/when the county culvert is altered as any fix to the county culvert will influence the fish passage and hydraulics of the State Highway culvert.	2
22	Rocky Gulch at Old Arcata Rd	Historic coho, steelhead and cutthroat stream. Dropped in priority due to decline in habitat condition from past and current landuse practices	HUM101 crossing at PM 83.61 is 2500 feet downstream	The HUM101 crossing is a Green-ranked site that presents no barrier or hindrance to fish passage. Just downstream of the HUM101 crossing is a railroad crossing and tidegates that limit passage at the mouth of Rocky Gulch.	Does not need remediation. Not on priority list.
26	Strawberry Creek at Dows Prairie Rd	Dropped in priority because this crossing is located upstream of two other potential barriers.	HUM101 crossing at PM 95.60 is 1.3 miles downstream	Just upstream of this culvert, the stream is channelized in a steep trapezoidal, concrete channel along Central Avenue through McKinleyville. Fish access into the Strawberry Creek watershed requires remediation of both the State Highway culvert and the concrete channel.	6
32	Strawberry Creek at Central Avenue	Dropped in priority because of probable passage problem at Highway 101	HUM101 crossing at PM 95.60 is 800 feet downstream		
28	Luffenholtz Creek at Westhaven Dr	This culvert is a barrier to resident rainbow and cutthroat trout located in middle of long fish-bearing stream reach. Treatment with baffles, weirs, and outlet beam would be relatively inexpensive.	HUM101 crossing at PM 99.03 is 1200 feet downstream	The HUM101 culvert is a total barrier because of a steep slope, a leap over an outlet weir and a cascade over boulders just downstream of the culvert outlet. Natural barriers at the creek outlet likely prevent anadromous adult access.	8
33	Luffenholtz Creek at Trinidad Scenic Dr	Dropped in priority because a steep set of natural falls below culvert (just above beach) inhibits access to culvert outlet.	HUM101 crossing at PM 99.03 is 500 feet upstream		

1 – Status and descriptions of County road culverts taken from HUMBOLDT COUNTY CULVERT INVENTORY AND FISH PASSAGE EVALUATION (Taylor, 2000) or personal communication with County personnel.

2 – This Caltrans priority rank considers only the State Highway fish passage sites in Humboldt County only, not all of District 1.

Table 3.7. Comparison of Humboldt County Stream Crossings Prioritization to Caltrans, cont'd.

County Stream Crossing Priority Rank	County Stream Crossing	Status of County Crossing[1]	Location of Caltrans Stream Crossing	Passage Status of Caltrans stream crossing	Caltrans Stream Crossing Priority Rank[2]
30	Widow White Creek at Murray Rd	Some work to improve passage in 2001	HUM101 crossing at PM 93.27 is 1700 feet downstream	The HUM101 crossing is modified with baffles and weirs and is predicted to provide some passage for adult anadromous salmonids. The elevation between weirs presents a leap barrier to resident and juvenile salmonids.	24
31	Widow White Creek at McKinleyville Rd	Some work to improve passage in 2001	HUM101 crossing at PM 93.27 is 3200 feet downstream		
41	Mill Creek at Central Avenue	Culvert set at grade, not a barrier. Located just upstream of natural barrier to anadromous fish (20 ft waterfall)	HUM101 crossing at PM 90.83 is 2900 feet downstream	The HUM101 crossing provides good passage conditions to adult anadromous and resident salmonids and some passage to juvenile salmonids so ranks very low on the prioritization list.	92
45	Mill Creek at Turner Road	Dropped because of natural barrier of 20' high falls 200' upstream. Between Turner Road and Highway 101 there is approximately 3,900' of fair/good anadromous habitat	HUM101 crossing at PM 90.83 is 2100 feet downstream		

1 – Status and descriptions of County road culverts taken from HUMBOLDT COUNTY CULVERT INVENTORY AND FISH PASSAGE EVALUATION (Taylor, 2000) or personal communication with County personnel.

2 – This Caltrans priority rank considers only the State Highway fish passage sites in Humboldt County only, not all of District 1.

Table 3.8 Comparison of Mendocino County Stream Crossings Prioritization to Caltrans.

County Stream Crossing Priority Rank	County Stream Crossing	Status of County Crossing[1]	Relative Location to Caltrans Stream Crossing	Passage Status of Caltrans stream crossing	Caltrans Stream Crossing Priority Rank[2]
2	Ryan Creek at Ryan Creek Road	Crossing scheduled for replacement in 2005. High-priority watershed with adult coho, chinook, steelhead, and Pacific lamprey all recently observed in outlet pool (Harris, DFG pers. comm. To R. Taylor).	There are two MEN101 crossings at PM 52.25 and 52.36 both 500 feet upstream of the County crossing	Access permission was denied for these sites. Passage conditions assumed from first pass data collection.	Using the estimated data, these two sites rank 1st (PM52.25) and 6th (PM52.36)
6	Digger Creek at Ocean Dr	Crossing replaced in 2003.	MEN01 crossing at PM 58.78 is 600 feet upstream	The MEN01 crossing has a perched outlet (2.3 feet) that is predicted to block passage for all species and lifestages.	7
16	Witherell Creek at Anderson Valley Way	Low-priority due to: poor quality of upstream habitat; additional potential barriers upstream and downstream; and limited presence of salmonids within watershed. High cost of fill removal also was reason to drop site in final ranking.	MEN128 crossing at PM 27.14 is 500 feet upstream.	Unknown. Access permission was denied for this site.	Not determined
24	Virgin Creek at Airport Road	Low-priority due to: current crossing allows for adult and juvenile passage; also, upstream habitat is degraded. Site should be periodically inspected for condition. Culvert is undersized, when needed, replace with a properly-sized crossing.	MEN01 crossing at PM 63.56 is 5400 feet downstream	The MEN01 crossing is a Green-ranked site that presents no barrier or hindrance to fish passage.	Does not need remediation. Not on priority list.

1 – Status of County road culverts taken from COASTAL MENDOCINO COUNTY CULVERT INVENTORY AND FISH PASSAGE EVALUATION (Taylor, 2001) or personal communication with County personnel.

2 – This Caltrans priority rank considers only the State Highway fish passage sites in Mendocino County only, not all of District 1.

4 RECOMMENDATIONS AND IMPLEMENTATION

The prioritization list for stream crossing remediation on State Highways in Caltrans District 1 is not a definitive order for which remediation projects should be planned and addressed but a guidance document identifying sites needing remediation and ranking high for either species diversity, extent of barrier, habitat or some combination of these conditions. The data upon which the prioritizations are based is very reliable with the exception of the upstream habitat quantity and quality values for those sites lacking on the ground habitat surveys and relying on habitat estimates using topographic maps. The habitat quality and quantity is a major factor in the prioritization process but given the access requirements for stream habitat surveys currently in place in California these values cannot be easily obtained or confirmed. Full-scale habitat surveys are recommended for those sites ranking high on the prioritization list and having only map estimates of habitat quantity.

There are many sites ranking lower than the top twenty-five listed in the report (see Appendix B tables) that may be considered for remediation prior to the top ranking sites because projects are scheduled for their routes or to complement planned or active restoration activities in their watershed. Some of these possible sites were described in Tables 3.6-8 comparing Caltrans and County stream crossings in the same watershed.

While the opportunity for remediation will strongly influence the order of remediation, the cost is also a major factor and the cost and effort for remediation can vary greatly from site to site. Passage problems at low slope or slightly perched outlet sites can likely be addressed by in-barrel and outlet modification without complete crossing replacement. These sites will likely present more opportunities for remediation than sites requiring full replacement. The site summaries for each of the top 25 sites in District 1 (Appendix C) indicate whether the site fish passage problems are likely to be addressed by moderate or extensive modifications. Site summaries and similar recommendations for lower ranking sites are available in the separate route report volumes.

A final consideration is that stream crossing sites are rarely static; they respond to watershed and stream processes to alter the crossing's function over time and changes may be especially drastic after flood events. Thus, site status and the prioritization lists will need to be periodically updated to reflect both site changes over time and to reflect completed remediation projects. Reassessment of sites every 5 years or after a significant flood event (recommend the 10-year recurrence interval flood as it matches the design for full flow for most Caltrans culvert sites) should capture site changes over time and allow Caltrans to maintain an up-to-date database of fish passage site status.

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Appendix A

First and Second Pass Data Sheets

Survey Data Sheets	
Original First Pass Data Sheet	A-1
Expanded First Pass Data Sheet	A-2
Original Second Pass Data Sheet	A-9
Expanded Second Pass Data Sheet	A-10

First Pass - Fish Passage Culvert Identification Data Sheet

Crew: _____ Date: _____

Culvert No. ____of _____ (from Left Bank to Right Bank)

Road:	Mile Post:	Cross Road:
Named Stream:		Watershed:
USGS Quad:		Lat/Long:

Culvert Information

Culvert Type: Circular Pipe Arch Box Open Arch Other: Diameter or Height (ft): _____ Width (ft): _____	**Material:** CSP CMP-*Al* SSP Plastic Concrete Log/wood Other: _____ Condition:
Inlet type: projecting wingwalls headwall mitered Inlet Apron: yes no	**Embedded:** yes no If yes, is embedding continuous? yes no

Barrel Retrofit (weirs/baffles)**:** yes no Type: _____

Description/Condition:

Outlet configuration: At stream grade Freefall into pool Cascade over riprap Drop (ft) _____

Outlet Apron: yes no

Tailwater Control: pool tailout Weir: log boulder concrete No. of Weirs: _____

channel x-section(no pool)

Fisheries Information

Historic **Anadromous** Reach: yes no maybe Fish Species/Age Classes of Concern:	Presence observed during survey? Upstream Downstream none Species/age class:

Stream Information	**Access Information**
Definable channel upstream of culvert? yes no Upstream chnl slope (%): _____ Downstream chnl slope (%): _____ Upstream active channel Width: _____ ft Appear to be potential fish habitat? yes no Additional comments:	**Land Ownership** Upstream**:** Public Private Tribal Unknown Agency/Landowner: _____ Downstream**:** Public Private Tribal Unknown Agency/Landowner: _____ Outlet pool accessible from road? yes no maybe Limitations: Inlet accessible from road: yes no maybe Limitations:

Place Additional Comments and Site Sketch on Back

Expanded First Pass data sheet
Used after May 2003

CALTRANS FISH PASSAGE
FIRST PASS DATA COLLECTION

FIRST PASS SURVEY INFORMATION

USE DISTRICT CULVERT LIST, IF AVAILABLE, IN COMBINATION WITH FIELD VERIFICATION SURVEY OF STATE HIGHWAY ROUTES TO IDENTIFY POTENTIAL FISH PASSAGE CULVERTS.

SURVEYOR INFORMATION

Date: Time:	Agency performing survey:
Data recorder:	Survey team:

SITE INFORMATION

County:	Route:	Postmile:

Crossing Type: ☐ culvert ☐ bridge ☐ other Comments:_____

Stream Name: _____ Source: ☐ USGS Quad ☐ sign at site ☐ local name ☐ other

GPS Information:

Location of GPS point taken: ☐ At culvert inlet ☐ At culvert outlet ☐ At postmile paddle marker
Distance from paddle to culvert inlet: _____ (ft)

Longitude:_____	Latitude:_____	GPS Unit Brand:_____

DEVELOP LIST OF POTENTIAL FISH PASSAGE CULVERT LOCATIONS. IF A COMPLETE INVENTORIED LIST CAN BE PROVIDED BY THE DISTRICT, THIS CAN BE USED. IF COMPLETE CULVERT LIST IS NOT AVAILABLE, USING OTHER SOURCES SUCH AS MAPS, BRIDGE LOGS, ETC, AND GROUND TRUTHING OF HIGHWAY ROUTE IS NEEDED TO LOCATE POTENTIAL CULVERTS.

A. Is there a definable channel upstream of culvert? ☐ YES ☐ NO IF "NO" **END HERE**

IF "NO", RECORD COUNTY/ROUTE/PM, CULVERT TYPE, AND CULVERT SIZE. ADD TO DATABASE AS NON-FISH PASSAGE CULVERT. END HERE.

B. Does the site contain an active channel width > 2 feet? ☐ YES ☐ NO IF "NO" **END HERE**

C. Is the stream gradient < 20%? ☐ YES ☐ NO IF "NO" **END HERE**

IF ANSWER IS "NO" TO EITHER QUESTION, ADD TO DATABASE AS NON-FISH PASSAGE CULVERT. SECOND PASS SURVEYS DO NOT NEED TO BE PERFORMED. END HERE.

Total # of Culverts: _____ (number from left bank to right bank, determined when facing downstream)

Total # of Segments: _____ (number from downstream to upstream)

Flow Condition: Is the stream ☐ wet ☐ dry ☐ discontinuous

Fish Presence observed during first pass survey? ☐ upstream ☐downstream ☐ in culvert ☐ not accessible ☐ no

ObservationSummary:_____

Revised 5/28/03

CALTRANS FISH PASSAGE
FIRST PASS DATA COLLECTION

Observed Downstream Barrier:

☐ dam ☐ debris jam ☐ culvert ☐ falls ☐ steep gradient
☐ lack of habitat ☐ unknown ☐ none ☐ other
Describe
other:_____
_____
_____
_____
_____

Observed Upstream Barrier:

☐ dam ☐ debris jam ☐ culvert ☐ falls ☐ steep gradient
☐ lack of habitat ☐ unknown ☐ none ☐ other
Describe
other:_____
_____
_____
_____
_____

Confined Spaces:

Can you stand up in the culvert? ☐ Yes ☐ No

Can you see all the way through the end of the culvert? ☐ Yes ☐ No

Can you feel a breeze through the culvert? ☐ Yes ☐ No

If answer is "No" to any of the above questions, site must have confined spaces equipment for surveying.

Trash Rack:

Is there a trash rack present at site? ☐ Yes ☐ No

What is the distance upstream of trash rack from crossing? _____(ft)

Rack condition at survey: ☐ clean ☐ full ☐ partially full ☐ bypassed by stream channel

Flows at which trash rack is being bypassed: ☐ low flows ☐ high flows ☐ all flows

FISHERIES INFORMATION

IF SITE IS NOT A FISH BEARING STREAM, SECOND PASS SURVEYS DO NOT NEED TO BE PERFORMED. RECORD COUNTY/ROUTE/POSTMILE AND CULVERT INFORMATION AND ADD TO DATABASE AS NON-FISH PASSAGE CULVERT.

Historic Anadromous Reach: ☐ yes ☐ no ☐ unknown
Source:_____
_____

Length of upstream anadromous habitat: _____ (ft)
Source:_____
_____
_____
_____
_____

Fish Species of Concern:

☐ Coho salmon ☐ Fall-run chinook ☐ Spring-run chinook
☐ Late-fall run chinook ☐ Winter run chinook

☐ Steelhead trout/anadromous ☐ Steelhead trout/resident

Source:_____
_____
_____
_____
_____

HYDROLOGY

Watershed Information:

Upstream drainage area:_____(mi^2) Mean annual precipitation_____ (in/yr)

Potential evapotranspiration:_____(in/yr) Mean elevation:_____(ft)

USGS Quad Name:	Tributary to:	Basin:

USGS Hydrologic Unit:_____ (See appendices for Table)

Calwater Hydrologic Unit (HU): _____

Calwater Hydrologic Area (HA): _____

Calwater Hydrologic Sub Area (HSA): _____

CALTRANS FISH PASSAGE
FIRST PASS DATA COLLECTION

Site Sketch (Plan/Profile/Details):

Site Description: (Unique features of the site)

CALTRANS FISH PASSAGE
FIRST PASS DATA COLLECTION

CULVERT SEGMENT INFORMATION

CULVERT _____of_____ **SEGMENT** # _____of _____

CULVERT SEGMENT SHAPE: ☐ Arch ☐ Arch-Top Box ☐ Box ☐ Circular pipe ☐ Pipe-arch ☐ Elliptical pipe

Diameter:_____(ft) Height/Rise:_____(ft) Width/Span:_____(ft) Length:_____(ft)

Culvert segment shape description: (Describe uniqueness of shape)

_____

_____

Rustline height:_____(ft)

Upstream culvert segment end type: ☐ inlet ☐ culvert segment connection ☐ discontinuous (gap in segment)

Downstream culvert segment end type: ☐ outlet ☐ culvert segment connection ☐ discontinuous (gap in segment)

Culvert connection description: (comments on this segment and its connections to upstream/downstream segments)

_____

_____

_____

CULVERT DESCRIPTION (Describe unique features of the culvert segment):

_____

_____

_____

_____

CULVERT SEGMENT
Material:

- ☐ Annular and Helical (125 mm x 25 mm)
- ☐ Annular and Helical (152 mm x 51 mm)
- ☐ Annular and Helical (229 mm x 64 mm)
- ☐ Annular and Helical (68 mm x 13 mm)
- ☐ Annular and Helical (76 mm x 25 mm)
- ☐ Cast Iron Pipe
- ☐ Clay Sewer Pipe
- ☐ Composite Steel Spiral Rib Pipe
- ☐ Concrete
- ☐ Concrete Pipe (Cast-in-place)
- ☐ Concrete Pipe (Pre-cast)
- ☐ Plastic Pipe (Corrugated Interior)
- ☐ Plastic Pipe (Smooth Interior)
- ☐ Spiral Rib Metal Pipe (19 mm (W) x 19 mm (D) @ 191 mm o/c)
- ☐ Spiral Rib Metal Pipe (19 mm (W) x 25 mm (D) @ 213 mm o/c)
- ☐ Spiral Rib Metal Pipe (19 mm (W) x 25 mm (D) @ 292 mm o/c)
- ☐ Steel Pipe, Ungalvanized
- ☐ Structural Plate
- ☐ Other:_____

CULVERT SEGMENT BOTTOM/LINING
Material:

- ☐ Same as segment material
- ☐ Annular and Helical (125 mm x 25 mm)
- ☐ Annular and Helical (152 mm x 51 mm)
- ☐ Annular and Helical (229 mm x 64 mm)
- ☐ Annular and Helical (68 mm x 13 mm)
- ☐ Annular and Helical (76 mm x 25 mm)
- ☐ Cast Iron Pipe
- ☐ Clay Sewer Pipe
- ☐ Composite Steel Spiral Rib Pipe
- ☐ Concrete
- ☐ Concrete Pipe (Cast-in-place)
- ☐ Concrete Pipe (Pre-cast)
- ☐ Plastic Pipe (Corrugated Interior)
- ☐ Plastic Pipe (Smooth Interior)
- ☐ Spiral Rib Metal Pipe (19 mm (W) x 19 mm (D) @ 191 mm o/c)
- ☐ Spiral Rib Metal Pipe (19 mm (W) x 25 mm (D) @ 213 mm o/c)
- ☐ Spiral Rib Metal Pipe (19 mm (W) x 25 mm (D) @ 292 mm o/c)
- ☐ Steel Pipe, Ungalvanized
- ☐ Structural Plate
- ☐ Bitumous Coating
- ☐ Plastic
- ☐ Grouted Rock
- ☐ Natural Substrate
- ☐ Other:_____

CALTRANS FISH PASSAGE
FIRST PASS DATA COLLECTION

CULVERT SEGMENT BOTTOM AND SIDE MATERIAL

(Note culvert segment side material by checking appropriate box in above left column)
Condition of culvert segment side material: ☐ Good ☐ Fair ☐ Poor
Condition description:_____
_____

(Note culvert segment bottom material by checking appropriate box in above right column)
Condition of culvert segment bottom material: ☐ Good ☐ Fair ☐ Poor

Condition description:_____
_____

If bottom material is natural substrate, is it embedded? ☐ Yes ☐ No
If YES, is it embedded: ☐ partially ☐ fully

Length of embeddness:_____(ft) Beginning depth:_____(ft) Ending depth:_____(ft)

Substrate: ☐ Silt/Clay ☐ Sand (<0.08") ☐ Gravel (0.08-2.5") ☐ Cobble (2.5-10") ☐ Boulder (>10") ☐ Bedrock

CULVERT SEGMENT RETROFIT (PHOTO)

Retrofit type: ☐ none ☐ corner baffles ☐ gravel retention weirs ☐ notched weirs ☐ offset baffles ☐ ramp baffle

Condition: ☐ Good ☐ Fair ☐ Poor ☐ Non-Functional

Outlet Sill (inside culvert at outlet): ☐ yes ☐ no

INLET

INLET TYPE: ☐ projecting ☐ headwall ☐ wingwall
☐ mitered ☐ flared end section ☐ segment connection

Average active channel width = or > than total culvert width
(measure of channel away from influence of culvert)
☐ yes ☐ no

Alignment: ☐ < 30^0 ☐ 30-45^0 ☐ >45^0
(inlet to channel)

Inlet Description: (Describe apron type, shape, material and other features influencing fish passage)
_____
_____
_____
_____

INLET APRON: ☐ yes ☐ no (Photo)

Upstream width: _____(ft)
(width of apron at furthest upstream point)

Downstream width: _____(ft)
(width of apron at culvert inlet)

Length of inlet apron:_____(ft)

OUTLET

OUTLET TYPE: ☐ projecting ☐ headwall ☐ wingwall
☐ mitered ☐ flared end section ☐ segment connection

Alignment: ☐ < 30^0 ☐ 30-45^0 ☐ >45^0
(outlet to channel)

Outlet Description: (Describe apron type, shape, material and other features influencing fish passage)
_____
_____
_____

OUTLET CONFIGURATION:
☐ at stream grade ☐ freefall into pool ☐ cascade over riprap
☐ freefall to apron

Outlet Elevation Drop:_____(ft)
(measured from culvert invert to water surface)
Max. Pool Depth w/in 5 ft of outlet or apron:_____(ft)
Riprap run-out distance to first pool (Photo): _____(ft)

Weir present: ☐ Yes ☐ No (Photo)
Fish Ladder: ☐ Yes ☐ No (Photo)

OUTLET APRON: ☐ yes ☐ no (Photo)

Upstream width: _____(ft)
(width of apron at outlet)

Downstream width: _____(ft)
(width of apron at the furthest downstream point)

Length of outlet apron:_____(ft)

ACCESS INFORMATION

Land Ownership

Upstream: ☐ public ☐ private ☐ tribal ☐ unknown

Agency/Landowner:_____

Downstream: ☐ public ☐ private ☐ tribal ☐ unknown

Agency/Landowner:_____

Outlet pool accessible from road? ☐ Yes ☐ No ☐ Maybe

Limitations:

Inlet accessible from road? ☐ Yes ☐ No ☐ Maybe

Limitations:

Major vegetation removal required (removal needed with large equipment)?

☐ Yes ☐ No ☐ Maybe

IF ACCESS TO SURVEY OUTSIDE OF CALTRANS RIGHT OF WAY IS NEEDED, BUT IS NOT GRANTED BY PRIVATE LAND OWNER, MAKE NOTE OF SITE AND RECORD IN DATABASE. SECOND PASS SURVEYS WILL NOT BE CONDUCTED AT THESE SITES. DOCUMENT AND RECORD SITES THAT WRITTEN PERMISSION IS NOT GRANTED BY PRIVATE LAND OWNER.

PHOTOGRAPHS

PHOTOS TAKEN:

Upstream looking upstream. Comments:_____\

Upstream looking downstream. Comments:_____

Downstream looking upstream. Comments:_____

Downstream looking downstream: Comments:_____

ADDITIONAL PHOTOS:

Orientation of photo with comments:

A.

B.

C.

D.

E.

F.

G.

Original Second Pass Data Sheet – Used April 2001 through May 2003

CalTrans Fish Passage Inventory Data Sheet

Site Name: _____ **Date:** _____.

Surveyors: Scope: _____ Rod: _____ Datasheet:_____.

Culvert #_____of_____ **Segment #**_____of_____.

Highway:	**Mile Post:**	**USGS Quad:**

Stream Information

Stream Name:

Source: ☐ 1:24K USGS MAP ☐ SIGN AT SITE ☐ LOCAL NAME ☐ OTHER:

Flow Conditions: ☐ WET-CONTINIOUS ☐ DISCONTINUOUS ☐ DRY

Tributary to:

Basin:

Fisheries Information

Fish Presence Observed During Survey: ☐ UPSTREAM ☐ DOWNSTREAM ☐ NONE OBSERVED

AGE CLASS: ☐ ADULTS ☐ JUVENILES SPECIES:_____

JUVENILE SIZE CLASSES: ☐ < 3" ☐ 3" – 6" ☐ >6"

RELATIVE ABUNDANCE: ☐ SEVERAL (<10) ☐ MODERATE (10-50) ☐ ABUNDANT (50-100) ☐ EXTREMELY ABUNDANT (>100)

Culvert Information

Culvert Type: ☐ CIRCULAR ☐ PIPE ARCH ☐ BOX ☐ OPEN-ARCH ☐ ARCH-CONC. FLOOR ☐ OTHER:

HEIGHT/DIA (ft): _____ WIDTH (ft): _____.

Material: ☐ SSP ☐ CSP ☐ CONCRETE ☐ AL ☐ PLASTIC ☐ MASONARY ☐ WOOD ☐ COMPOSITE:_____.

CORRUGATIONS (*width x depth*): ☐ 2-2/3" x ½" ☐ 3" x 1" ☐ 5" x 1" ☐ 6" x 2" ☐ OTHER: _____ ☐ HELICAL

CULVERT CONDITON: ☐ GOOD ☐ FAIR ☐ POOR ☐ NON-FUNC. DESCRIBE:

CONCRETE LINED: ☐ YES ☐ NO DEPTH: _____

RUSTLINE HT: _____

Breaks-in-Slope: ☐ YES ☐ NO NUMBER: _____

Inlet Type: ☐ PROJECTING ☐ HEADWALL ☐ WINGWALL ☐ MITERED ☐ TAPERED END-SECTION

INLET APRON ☐ YES ☐ NO

TOP WIDTH: _____ BOTTOM WIDTH: _____

DESCRIPTION:

Outlet Configuration: ☐ AT STREAM GRADE ☐ FREEFALL INTO POOL ☐ CASCADE OVER RIPRAP

OUTLET APRON ☐ YES ☐ NO

TOP WIDTH: _____ BOTTOM WIDTH: _____

DESCRIPTION:

Barrel Retrofit: ☐ NONE ☐ OFFSET ☐ RAMP ☐ CORNER ☐ NOTCHED WEIRS ☐ OTHER:_____

DESCRIBE (No., placement, material):

OUTLET BEAM: ☐ YES ☐ NO

Embedded: ☐ YES ☐ PARTIAL ☐ NO DEPTH: INLET: _____ OUTLET: _____.

SUBSTRATE: ☐ SILT/CLAY ☐ SAND (<0.08") ☐ GRAVEL (0.08-2.5") ☐ COBBLE (2.5-10") ☐ BOULDER (>10") ☐ BEDROCK

Tailwater Information
Weirs: ☐ YES ☐ NO NUMBER: _____ CONSTRUCTION: ☐ CONCRETE ☐ LOG ☐ BOULDER ☐ FISH LADDER
Natural TW Control: ☐ POOL TAILOUT ☐ NO CONTROL PT (CHNL XS) ☐ DEBRIS JAM OTHER: SUBSTRATE: ☐ SILT/CLAY ☐ SAND (<0.08”) ☐ GRAVEL (0.08-2.5”) ☐ COBBLE (2.5-10”) ☐ BOULDER (>10”) ☐ BEDROCK
Upstream Channel Widths: (1) (2) (3) (4) (5) **Average width =**

Add Site sketches and qualitative habitat comments below

SECOND PASS SURVEY INFORMATION

SURVEYOR INFORMATION

Agency performing survey:	Date:	Time:
Survey team leader:		
Scope surveyor:	Rod surveyor:	Data recorder:

SITE INFORMATION

County:	Route:	Postmile:

FISH PRESENCE INFORMATION

Fish presence observed during second pass survey? ☐ upstream ☐downstream ☐ in culvert ☐ none

Summary:_____

TAILWATER CONTROL INFORMATION

Downstream Weirs: ☐ yes ☐ no Wier count: _____

Construction: ☐ concrete ☐ log ☐ boulder ☐ sheet pile ☐ wood

Weir sizing:_____ Weir spacing:_____ Weir Condition: ☐ Good ☐ Fair ☐ Poor

Weir Description:_____

Natural Tailwater Control (below weirs if present**)** : ☐ Pool tailout ☐ No control point (do channel X.S.)

☐ bedrock ☐ large debris ☐ small debris

Substrate: ☐ silt/clay ☐ sand (<0.08”) ☐ gravel (0.08-2.5”) ☐ cobble (2.5-10”) ☐ boulder (>10”) ☐ bedrock

Active channel elevation at TWC:_____(ft) Downstream channel slope:_____(%)

Upstream Channel Slope:_____(%)

Upstream Channel Widths: (1)_____ (2) _____ (3) _____ (4) _____ (5) _____ **Average width = _____(ft)**

FILL VOLUME INFORMATION

Lu (ft)_____ Su (%)_____ Wr (ft)_____Ld (ft)_____ Sd (%)_____ Lf (ft)_____

Fill height at inlet:_____ (ft) Fill Volume:_____(yard^3)

CULVERT SEGMENT INFORMATION

CULVERT # _____ of _____	SEGMENT # _____of _____

Segment slope:_____(%) Breaks-in-Slope: ☐ Yes ☐ No Number: _____

INLET and OUTLET APRON SLOPES

Inlet Apron slope:_____(%) Outlet apron slope:_____(%)

Expanded Second Pass Data Sheet used after May 2003

CALTRANS FISH PASSAGE DATA COLLECTION

FLOW CAPACITY of CULVERT SEGMENT

Q-100 year_____(cfs) Q-50 year_____(cfs) Q-25 year_____(cfs) Q-10 year_____(cfs)

Q-Overtop inlet(s)_____(cfs) Recurrence interval_____(yr) Source:_____

Q-Overtop road _____(cfs) Recurrence interval_____(yr)

CDFG PASSAGE EVALUATION FILTER INFORMATION

Inlet width_____(ft) Active channel width_____(ft) Channel constriction_____(ft/ft) Substrate throughout ☐ yes ☐ no
Maximum slope_____(%) Residual outlet depth_____(ft) Residual inlet depth_____(ft) Baffles/Weirs ☐ yes ☐ no
Filter results_____(red,green,gray) Filter results adjusted ☐ yes ☐ no
Explanation:_____
_____

FISHXING RESULTS SUMMARY

ADULT ANADROMOUS

Qhp-Upper fish passage design flow_____cfs
Accommodates passage from _____cfs
(lowest flow for passage, none=0)
Percent flows passable _____cfs

Qlp-Lower fish passage design flow_____cfs
Accommodates passage to _____cfs
(highest flow for passage, none=0)
(% of flows between Qlp and Qhp that accommodates passage)

Assumptions and Comments_____

RESIDENT SALMONID

Qhp-Upper fish passage design flow_____cfs
Accommodates passage from _____cfs
(lowest flow for passage, none=0)
Percent flows passable _____cfs

Qlp-Lower fish passage design flow_____cfs
Accommodates passage to _____cfs
(highest flow for passage, none=0)
(% of flows between Qlp and Qhp that accommodates passage)

Assumptions and Comments_____

JUVENILE SALMONID

Qhp-Upper fish passage design flow_____cfs
Accommodates passage from _____cfs
(lowest flow for passage, none=0)
Percent flows passable _____cfs

Qlp-Lower fish passage design flow_____cfs
Accommodates passage to _____cfs
(highest flow for passage, none=0)
(% of flows between Qlp and Qhp that accommodates passage)

Assumptions and Comments_____

OTHER SPECIES

Qhp-Upper fish passage design flow_____cfs
Accommodates passage from _____cfs
(lowest flow for passage, none=0)
Percent flows passable _____cfs

Qlp-Lower fish passage design flow_____cfs
Accommodates passage to _____cfs
(highest flow for passage, none=0)
(% of flows between Qlp and Qhp that accommodates passage)

Assumptions and Comments_____

CALTRANS FISH PASSAGE DATA COLLECTION

Site sketch

Expanded Second Pass Data Sheet used after May 2003

CALTRANS FISH PASSAGE DATA COLLECTION

SURVEY DATA

Longitudinal Surveyed Elevations						Station Description and Water Depth (Bold = required)
Observation	Station (ft)	BS (+)	HI (ft)	FS (-)	Elevation (ft)	
1						**TBM:**
2						TW Control of 1st resting habitat u/s of inlet
3						Inlet Apron/Riprap
4						**Inlet Depth=**
5						**Outlet Depth=**
6						Outlet Apron/Riprap
7						**Max. Depth within 5' of outlet=**
8						Max. Pool Depth
9						**TW Control Depth=**
10						**Active Channel Stage**
11						Downstream Channel Slope (%)

Expanded Second Pass Data Sheet used after May 2003

CALTRANS FISH PASSAGE DATA COLLECTION

CULVERT PROFILE

Enter thalweg from first resting pool upstream of culvert to slope break downstream of tailwater control
Longitudinal Profile

Observation	Station (ft)	BS (+)	HI (ft)	FS (-)	Elevation (ft)	Notes
1	0					
2						
3						
4						
5						
6						
7						
8						
9						
10						
11						
12						
13						
14						
15						
16						

Break Profile
Enter length and slope of each segment between slope breaks

Observation	Length (ft)	Slope
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
11		
12		
13		
14		
15		
16		
17		
18		

Expanded Second Pass Data Sheet used after May 2003

CALTRANS FISH PASSAGE DATA COLLECTION

Upper Embedded Cross Section Elevations (cross section along substrate at end of segment)
Lower Embedded Cross Section Elevations (cross section along substrate at beginning of segment)

Observation	Station (ft)	BS (+)	HI (ft)	FS (-)	Elevation (ft)	Notes
1	0					
2						
3						
4						
5						
6						
7						
8						
9						
10						
11						
12						
13						
14						
15						
16						
17						
18						

Weirs Cross Section
Enter cross section running along the top of each weir

Observation	Station (ft)	BS (+)	HI (ft)	FS (-)	Elevation (ft)	Notes
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						

Expanded Second Pass Data Sheet used after May 2003

CALTRANS FISH PASSAGE DATA COLLECTION

Active Channel Elevation at Weirs

Enter weir number (upstream to downstream) and corresponding active channel (OHW) elevation. Elevation is measured along banks of pool upstream of wier.

Observation	Station (ft)	BS (+)	HI (ft)	FS (-)	Elevation (ft)	Notes
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						

Tailwater Cross Section

(optional; appropriate for stream crossings with little or no outlet pool, resulting in unimpeded flow downstream of the culvert outlet)

Observation	Station (ft)	BS (+)	HI (ft)	FS (-)	Elevation (ft)	Notes
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						

Expanded Second Pass Data Sheet used after May 2003

CALTRANS FISH PASSAGE DATA COLLECTION

Additional Surveyed Elevations						
Observation	Station (ft)	BS (+)	HI (ft)	FS (-)	Elevation (ft)	Notes
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						
11						
12						
13						
14						
15						
16						
17						
18						
19						
20						
21						
22						

Expanded Second Pass Data Sheet used after May 2003

CALTRANS FISH PASSAGE DATA COLLECTION

PRIORITIZATION

RANKING CRITERIA

SPECIES DIVERSITY SCORING

1) *Species diversity* **This information will be obtained when doing research on fisheries presence with resource agencies**

For each Federally or State listed salmonid species:

☐ Endangered = 4 points
☐ Threatened or Candidate = 2 points
☐ Not listed = 1 point
☐ Unknown – N/A = non computing variable

Source of information:_____

2) *Extent of Barrier* **This information will be obtained after doing hydraulic analysis**

Adult anadromous

☐ 80% or greater passable = 0 points
☐ 79-60% passable = 1 point
☐ 59-40% passable = 2 points
☐ 39-20% passable = 3 points
☐ 19% or less passable = 4 points
☐ 0% passable = 5 points

Resident salmonid

☐ 80% or greater passable = 0 points
☐ 79-60% passable = 1 point
☐ 59-40% passable = 2 points
☐ 39-20% passable = 3 points
☐ 19% or less passable = 4 points
☐ 0% passable = 5 points

Juvenile salmonid

☐ 80% or greater passable = 0 points
☐ 79-60% passable = 1 point
☐ 59-40% passable = 2 points
☐ 39-20% passable = 3 points
☐ 19% or less passable = 4 points
☐ 0% passable = 5 points

Source of Information:_____

3) *Habitat Value* – Multiply habitat quantity score by habitat quality score

a) Habitat Quantity-length in feet to a sustained 8% gradient or field identified limit of anadromy.

☐ <500N = 0.5 points (e.g. 0.5 points for each 500 feet of stream)
☐ 1,000N = 1 point
☐ 2000N = 2 points
☐ 5,500N = 5.5 points
☐ Unknown **added this**

b) Habitat Quality

☐ Excellent = 1.0 point
☐ Good = 0.75 point
☐ Fair = 0.5 point
☐ Unknown **added this**

Source of Information:_____

CALTRANS FISH PASSAGE DATA COLLECTION

4) *Sizing* – Risk of Failure

- ☐ sized for at least a 100-year flow, low risk = 0 point
- ☐ sized for at least a 50 year flow, low/moderate risk = 1 point
- ☐ sized for at least a 25 year flow, moderate risk of failure = 2 points
- ☐ sized for at least a 10 year flow, moderate/high rish of failure = 3 points
- ☐ sized for at less than a 10 year flow, high risk of failure = 4 points
- ☐ sized for less than a 5 year flow, extreme risk of failure = 5 points

5) *Fish observed during survey* **Info obtained during survey**

- ☐ yes
- ☐ no

6) *Current condition* **Information obtained during survey**

7) *Other Stream crossings* **Document if there is other know stream crossings up or downstream of site**

8) *Amount of road fill* **Information obtained during survey**

9) *Remediation project cost* **–CT to provide**

10) *Opportunity***- CT to provide**

Appendix B

Prioritization Lists and Descriptions of Green-ranked and Unsurveyed Sites

Survey Data Sheets	
District 1 Prioritization List	B-1
District 1 Green-ranked Sites Descriptions	B-12
District 1 Unsurveyed Sites Descriptions	B-13
Del Norte County Prioritization List	B-16
Del Norte County Green-ranked Sites Descriptions	B-19
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Table B1: District 1 Stream Crossing Sites - Red and Gray Ranked Sites Prioritized for Remediation

RANK	County	Route	Post Mile	Stream Name	Calwater Unit Hydrologic Subarea (HSA)	Presumed Species Diversity	Species Diversity Score	Extent of Barrier Score	Current Sizing Score	Current Condition Score	Length of Upstream Habitat	Habitat Quantity Score	Habitat Quality Modifier	Total Habitat Score	TOTAL SCORE	References	Comments
1	Humboldt	254	4.18	Fish Creek	Weott	Coho, Chinook, Steelhead	6	15	5	1	8,600	8.6	0.75	5.00	29.00	A, B	
2	Mendocino	101	52.25	Ryan Creek	Outlet Creek	Coho, Chinook, Steelhead	6	14	5	2	9,000	9	0.5	4.50	28.00	A, D	RoE not obtained for site. Culvert is 5 ft diameter CMP with outlet at stream grade and a concrete lining but slope is unknown. Assumed some minimal adult passage for a barrier score of 14.
3	Mendocino	101	81.46	Rattlesnake Creek	Benbow	Coho, Chinook, Steelhead	6	12	3	1	41,000	10	0.75	7.50	27.50	A, B	
4	Del Norte	197	5.00	Sultan Creek	Smith River Plain	Coho, Chinook, Steelhead, Coastal Cutthroat Trout	5	15	5	3	4,500	4.5	0.75	3.38	27.38	A, D	
5	Mendocino	101	48.14	Upp Creek	Outlet Creek	Coho, Chinook, Steelhead	6	15	5	0	7,600	7.6	0.5	3.80	27.30	A, B	
6	Mendocino	101	83.99	Rattlesnake Creek	Benbow	Coho, Chinook, Steelhead	6	11	4	1	67,700	10	0.75	7.50	27.00	A, B	
6	Mendocino	101	89.04	Cedar Creek	Benbow	Coho, Chinook, Steelhead	6	12	3	0	42,200	10	0.75	7.50	27.00	A, B	
8	Mendocino	101	52.36	Ryan Creek	Outlet Creek	Coho, Chinook, Steelhead	6	15	3	2	6,800	6.8	0.5	3.40	26.90	A, D	Site not yet surveyed. Culvert is 5 ft diameter CMP with a 3 ft outlet perch at low flow and a concrete lining but slope is unknown. Assumed no passage for a barrier score of 15.
9	Mendocino	1	58.78	Digger Creek	Noyo River	Coho, Steelhead	4	15	5	0	11,000	10	0.5	5.00	26.50	A, D	
10	Del Norte	197	6.15	Little Mill Creek	Smith River Plain	Coho, Chinook, Steelhead, Coastal Cutthroat Trout	5	15	2	0	4,900	4.9	0.5	2.45	26.45	A, D	Score increased from 23.45 to 26.45 to adjust Del Norte rankings to match professional consensus. Little Mill Creek has had significant restoration activity in recent years.
11	Humboldt	299	2.97	Essex Gulch	Blue Lake	Coho, Steelhead, Coastal Cutthroat Trout	5	15	5	1	6,000	6	0.5	3.00	26.00	C, D	Essex Gulch is currently blocked by a county culvert approximately 100 feet downstream of the state highway culvert. The county culvert is perched about 5 feet. A joint project will be important if/when the county culvert is altered as any fix to the county culvert will influence the fish passage and hydraulics of the state highway culvert.
12	Del Norte	101	39.78	Dominie Creek	Smith River Plain	Coho, Steelhead, Coastal Cutthroat Trout	4	15	5	0	8,400	8.4	0.5	4.20	25.70	A, D	Maintenance work is needed to repair exposed and corroding rebar.
13	Humboldt	101	124.49	Little Lost Man Cr.	Orick	Coho, Chinook, Steelhead, Coastal Cutthroat Trout	7	14	3	0	4,200	4.2	0.75	3.15	25.65	A, D	
14	Humboldt	101	59.94	Strongs Creek	Ferndale	Coho, Steelhead, Coastal Cutthroat Trout	5	15	0	1	19,000	10	0.5	5.00	25.50	A, D	Site is likely ranked too high. Passage is predicted to be impeded primarily by water depth.
15	Del Norte	199	31.31	Griffin Creek	Middle Fork Smith River	Coho, Chinook, Steelhead, Coastal Cutthroat Trout	5	12	0	0	9,700	9.7	0.75	7.28	25.48	A, B	Score increased from 24.28 to 25.48 to adjust Del Norte rankings to match professional consensus. Site needs in channel work to improve rock weirs at the outlet to provide passage. Consider fixing earlier as this stream crossing fix is low cost and provides a good return for the effort.
16	Mendocino	101	44.51	Unnamed Trib to Haehl Ck	Outlet Creek	Coho, Chinook, Steelhead	6	15	0	0	8,600	8.6	0.5	4.30	25.30	C, D	
17	Mendocino	1	54.62	Doyle Creek		Coho, Steelhead	4	15	1	1	12,500	10	0.5	5.00	25.00	A, D	
17	Mendocino	1	57.81	Mitchell Creek	Noyo River	Coho, Steelhead	4	15	2	0	13,000	10	0.5	5.00	25.00	A, B	
17	Del Norte	197	2.12	Peacock Creek	Smith River Plain	Coho, Chinook, Steelhead, Coastal Cutthroat Trout	5	10	3	1	6,000	6	0.75	4.50	25.00	A, D	Score increased from 21.50 to 25.00 to adjust Del Norte rankings to match professional consensus.
20	Mendocino	1	4.64	Fish Rock Gulch	Garcia River	Coho, Steelhead	4	15	4	3	2,900	2.9	0.75	2.18	24.68	A, D	

Table B1: District 1 Stream Crossing Sites - Red and Gray Ranked Sites Prioritized for Remediation

RANK	County	Route	Post Mile	Stream Name	Calwater Unit Hydrologic Subarea (HSA)	Presumed Species Diversity	Species Diversity Score	Extent of Barrier Score	Current Sizing Score	Current Condition Score	Length of Upstream Habitat	Habitat Quantity Score	Habitat Quality Modifier	Total Habitat Score	TOTAL SCORE	References	Comments
21	**Del Norte**	**101**	2.22	Waukell Creek	Klamath Glen	Coho, Steelhead, Coastal Cutthroat Trout	4	15	4	1	5,000	5	0.5	2.50	24.00	A, D	The highest priority barrier on Waukell Ck is the concrete channel (a > 25% slope) just downstream of the stream crossing at PM 2.22. The stream crossing should only be addressed before the concrete channel is passable if the Waukell Creek headwaters is determined to be unique habitat with a genetically significant coastal cutthroat trout population.
21	**Humboldt**	**101**	95.60	Strawberry Creek	Blue Lake	Coho, Steelhead, Coastal Cutthroat Trout	5	12	4	0	18,000	10	0.5	5.00	24.00	A, R	Just upstream of this culvert, the stream is channelized in a steep trapezoidal, concrete channel along Central Avenue through McKinleyville. Fish access into the Strawberry Creek watershed requires remediation of both the state highway culvert and the concrete channel.
23	**Humboldt**	**36**	9.92	Flannigan Creek	Hydesville	Chinook, Coho, Steelhead	6	13	5	1	3,800	3.8	0.5	1.90	23.90	B, C	
24	**Mendocino**	**20**	30.87	Unnamed Trib to Broaddus Creek	Outlet Creek	Coho, Chinook, Steelhead	6	15	1	1	3,700	3.7	0.5	1.85	23.85	C, D	
25	**Humboldt**	**101**	99.03	Luffenholtz Creek	Big Lagoon	Steelhead, Coastal Cutthroat Trout	3	15	1	0	37,000	10	0.5	5.00	23.50	A, R	
26	**Del Norte**	**197**	0.36	Rock Creek	Smith River Plain	Coho, Chinook, Steelhead, Coastal Cutthroat Trout	5	15	5	1	600	0.6	0.5	0.30	23.30	A, D	
27	**Mendocino**	**101**	82.41	Elk Creek	Benbow	Steelhead	2	12	3	1	9,500	9.5	0.75	7.13	23.13	A, B	CDFG has evidence site provides some adult passage. Extent of barrier score decreased from 15 to 12.
28	**Del Norte**	**199**	2.56	Clarks Creek	Lower Smith River	Coho, Chinook, Steelhead, Coastal Cutthroat Trout	5	11	1	1	6,100	6.1	1	6.10	23.10	A, B, R	Clarks Creek has the most pristine habitat of any of the Del Norte County streams and is a high priority for fish access. The crossing has baffles and is predicted to pass adult salmonids but not resident or juvenile salmoinds.
29	**Mendocino**	**101**	81.17	Cummings Creek	Benbow	Coho, Steelhead	4	15	3	0	4,200	4.2	0.5	2.10	22.60	A, B	
30	**Mendocino**	**128**	21.80	Clow Creek	Navarro River	Steelhead	2	15	4	1	4,100	4.1	0.75	3.08	22.58	C, D	
31	**Humboldt**	**254**	40.83	Chadd Creek	Scotia	Coho, Chinook, Steelhead	6	11	4	1	4,000	4	0.75	3.00	22.50	A, B	
31	**Mendocino**	**128**	20.15	Unnamed Trib Navarro R	Navarro River	Steelhead	2	15	5	1	5,000	5	0.5	2.50	22.50	C, D	
33	**Humboldt**	**101**	40.12	Chadd Creek	Scotia	Chinook, Coho, Steelhead	6	15	1	1	900	0.9	0.5	0.45	22.45	A, B	
34	**Mendocino**	**101**	74.20	Unnamed Trib to Ten Mile Ck		Coho, Steelhead	4	15	2	2	2,500	2.5	0.5	1.25	22.25	A, D	Site not yet analyzed so results presumed from first pass observations. Culvert is 6 ft diameter SSP that outlets onto a cascade over riprap. There appears to be leakage/seepage around the culvert. Culvert is bit-lined. Assumed no passage for a barrier score of 15.
34	**Humboldt**	**96**	36.88	Crawford Creek	Orleans	Steelhead	2	15	0	0	7,000	7	0.75	5.25	22.25	K1, K2	
36	**Del Norte**	**101**	35.56	Tryon Creek	Lower Smith River	Coho, Steelhead, Coastal Cutthroat Trout	4	15	5	0	1,400	1.4	0.5	0.70	22.20	A, D	
36	**Humboldt**	**36**	5.18	Wilson Creek (sign)	Hydesville	Chinook, Coho, Steelhead	6	12	2	1	5,400	5.4	0.5	2.70	22.20	A, D	
38	**Mendocino**	**1**	88.71	Unnamed trib to Cottaneva Creek	Rockport	Coho, Steelhead	4	15	5	0	1,200	1.2	0.5	0.60	22.10	C, D	
38	**Mendocino**	**128**	18.69	Lazy Creek	Navarro River	Steelhead	2	15	0	0	6,800	6.8	0.75	5.10	22.10	C, D	
40	**Del Norte**	**101**	31.75	Brush or Bush Creek (local name)	Lower Smith River	Coho, Steelhead, Coastal Cutthroat Trout	4	15	4	0	1,800	1.8	0.5	0.90	21.90	A, R	

Table B1: District 1 Stream Crossing Sites - Red and Gray Ranked Sites Prioritized for Remediation

RANK	County	Route	Post Mile	Stream Name	Calwater Unit Hydrologic Subarea (HSA)	Presumed Species Diversity	Species Diversity Score	Extent of Barrier Score	Current Sizing Score	Current Condition Score	Length of Upstream Habitat	Habitat Quantity Score	Habitat Quality Modifier	Total Habitat Score	TOTAL SCORE	References	Comments
41	Del Norte	199	34.04	Broken Kettle Creek	Illinois River	Coho, Steelhead, Coastal Cutthroat Trout	4	15	0	1	3,000	3	0.75	2.25	21.75	A, D	
42	Mendocino	1	47.07	Schoolhouse Creek	Albion	Steelhead	2	15	5	3	1,300	1.3	0.5	0.65	21.65	C, D	
43	Humboldt	96	36.35	Ullathorne Creek	Orleans	Steelhead	2	15	0	0	6,000	6	0.75	4.50	21.50	K1, K2	
44	Humboldt	254	15.04	Mowry Creek	Weott	Steelhead	2	15	5	3	900	0.9	0.5	0.45	21.45	C, D	
45	Del Norte	101	37.46	Unnamed trib to Morrison Ck	Lower Smith River	Coastal Cutthroat Trout	1	15	5	4	1,500	1.5	0.5	0.75	21.25	C, D	
45	Humboldt	299	21.2	Lupton Creek	Beaver	Steelhead	2	15	1	0	5,000	5	0.75	3.75	21.25	C, D	
47	Humboldt	36	9.17	Fox Creek	Hydesville	Resident Trout	1	15	5	1	8,900	8.9	0.25	2.23	21.23	A, D	
47	Humboldt	36	18.57	Unnamed trib to Van Duzen Riv	Bridgeville	Steelhead	2	15	5	3	900	0.9	0.25	0.23	21.23	C, D	
49	Del Norte	199	34.79	Trib. to Broken Kettle Creek	Illinois River	Coho, Steelhead, Coastal Cutthroat Trout	4	15	2	1	1,400	1.4	0.5	0.70	21.20	C, D	
50	Mendocino	162	1.72	Trib to Outlet Creek	Outlet Creek	Steelhead	2	15	5	3	700	0.7	0.25	0.18	21.18	C, D	
51	Mendocino	20	15.23	Unnamed Trib to Two Log Creek	Big River	Coho, Steelhead	4	15	0	3	1,300	1.3	0.5	0.65	21.15	C, D	
52	Del Norte	101	0.45	Unnamed trib to McGarvey Ck	Klamath Glen	Steelhead, Coastal Cutthroat Trout	2	15	3	1	4,200	4.2	0.5	2.10	21.10	C, D	
53	Mendocino	1	89.20	Unnamed trib to Cottaneva Creek	Rockport	Coho, Steelhead	4	15	3	1	200	0	0.5	0.00	21.00	C, D	
53	Mendocino	20	16.38	Unnamed Trib to North Fork Big River	Big River	Steelhead	2	15	4	3	2,000	2	0.25	0.50	21.00	C, D	Should have lower ranking. Goes dry in summer.
55	Del Norte	101	38.25	Morrison Creek	Lower Smith River	Coho, Chinook, Steelhead, Coastal Cutthroat Trout	5	11	5	0	4,800	4.8	0.5	2.40	20.90	A, B	
56	Mendocino	1	46.92	Buckhorn Creek	Albion	Coho, Steelhead	4	10	3	1	9,500	9.5	0.5	4.75	20.75	A, B	
57	Humboldt	101	30.46	Mowry Creek	Weott	Steelhead	2	15	3	3	700	0.7	0.75	0.53	20.53	A, D	
58	Mendocino	1	70.70	Seaside Creek	Ten Mile River	Coho, Steelhead	4	13	2	0	5,000	5	0.5	2.50	20.50	A, B	
58	Mendocino	128	39.88	Beebe Creek	Navarro River	Steelhead	2	15	3	1	2,000	2	0.75	1.50	20.50	C, D	
58	Mendocino	128	43.30	Wattle Creek	Warm Springs	Resident trout	1	15	5	3	1,000	1	0.5	0.50	20.50	C, D, E, F	
61	Humboldt	96	38.34	Wilder Gulch	Orleans		0	15	5	3	2,900	2.9	0.5	1.45	20.45	E, D	
61	Mendocino	1	44.98	Dark Gulch	Albion	Steelhead	2	14	4	1	2,600	2.6	0.75	1.95	20.45	A, B	
63	Del Norte	101	43.75	Lopez Creek	Winchuck River	Steelhead, Coastal Cutthroat Trout	2	15	4	0	2,800	2.8	0.5	1.40	20.40	R	
64	Del Norte	101	36.72	Unnamed trib to Smith River	Lower Smith River	Steelhead, Coastal Cutthroat Trout	2	15	5	0	1,600	1.6	0.5	0.80	20.30	C, D	
64	Mendocino	128	19.17	Trib to Lazy Creek	Navarro River	Steelhead	2	15	4	0	2,600	2.6	0.5	1.30	20.30	C, D	
66	Mendocino	128	25.54	Trib to Anderson Cr	Navarro River	Steelhead	2	15	5	1	1,100	1.1	0.25	0.28	20.28	C, D	
67	Humboldt	299	31.07	Willow Creek	Wilow Creek	Steelhead	2	15	3	0	3,500	3.5	0.5	1.75	20.25	A, D	
67	Humboldt	299	30.36	Low Gap Creek	Wilow Creek	Resident Trout	1	15	5	3	500	0.5	0.5	0.25	20.25	A, D	
69	Humboldt	254	1.82	Anderson Creek	Weott	Coho, Steelhead	4	15	0	1	1,400	1.4	0.5	0.70	20.20	A, C, D	
70	Humboldt	101	101.71	Unnamed stream	Big Lagoon	Resident Trout	1	15	5	3	500	0.5	0.25	0.13	20.13	C, D	

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71	Del Norte	199	30.33	Trib. to Griffin Creek	Middle Fork Smith River	Steelhead, Coastal Cutthroat Trout	2	15	5	1	350	0	0.25	0	20.00	A, B	
71	Humboldt	101	1.61	Durphy Creek	Benbow	Chinook, Coho, Steelhead	6	6	3	3	10,560	10	0.5	5.00	20.00	A, B	
71	Humboldt	101	93.27	Widow White Creek	Blue Lake	Coho, Steelhead, Coastal Cutthroat Trout	5	11	2	1	12,500	10	0.25	2.50	20.00	A, R	
71	Humboldt	36	10.07	Unnamed trib to Van Duzen Riv	Hydesville	Steelhead	2	15	5	1	0	0	0.25	0.00	20.00	C, D	
71	Humboldt	254	41.76	Unnamed trib to Chadd Creek	Scotia	Steelhead	2	15	5	1	300	0	0.25	0.00	20.00	C, D	
71	Humboldt	169	32.74	Bens Creek	Klamath Glen	Steelhead	2	15	5	1	>8% slope	0	0.5	0.00	20.00	A, D	
71	Mendocino	20	39.17	Cold Creek		Resident Trout	1	15	3	0	5,000	5	0.5	2.50	20.00	A, B	
71	Mendocino	128	27.54	Graveyard Creek	Navarro River	Steelhead	2	15	0	1	5,000	5	0.5	2.50	20.00	C, D	
71	Mendocino	128	39.37	Beebe Creek	Navarro River	Steelhead	2	15	0	1	5,000	5	0.5	2.50	20.00	C, D	
71	Mendocino	128	49.82	Edwards Creek	Geyserville	Steelhead	2	15	5	1	>8% slope	0	0.5	0.00	20.00	C, D	
71	Humboldt	169	22.37	Cappell Creek (bridge with concrete sill)	Klamath Glen	Steelhead, Chinook[1]	4	15	0	0	1,000	1	1	1.00	20.00	A,D	NOTE: My opinion (ML) is that this site should be moved up because Cappell is a large stream and the ranking is artificially low due to the Condition and Sizing scores. An on the ground habitat length survey is also needed.
82	Humboldt	299	41.27	Schoolhouse Creek	Wilow Creek	Steelhead	2	15	5	0	1,500	1.5	0.25	0.38	19.88	C, D	
83	Mendocino	128	4.30	Barton Gulch	Navarro River	Steelhead	2	15	5	0	600	0.6	0.5	0.30	19.80	A, B	
83	Mendocino	253	14.71	Trib to Robinson Creek	Ukiah	Steelhead	2	15	4	1	600	0.6	0.5	0.30	19.80	C, D	
85	Humboldt	36	3.99	Barber Creek	Hydesville	Steelhead	1	15	5	1	3,000	3	0.25	0.75	19.75	A, D	
85	Mendocino	1	104.82	Unnamed trib to SF Eel River	Benbow	Steelhead	2	15	4	1	500	0.5	0.5	0.25	19.75	C, D	
87	Del Norte	101	41.41	Ritmer Creek	Smith River Plain	Steelhead, Coastal Cutthroat Trout	2	12	3	0	5,600	5.6	0.75	4.20	19.70	R	
87	Humboldt	101	103.88	Burris Creek	Big Lagoon	Coastal Cutthroat Trout	1	15	5	1	2,800	2.8	0.25	0.70	19.70	A, D	
89	Humboldt	101	99.43	Unnamed stream	Big Lagoon	Steelhead, Coastal Cutthroat Trout	3	15	3	0	700	0.7	0.25	0.18	19.68	C, D	
90	Humboldt	101	106.71	Unnamed stream	Big Lagoon	Coastal Cutthroat Trout	1	15	4	0	3,300	3.3	0.5	1.65	19.65	C, D	
91	Mendocino	20	30.56	Unnamed Trib to Broaddus Creek	Outlet Creek	Chinook, Steelhead	4	15	0	1	300	0.5	0.25	0.13	19.63	C, D	
91	Mendocino	20	32.24	Unnamed Trib to Broaddus Creek	Outlet Creek	Chinook, Steelhead	4	15	0	1	350	0.5	0.25	0.13	19.63	C, D	
91	Mendocino	101	94.61	Unnamed Trib to Eel River	Benbow	Steelhead	2	15	5	0	500	0.5	0.25	0.13	19.63	C, D	
94	Del Norte	197	6.83	Hutsinpillar Cr.	Smith River Plain	Steelhead, Coastal Cutthroat Trout	2	15	5	0	>8% slope	0	0	0.00	19.50	A, D	
94	Humboldt	254	15.75	Feese Creek	Weott	Steelhead	2	15	2	3	>8% Slope	0	0.25	0.00	19.50	A, D	
94	Humboldt	169	14.92	Knulthkarn Creek	Klamath Glen	Steelhead	2	15	5	0	>8% slope	0	0.5	0.00	19.50	C, D	
94	Humboldt	169	29.46	Burrill Creek		Steelhead	2	15	4	1	>8% slope	0	0.5	0.00	19.50	C, D	
94	Mendocino	128	14.04	Soda Creek	Navarro River	Steelhead	2	15	0	3	2,020	2	0.5	1.00	19.50	A, D	

Table B1: District 1 Stream Crossing Sites - Red and Gray Ranked Sites Prioritized for Remediation

RANK	County	Route	Post Mile	Stream Name	Calwater Unit Hydrologic Subarea (HSA)	Presumed Species Diversity	Species Diversity Score	Extent of Barrier Score	Current Sizing Score	Current Condition Score	Length of Upstream Habitat	Habitat Quantity Score	Habitat Quality Modifier	Total Habitat Score	TOTAL SCORE	References	Comments
99	**Humboldt**	**101**	11.71	Bear Canyon	Benbow	Chinook, Coho, Steelhead	6	8	5	0	5,800	5.8	0.5	2.90	19.40	A, D	
100	**Humboldt**	**101**	103.66	Savage Creek	Big Lagoon	Coastal Cutthroat Trout	1	15	5	1	1,500	1.5	0.25	0.38	19.38	A, D	
	Humboldt	**101**	105.36	Beach Creek	Big Lagoon	Coastal Cutthroat Trout	1	15	3	3	1,400	1.4	0.25	0.35	19.35	A, D	
	Mendocino	**1**	7.70	Signal Port Creek	Garcia River	Steelhead	2	15	3	0	1,600	1.6	0.5	0.80	19.30	C, D	
	Mendocino	**101**	88.97	Big Dann Creek	Benbow	Steelhead	2	15	3	0	1,000	1	0.75	0.75	19.25	A, B	Habitat decreased to 1000 ft due to 12 ft rock falls upstream.
	Mendocino	**162**	26.29	Trib to Turner Creek		Steelhead	2	12	4	0	6,500	6.5	0.5	3.25	19.25	A, D	Site has a fish ladder at outlet. Extent of barrier score decreased from 15 to 12.
	Humboldt	**101**	104.79	Unnamed stream	Big Lagoon	Coastal Cutthroat Trout	1	15	5	1	600	0.6	0.25	0.15	19.15	C, D	
	Mendocino	**128**	43.67	Ward Creek - 2 pipes	Warm Springs	Resident trout	1	15	3	1	2,300	2.3	0.5	1.15	19.15	C, D, E, F	
	Mendocino	**253**	6.17	Soda Creek	Navarro River	None[1]	0	15	5	3	600	0.6	0.25	0.15	19.15	A, D	
	Humboldt	**101**	17.23	Williams Creek	Benbow	Steelhead	2	15	3	1	550	0.5	0.25	0.13	19.13	C, B	
	Humboldt	**36**	4.39	Fischer Creek	Hydesville	Steelhead	2	15	0	1	6,300	6.3	0.25	1.58	19.08	C, D	
	Mendocino	**128**	38.33	York Creek	Navarro River	Steelhead	2	15	3	1	300	0.3	0.25	0.08	19.08	C, D	
	Humboldt	**101**	105.64	Penn Creek	Big Lagoon	Coastal Cutthroat Trout	1	15	2	3	1,100	1.1	0.5	0.55	19.05	A, D	
	Del Norte	**101**	31.11	Unnamed trib to Jordan Creek	Lower Smith River	Steelhead, Coastal Cutthroat Trout	2	15	2	0	2,000	2	0.5	1.00	19.00	C, D	
	Del Norte	**101**	23.43	Unnamed trib drains to ocean	Smith River Plain	Coastal Cutthroat Trout	1	15	5	1	> 8% slope	0	0.25	0.00	19.00	E	
	Humboldt	**101**	0.86	Hartsook Creek	Benbow	Coho, Steelhead	4	12	3	1	2,000	2	0.5	1.00	19.00	A, B	
	Humboldt	**101**	105.05	Unnamed Trib to Beach Ck	Big Lagoon		0	15	5	3	0	0	0	0.00	19.00	E	
	Humboldt	**101**	106.13	Unnamed stream	Big Lagoon		0	15	5	3	0	0	0	0.00	19.00	E	
	Humboldt	**36**	33.44	Unknown trib to Butte Creek	Bridgeville		0	15	5	3	0	0	0.25	0.00	19.00	E	
	Humboldt	**254**	6.85	Unnamed trib to SF Eel River	Weott		0	15	5	3	>8% Slope	0	0.25	0.00	19.00	C, D	
	Humboldt	**96**	38.89	Cheenitch Creek	Orleans	Steelhead	2	15	3	0	1,000	1	0.5	0.50	19.00	K1, D	
	Mendocino	**20**	18.23	Unnamed Trib to North Fork Big River	Big River		0	15	5	3	0	0	0.25	0.00	19.00	E	
	Mendocino	**20**	19.68	Unnamed Trib to North Fork Big River	Big River		0	15	5	3	0	0	0.25	0.00	19.00	E	
	Mendocino	**128**	42.49	Unnamed Trib to Dry Ck	Warm Springs			15	5	1	1,800	1.8	0.5	0.90	18.90	C, D, E, F	
	Mendocino	**128**	45.09	Jungle Creek	Warm Springs	Resident trout	1	15	0	0	3,800	3.8	0.75	2.85	18.85	C, D, E, F	
	Humboldt	**101**	100.18	McConnahas Mill Creek	Big Lagoon	Resident Trout	1	15	4	1	1,200	1.2	0.25	0.30	18.80	A, D	
	Mendocino	**128**	41.29	Unnamed Trib to Dry Ck	Warm Springs	Resident trout	1	15	0	1	4,600	4.6	0.5	2.30	18.80	C, D, E, F	
	Humboldt	**254**	7.69	Dry Creek	Weott	Steelhead	2	15	2	1	1,000	1	0.25	0.25	18.75	A, B	
	Mendocino	**128**	21.54	Gowan Cr	Navarro River	Steelhead	2	15	0	1	2,500	2.5	0.5	1.25	18.75	C, D	
	Mendocino	**162**	15.48	Steep Creek	Eden Valley	Steelhead	2	15	1	0	5,000	5	0.25	1.25	18.75	A, B	

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	Humboldt	**101**	109.90	Unnamed Trib to Big Lagoon	Big Lagoon	Coastal Cutthroat Trout	1	15	5	0	900	0.9	0.25	0.23	18.73	C, D	
	Humboldt	**101**	12.11	Unnamed Trib to SF Eel River	Benbow	Steelhead	2	15	0	3	700	0.7	0.25	0.18	18.68	C, D	
	Del Norte	**199**	15.58	Trib. to Smith River	Middle Fork Smith River	Resident Trout	1	15	4	1	600	0.6	0.25	0.15	18.65	C, D	
	Del Norte	**199**	10.04	Trib. to Smith River	Middle Fork Smith River	Resident Trout	1	15	5	0	300	0	0.25	0.00	18.50	C, D	
	Mendocino	**1**	3.33	St Orres Creek	Garcia River	Steelhead	2	15	1	0	2,000	2	0.5	1.00	18.50	C, D	
	Mendocino	**1**	35.02	Laurel Gulch	Greenwood Creek	Steelhead	2	15	3	0	>8% slope	0	0.5	0.00	18.50	C, D	
	Mendocino	**101**	83.25	Mad Creek	Benbow		0	15	4	3	>8% Slope	0	0.25	0.00	18.50	E	Remove from list, culvert sits on natural falls barrier.
	Mendocino	**128**	22.97	No stream on map	Navarro River			15	4	3	0	0	0.25	0.00	18.50	E	
	Humboldt	**101**	108.32	Unnamed Trib to Big Lagoon	Big Lagoon	Coastal Cutthroat Trout	1	15	4	0	1,700	1.7	0.25	0.43	18.43	C, D	
	Mendocino	**1**	92.83	Dunn Creek	Rockport	Coho, Steelhead	4	10	4	3	1,200	1.2	0.75	0.90	18.40	C, D	
	Mendocino	**128**	45.64	Unnamed Trib to Dry Ck	Warm Springs			15	5	1	800	0.8	0.5	0.40	18.40	C, D, E, F	
	Mendocino	**253**	4.25	Trib to Soda Creek	Navarro River	None[1]	0	15	4	1	1,800	1.8	0.5	0.90	18.40	A, D	
	Del Norte	**199**	32.26	Trib. to Griffin Creek	Middle Fork Smith River	Steelhead, Resident Trout	2	15	1	1	700	0.7	0.5	0.35	18.35	C, D	
	Mendocino	**20**	29.04	Unnamed Trib to Broaddus Creek	Outlet Creek		0	15	4	0	2,700	2.7	0.5	1.35	18.35	C, D	Remove from list, not a fish stream (Harris,Nov 2004)
	Humboldt	**299**	32.61	Ruby Creek	Wilow Creek	Steelhead	2	15	2	0	1,300	1.3	0.25	0.33	18.33	C, D	
	Humboldt	**299**	40.3	China Creek	Wilow Creek	Steelhead	2	15	2	0	1,000	1	0.25	0.25	18.25	A, B	
	Humboldt	**169**	24.66	Mareep Creek	Klamath Glen	Steelhead	2	15	1	1	500	0.5	0.5	0.25	18.25	A, D	
	Mendocino	**128**	39.95	John Hatt Creek	Navarro River			15	0	3	3,500	3.5	0.5	1.75	18.25	C, D, E	
	Mendocino	**253**	4.97	Trib to Soda Creek	Navarro River	None[1]	0	15	3	3	300	0.5	0.5	0.25	18.25	A, D	
	Del Norte	**199**	31.22	Trib. to Griffin Creek	Middle Fork Smith River	Coho, Steelhead, Coastal Cutthroat Trout	4	12	2	0	2,400	2.4	0.5	1.20	18.20	A, B	
	Humboldt	**101**	136.36	Unnamed Tribs to McGarvey Ck		Resident Trout	1	15	3	1	800	0.8	0.25	0.20	18.20	C, D	
	Humboldt	**36**	33.56	Unknown trib to Butte Creek	Bridgeville		0	15	3	3	800	0.8	0.25	0.20	18.20	E	
	Humboldt	**36**	6.57	Unnamed trib to Van Duzen Riv	Hydesville		0	15	5	1	700	0.7	0.25	0.18	18.18	E	
	Del Norte	**199**	31.81	Trib. to Griffin Creek	Middle Fork Smith River	Resident Trout	1	15	3	1	600	0.6	0.25	0.15	18.15	C, D	
	Humboldt	**254**	16.44	Unnamed trib to SF Eel River	Weott		0	15	5	1	600	0.6	0.25	0.15	18.15	E	
	Mendocino	**128**	26.07	Trib to Anderson Cr	Navarro River	Steelhead	2	15	2	0	600	0.6	0.25	0.15	18.15	C, D	
	Humboldt	**299**	29.68	Mason Gulch	Wilow Creek	Resident Trout	1	15	4	0	500	0.5	0.25	0.13	18.13	C, D	
	Mendocino	**1**	8.58	Slick Rock Creek	Garcia River	Steelhead	2	15	0	0	1,500	1.5	0.75	1.13	18.13	C, D	
	Humboldt	**101**	102.69	McNeil Creek	Big Lagoon	Coastal Cutthroat Trout	1	15	1	3	400	0.4	0.25	0.10	18.10	A, D	

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	Mendocino	**128**	16.22	Peat Pasture Gulch	Navarro River	Steelhead	2	15	0	1	2,300	2.3	0.25	0.58	18.08	C, D	
	Mendocino	**128**	44.75	Morrow Creek	Warm Springs			15	5	1	100	0.1	0.25	0.03	18.03	C, D, E, F	
	Del Norte	**101**	30.12	Unnamed trib to Jordan Creek	Lower Smith River			15	5	1	0	0	0.25	0.00	18.00	E	
	Del Norte	**197**	2.90	Unnamed Trib to Smith River	Smith River Plain			14	5	3	0	0	0.5	0.00	18.00	E, D	
	Humboldt	**101**	1.97	Laurel Creek	Benbow		0	15	3	3	0	0	0.25	0.00	18.00	E	
	Humboldt	**101**	16.75	Tuttle Creek	Benbow	Steelhead	2	15	2	0	180	0	0.25	0.00	18.00	C, B	
	Humboldt	**101**	102.33	Unnamed stream	Big Lagoon		0	15	3	3	0	0	0	0.00	18.00	E	
	Humboldt	**299**	37.29	Boise Creek	Wilow Creek	Resident Trout	1	15	4	0	>8% slope	0	0.25	0.00	18.00	A, B	
	Mendocino	**20**	41.87	Unnamed Trib to Cold Creek		Resident Trout	1	15	2	0	2,000	2	0.5	1.00	18.00	C, D	
	Mendocino	**20**	29.77	Unnamed Trib to Broaddus Creek	Outlet Creek		0	15	3	3	0	0	0	0.00	18.00	E	
	Mendocino	**128**	23.90	Unnamed Trib Navarro R	Navarro River	Steelhead	2	15	0	0	2,000	2	0.5	1.00	18.00	C, D	
	Mendocino	**128**	27.78	Trib to Anderson Cr	Navarro River	Steelhead	2	15	0	1	1,000	1	0.5	0.50	18.00	C, D	
	Mendocino	**128**	36.63	Lost Creek	Navarro River	Steelhead	2	15	0	1	1,000	1	0.5	0.50	18.00	C, D	
	Mendocino	**128**	44.14	Ingram Creek	Warm Springs	Resident trout	1	15	0	0	4,000	4	0.5	2.00	18.00	C, D, E, F	
	Mendocino	**1**	89.63	Unnamed trib to Cottaneva Creek	Rockport	Coho, Steelhead	4	11	4	1	900	0.9	0.5	0.45	17.95	C, D	
	Del Norte	**199**	12.86	Marys Creek	Middle Fork Smith River	Steelhead, Coastal Cutthroat Trout, Coho	4	12	0	0	2,400	2.4	0.75	1.8	17.80	C, D	
	Humboldt	**101**	20.11	Unnamed Trib to SF Eel River	Weott	Steelhead	2	15	0	1	500	0.5	0.5	0.25	17.75	C, D	
	Mendocino	**128**	40.10	John Hatt Creek	Navarro River			15	0	3	2,500	2.5	0.5	1.25	17.75	C, D, E	
	Mendocino	**253**	15.78	Trib to Robinson Creek	Ukiah			15	5	0	100	0.5	0.25	0.13	17.63	C, D	
	Mendocino	**128**	38.64	No stream on map	Navarro River	Steelhead	2	15	0	0	1,100	1.1	0.5	0.55	17.55	C, D	
	Mendocino	**128**	37.38	Trib to Rancheria Ck	Navarro River	Steelhead	2	15	0	1	100	0.1	0.25	0.03	17.53	C, D	
	Del Norte	**199**	1.00	Trib to Jordan Creek	Lower Smith River	Resident Trout	1	15	2	1	Above Anadromy	0	0.25	0.00	17.50	E	
	Del Norte	**199**	8.97	Trib. to Smith River	Middle Fork Smith River		0	15	5	0	0	0	0.25	0.00	17.50	E	
	Humboldt	**101**	49.52	Unnamed Trib to Eel River	Scotia		0	15	2	3	0	0	0.25	0.00	17.50	E	
	Humboldt	**36**	30.19	Unknown trib to Muddy Creek	Bridgeville		0	15	4	1	>8% Slope	0	0.25	0.00	17.50	E	
	Humboldt	**36**	32.89	Unknown trib to Butte Creek	Bridgeville		0	15	5	0	0	0	0.25	0.00	17.50	E	
	Humboldt	**36**	33	Unknown trib to Butte Creek	Bridgeville		0	15	5	0	0	0	0.25	0.00	17.50	E	
	Humboldt	**254**	0.44	Rocky Glen Creek	Benbow	Steelhead	2	15	0	1	>8% Slope	0	0.5	0.00	17.50	C, D	

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	Humboldt	**254**	14.07	Truss Creek	Weott		0	15	5	0	>8% Slope	0	0.25	0.00	17.50	E	
	Humboldt	**299**	41.01	Unnamed trib to Trinity River	Wilow Creek		0	15	5	0	>8% slope	0	0.25	0.00	17.50	E	
	Humboldt	**299**	41.12	Unnamed trib to Trinity River	Wilow Creek		0	15	5	0	>8% slope	0	0.25	0.00	17.50	E	
	Humboldt	**299**	41.39	Unnamed trib to Trinity River	Wilow Creek		0	15	4	1	>8% slope	0	0.25	0.00	17.50	E	
	Humboldt	**169**	27.57	Rube Creek (bridge with poured concrete lining channel)	Klamath Glen	Steelhead	2	15	0	1	>8% slope	0	0.5	0.00	17.50	A,D	
	Mendocino	**1**	1.27	Robinson Gulch	Garcia River	Steelhead	2	15	0	1	>8% slope	0	0.5	0.00	17.50	C, D	
	Mendocino	**101**	60.83	Long Valley Creek Trib	Outlet Creek		0	15	2	3	>8% Slope	0	0.25	0.00	17.50	E	
	Mendocino	**128**	8.68	Unnamed Trib NF Navarro	Navarro River			15	5	0	0	0	0.25	0.00	17.50	E	
	Mendocino	**253**	12.47	Trib to Robinson Creek	Ukiah			15	4	1	>8% slope	0	0.5	0.00	17.50	C, D	
	Mendocino	**1**	3.22	Glennen Gulch	Garcia River	Steelhead	2	15	0	0	500	0.5	0.75	0.38	17.38	C, D	
	Humboldt	**101**	19.68	Unnamed Trib to SF Eel River	Weott	Steelhead	2	15	0	0	600	0.6	0.5	0.30	17.30	C, D	
	Mendocino	**1**	6.17	Triplett Gulch	Garcia River	Steelhead	2	15	0	0	600	0.6	0.5	0.30	17.30	C, D	
	Mendocino	**1**	57.48	Ward Creek	Noyo River		0	15	3	1	500	0.5	0.5	0.25	17.25	C, D	
	Mendocino	**128**	24.84	Hannah Creek	Navarro River	Steelhead	2	14	1	1	900	1	0.25	0.25	17.25	C, D	
	Del Norte	**101**	2.39	Unnamed trib to Waukell Ck	Klamath Glen	Coastal Cutthroat Trout	1	15	1	1	500	0.5	0.25	0.13	17.13	C, D	
	Mendocino	**101**	55.12	Outlet Creek Trib	Outlet Creek	Steelhead??	2	15	0	0	500	0.5	0.25	0.13	17.13	C, D	
	Mendocino	**128**	32.77	Soda Creek	Navarro River	Steelhead	2	15	0	0	200	0.2	0.5	0.10	17.10	C, D	
	Del Norte	**197**	4.34	Unnamed Trib to Smith River	Smith River Plain			15	3	1	200	0.2	0.25	0.05	17.05	E, D	
	Mendocino	**101**	16.73	Unnamed Trib to Russian R	Ukiah		0	15	2	0	4,200	4.2	0.25	1.05	17.05	C, D	
	Mendocino	**1**	25.47	Mallo Pass Ck		Steelhead	2	9	1	1	13,000	10	0.5	5.00	17.00	A, D	
	Del Norte	**199**	18.04	Trib. to Smith River	Middle Fork Smith River		0	15	3	1	0	0	0.25	0.00	17.00	E	
	Del Norte	**199**	34.64	Trib. to Broken Kettle Creek	Illinois River		0	15	3	1	0	0	0.25	0.00	17.00	E	
	Humboldt	**101**	43.91	Unnamed Trib to Eel River	Scotia		0	15	3	1	0	0	0.25	0.00	17.00	E	
	Humboldt	**101**	125.02	Unnamed Trib to Prairie Ck	Orick		0	15	3	1	0	0	0	0.00	17.00	E	
	Humboldt	**36**	19.09	Unnamed trib to Van Duzen Riv	Bridgeville	Steelhead	2	15		0				0.00	17.00	C	
	Humboldt	**254**	41.88	Unnamed trib to Chadd Creek	Scotia	Steelhead	2	15	0	0	200	0	0.25	0.00	17.00	C, D	

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	Humboldt	**299**	6.54	Powers Creek	Blue Lake		0	15	3	1	>8% slope	0	0.25	0.00	17.00	A, B	
	Humboldt	**299**	14.55	Unnamed trib to Long Prairie Ck	North Fork Mad River		0	15	4	0	>8% slope	0	0.25	0.00	17.00	E	
	Humboldt	**299**	39.19	Bloody Nose Creek	Wilow Creek		0	15	4	0	0	0	0.25	0.00	17.00	E	
	Mendocino	**1**	75.33	Chadbourne Gulch	Ten Mile River	Steelhead	2	11	3	1	4,000	4	0.5	2.00	17.00	A, B	
	Mendocino	**101**	94.66	Unnamed Trib to Eel River	Benbow		0	15	1	3	>8% Slope	0	0.25	0.00	17.00	E	
	Mendocino	**128**	9.94	Trib NF Navarro	Navarro River			15	3	1	0	0	0.25	0.00	17.00	E	
	Mendocino	**128**	24.65	Prather Creek	Navarro River			15	3	1	0	0	0.25	0.00	17.00	E	
	Mendocino	**128**	35.54	Elkins Creek	Navarro River			15	3	1	>8% slope	0	0.5	0.00	17.00	E	
	Mendocino	**128**	37.68	No stream on map	Navarro River			15	3	1	0	0	0.25	0.00	17.00	E	
	Mendocino	**162**	3.41	Trib to Outlet Creek	Outlet Creek		0	15	3	1	0	0	0.25	0.00	17.00	E	
	Mendocino	**128**	44.01	Dog Town Creek	Warm Springs	Resident trout	1	15	0	0	1,900	1.9	0.5	0.95	16.95	C, D, E, F	
	Humboldt	**299**	34.41	Gregg Creek	Wilow Creek	Resident Trout	1	15	1	0	800	0.8	0.25	0.20	16.70	A, B	
	Del Norte	**199**	34.94	Trib. to Broken Kettle Creek	Illinois River		0	15	3	0	0	0	0	0.00	16.50	E	
	Del Norte	**199**	1.98	Trib to Clarks Creek	Lower Smith River	Resident Trout	1	15	0	1	Above Anadromy	0	0.25	0.00	16.50	E	
	Humboldt	**101**	133.72	Unnamed Trib to NF Ah Pah Ck	Klamath Glen		0	15	2	1	0	0	0	0.00	16.50	E	
	Humboldt	**254**	22.87	Unnamed trib to SF Eel River	Scotia		0	15	0	3	>8% Slope	0	0.25	0.00	16.50	E	
	Humboldt	**254**	45.07	Unnamed trib to Eel River	Scotia		0	15	0	3	0	0	0.25	0.00	16.50	E	
	Mendocino	**1**	66.93	Unknown	Noyo River	Steelhead	2	10	5	3	2,000	2	0.25	0.50	16.50	C, D	
	Mendocino	**128**	47.19	Unnamed Trib to Dry Ck				15	0	3	0	0	0.5	0.00	16.50	C, D, E, F	
	Mendocino	**128**	9.07	No stream on map	Navarro River			15	3	0	0	0	0.25	0.00	16.50	E	
	Mendocino	**128**	17.51	No stream on map	Navarro River			15	0	3	0	0	0.25	0.00	16.50	E	
	Mendocino	**128**	32.98	Coon Creek	Navarro River			15	3	0	>8% slope	0	0.5	0.00	16.50	E	
	Mendocino	**128**	35.84	Wash Creek	Navarro River			15	3	0	>8% slope	0	0.25	0.00	16.50	E	
	Mendocino	**253**	12.06	Trib to South Branch Robinson Creek	Ukiah		0	15	3	0	>8% slope	0	0.5	0.00	16.50	C, D	
	Humboldt	**101**	90.83	Mill Creek	Blue Lake	Chinook, Coho, Steelhead, Coastal Cutthroat Trout	7	5	5	1	2,600	2.6	0.5	1.30	16.30	A, B, R	
	Humboldt	**101**	98.69	Unnamed Trib to Luffenholtz Ck	Big Lagoon	Resident Trout	1	15	0	0	500	0.5	0.5	0.25	16.25	C, D	
	Del Norte	**101**	11.65	Unnamed trib to Lagoon Pond	Klamath Glen	Coastal Cutthroat Trout	1	13	4	0	700	0.7	0.25	0.18	16.18	C, D	
	Mendocino	**101**	68.8	Ten Mile Creek Trib	Laytonville	Steelhead	2	12	3	1	600	0.6	0.25	0.15	16.15	C, D	

Table B1: District 1 Stream Crossing Sites - Red and Gray Ranked Sites Prioritized for Remediation

RANK	County	Route	Post Mile	Stream Name	Calwater Unit Hydrologic Subarea (HSA)	Presumed Species Diversity	Species Diversity Score	Extent of Barrier Score	Current Sizing Score	Current Condition Score	Length of Upstream Habitat	Habitat Quantity Score	Habitat Quality Modifier	Total Habitat Score	TOTAL SCORE	References	Comments
	Mendocino	**20**	42.94	Unnamed Trib to Cold Creek		Resident Trout	1	15	0	0	100	0.5	0.25	0.13	16.13	Refuge from cold creek	
	Humboldt	**101**	32.26	Robinson Creek	Weott	Above Anadromy	0	15	1	1	0	0	0	0.00	16.00	E	
	Humboldt	**101**	44.05	Unnamed Trib to Eel River	Scotia		0	15	1	1	0	0	0.25	0.00	16.00	E	
	Humboldt	**101**	50.38	Unnamed Trib to Eel River	Scotia		0	15	1	1	0	0	0.25	0.00	16.00	E	
	Humboldt	**101**	63.96	Unnamed Trib to Eel River	Ferndale		0	15	2	0	0	0	0	0.00	16.00	E	
	Humboldt	**101**	98.14	Unnamed stream	Little River	Coastal Cutthroat Trout	1	15	0	0	300	0	0.25	0.00	16.00	C, D	
	Humboldt	**101**	123.95	Unnamed Trib to Prairie Ck			0	15	1	1	0	0	0	0.00	16.00	E	
	Humboldt	**96**	41.46	Whitmore Creek	Orleans		0	15	2	0	>8% slope	0	0.25	0.00	16.00	K1, D	
	Humboldt	**254**	16.75	Robinson Creek	Weott		0	15	0	1	800	0.8	0.5	0.40	15.90	C, D	
	Mendocino	**128**	45.31	Unnamed Trib to Dry Ck	Warm Springs			15	1	0	300	0.3	0.25	0.08	15.58	C, D, E, F	
	Del Norte	**199**	32.55	Trib. to Griffin Creek	Middle Fork Smith River		0	15	0	1	0	0	0.25	0.00	15.50	E	
	Del Norte	**199**	33.89	Trib. to Broken Kettle Creek	Illinois River		0	15	0	1	0	0	0.25	0.00	15.50	E	
	Humboldt	**101**	24.26	Eel River	Weott		0	15	0	1	0	0	0.25	0.00	15.50	E	
	Humboldt	**299**	15.28	Unnamed trib to Long Prairie Ck	North Fork Mad River		0	15	1	0	>8% slope	0	0.25	0.00	15.50	E	
	Mendocino	**20**	19.24	Unnamed Trib to North Fork Big River	Big River		0	15	0	1	0	0	0.25	0.00	15.50	E	
	Mendocino	**101**	79.2	Rattlesnake Creek	Benbow	Steelhead, Coho, Chinook	6		4	0	14,260	10	0.75	7.50	15.50	A, B	
	Mendocino	**128**	17.11	Floodgate Cr	Navarro River			15	0	1	0	0	0.25	0.00	15.50	E	
	Mendocino	**128**	32.08	No stream on map	Navarro River			15	1	0	>8% slope	0	0.25	0.00	15.50	E	
	Mendocino	**128**	33.78	No stream on map	Navarro River			15	0	1	>8% slope	0	0.25	0.00	15.50	E	
	Mendocino	**128**	37.82	Trib to Rancheria Ck	Navarro River			15	0	1	0	0	0.25	0.00	15.50	E	
	Mendocino	**162**	19.86	Sand Bank Creek	Eden Valley		0	15	1	0	0	0	0.25	0.00	15.50	E	
	Humboldt	**101**	122.69	Skunk Cabbage Creek	Orick	Coho, Steelhead, Coastal Cutthroat Trout	5	3	0	0	9,500	9.5	0.75	7.13	15.13	A, D	
	Humboldt	**101**	126.22	May Creek	Orick	Coho, Steelhead, Coastal Cutthroat Trout	5	3	0	0	9,500	9.5	0.75	7.13	15.13	A, B	
	Humboldt	**101**	99.91	Unnamed stream	Big Lagoon		0	15	0	0	0	0	0	0.00	15.00	E	
	Humboldt	**101**	123.52	Unnamed Trib to Prairie Ck	Orick	Coho, Steelhead, Coastal Cutthroat Trout	5	9	1	1	350	0	0.25	0.00	15.00	C, D	
	Humboldt	**254**	8.13	Unnamed trib to SF Eel River	Weott		0	15	0	0	>8% Slope	0	0.25	0.00	15.00	E	
	Humboldt	**254**	41.92	Unnamed trib to Chadd Creek	Scotia		0	15		0	>8% Slope	0	0.25	0.00	15.00	E	

Table B1: District 1 Stream Crossing Sites - Red and Gray Ranked Sites Prioritized for Remediation

RANK	County	Route	Post Mile	Stream Name	Calwater Unit Hydrologic Subarea (HSA)	Presumed Species Diversity	Species Diversity Score	Extent of Barrier Score	Current Sizing Score	Current Condition Score	Length of Upstream Habitat	Habitat Quantity Score	Habitat Quality Modifier	Total Habitat Score	TOTAL SCORE	References	Comments
	Humboldt	**299**	12.33	Pine Creek	North Fork Mad River		0	15	0	0	>8% slope	0	0.5	0.00	15.00	A, B	
	Mendocino	**20**	27.64	Unnamed Trib to Broaddus Creek	Outlet Creek		0	15	0	0	0	0	0.25	0.00	15.00	E	Remove from list, not a fish stream (Harris,Nov 2004)
	Mendocino	**101**	1.4	Unnamed Trib to Russian R	Geyserville		0	15	0	0	>8% Slope	0		0.00	15.00	C, D	
	Mendocino	**101**	41.76	Unnamed Trib to Haehl Ck	Outlet Creek		0	15	0	0	0	0	0.25	0.00	15.00	E	
	Mendocino	**128**	32.34	No stream on map	Navarro River			15	0	0	>8% slope	0	0.25	0.00	15.00	E	
	Mendocino	**162**	14.00	Trib to Eel River	Eel River		0	15	0	0	0	0	0.25	0.00	15.00	E	
	Humboldt	**101**	22.80	Coon Creek	Weott	Steelhead	2	9	3	1	3,500	3.5	0.5	1.75	14.75	A, D	
	Del Norte	**199**	3.00	Trib. to Smith River	Lower Smith River	Resident Trout	1	11	4	1	800	0.8	0.25	0.20	14.70	C, D	
	Mendocino	**101**	72.73	Stapp Creek	Laytonville	Steelhead	2	10	0	1	1,700	1.7	0.5	0.85	13.35	C, D	
	Humboldt	**101**	62.22	Palmer Creek	Ferndale		0	7	3	1	6,000	6	0.5	3.00	12.00	C, D	
	Del Norte	**101**	32.24	Yonkers Creek	Lower Smith River	Coho, Steelhead, Coastal Cutthroat Trout	4	4	0	0	4,400	4.4	0.5	2.20	10.20	R	
	Mendocino	**101**	12.76	Unnamed Trib to Russian R	Ukiah		0	5	5	0	4,600	4.6	0.25	1.15	8.65	C, D	
	Mendocino	**128**	7.27	Mustard Gulch	Navarro River	Steelhead	2	1	5	0	2,600	2.6	0.25	0.65	6.15	A, D	Site meets all passage criteria but ranks GRAY because inlet width < active channel width.
	Mendocino	**128**	10.18	Coon Creek	Navarro River	Steelhead	2	0	5	0	1,600	1.6	0.75	1.20	5.70	A, B	Site meets all passage criteria but ranks GRAY because inlet width < active channel width.
	Mendocino	**253**	14.20	Trib to Robinson Creek	Ukiah	Steelhead	2	0	4	0	1,700	1.7	0.75	1.28	5.28	C, D	Site meets all passage criteria but ranks GRAY because inlet width < active channel width.

A - Species diversity taken from CDFG surveys or direct observations from local fisheries biologists.
B - Length of habitat taken from CDFG surveys
C - Species diversity assumed by presence in downstream confluence channel, size and slope of creek or observation upon site visit
D - Length of habitat estimated using USGS topographic maps
E - Presumed not a significant anadromous fish stream
R - Obtained species diversity and habitat information from Ross Taylor & Associates, Humboldt County Culvert Inventory and Fish Passage Evaluation (2000), Del Norte County Culvert Inventory and Fish Passage Evaluation (2001), or Mendocino County Culvert Inventory and Fish Passage Evaluation (2001) reports
K1 - Species diversity from Karuk Tribal Fisheries
K2 - Habitat information from Karuk Tribal Fisheries

Table B2: Caltrans District 1 Green Ranked Stream Crossings

County	Route	Post Mile	Stream Name	Calwater Unit Hydrologic Subarea (HSA)	Presumed Species Diversity	Species Diversity Score	Extent of Barrier Score	Current Sizing Score	Current Condition Score	Length of Upstream Habitat	Habitat Quantity Score	Habitat Quality Modifier	Total Habitat Score	TOTAL SCORE	Sources	Comments
Del Norte	**101**	26.15	Elk Ck	Smith River Plain	Coho, Steelhead, Coastal Cutthroat Trout, Chinook	5	0	0	0	20,000	20	0.5	10.00	15.00	A	
Del Norte	**101**	30.31	Jordan Creek	Lower Smith River	Coho, Steelhead, Coastal Cutthroat Trout	4	0	5	0	5,100	5.1	0.5	2.55	9.05	A, R	
Del Norte	**101**	25.26	Unnamed trib drains to ocean	Smith River Plain	Coastal Cutthroat Trout	1	0	5	0	9,500	9.5	0.25	2.38	5.88	C, D	
Del Norte	**101**	24.46	Unnamed trib drains to ocean	Smith River Plain	Coastal Cutthroat Trout	1	0	5	1	5,000	5	0.25	1.25	5.25	C, D	
Del Norte	**101**	27.46	Unnamed trib to Elk Creek	Smith River Plain	Coastal Cutthroat Trout	1	0	2	0	300	0	0.25	0.00	2.00	E	
Humboldt	**36**	8.15	Cummings Creek	Hydesville	Chinook, Coho, Steelhead	6	0	3	0	10,500	10	0.5	5.00	12.50	A, D	
Humboldt	**36**	6.25	Cuddeback Creek	Hydesville	Chinook, Coho, Steelhead	6	0	5	1	2,700	2.7	0.5	1.35	10.35	A, D	
Humboldt	**36**	7.00	Fiedler Creek	Hydesville	Chinook, Coho, Steelhead	6	0	5	1	900	0.9	0.25	0.23	9.23	A, B	
Humboldt	**36**	1.62	Wolverton Gulch (sign)	Hydesville	Chinook, Coho, Steelhead	6	0	0	0	20,000	10	0.25	2.50	8.50	A, B	
Humboldt	**101**	83.61	Rocky Gulch	Eureka Plain	Coho, Steelhead, Coastal Cutthroat Trout	5	0	5	0	13,400	10	0.25	0.00	0.00	A, R	
Humboldt	**101**	110.34	Tom Creek	Big Lagoon	Coho, Steelhead, Coastal Cutthroat Trout	5	0	5	1	1,200	1.2	0.5	0.60	8.60	A, B	
Humboldt	**254**	45.38	Unnamed trib to Eel River	Scotia		0	0	4	1	0	0	0.25	0.00	2.50	E	
Humboldt	**254**	3.17	Unnamed trib to SF Eel River	Weott	Steelhead	2	0	0	0	500	0.5	0.5	0.25	2.25	C, D	
Humboldt	**254**	45.76	Unnamed trib to Eel River	Scotia		0	0	0	1	0	0	0.25	0.00	0.50	E	
Mendocino	**1**	64.96	Mill Creek	Noyo River	Coho, Steelhead	4	5	0	0	9,200	9.2	0.75	6.90	15.90	A, B	
Mendocino	**1**	63.56	Virgin Creek	Noyo River	Coho, Steelhead	4	0	5	0	6,200	6.2	0.5	3.10	9.60	A, B	
Mendocino	**1**	71.29	Abalobadiah Creek	Ten Mile River	Steelhead	2	0	2	0	12,700	10	0.5	5.00	8.00	A, B	
Mendocino	**1**	12.36	Ross Creek	Garcia River	Steelhead	2	0	3	0	2,700	2.7	0.25	0.68	4.18	C, D	
Mendocino	**20**	32.41	Unnamed Trib to Broaddus Creek	Outlet Creek		0	15	0	3	0	0	0.25	0.00	16.50	E	
Mendocino	**101**	78.41	Rattlesnake Creek	Benbow	Steelhead, Coho, Chinook	6	0	2	1	5,800	5.8	0.75	4.35	11.85	A, B	
Mendocino	**128**	5.68	Ray,Roller Gulch	Navarro River	Steelhead	2	0	5	1	6,500	6.5	0.5	3.25	8.25	A, B	
Mendocino	**128**	9.49	Dead Horse Gulch	Navarro River	Coho, Steelhead	4	0	5	0	2,400	2.4	0.5	1.20	7.70	A, B	
Mendocino	**128**	21.07	Unnamed Trib Navarro R	Navarro River	Steelhead	2	0	5	1	3,500	3.5	0.5	1.75	6.75	C, D	
Mendocino	**128**	26.94	Con Creek	Navarro River	Steelhead	2	0	2	0	4,800	4.8	0.75	3.60	6.60	A, B	
Mendocino	**128**	49.66	Edwards Creek	Geyserville	Steelhead	2	0	3	1	>8% slope	0	0.5	0.00	4.00	C, D	
Mendocino	**128**	42.29	Elkhorn Creek	Warm Springs	Resident trout	1	0	0	0	2,100	2.1	0.5	1.05	2.05	C, D, E, F	
Mendocino	**162**	2.21	Corral Creek	Outlet Creek	Steelhead	2	0	0	0	600	0.6	0.25	0.15	2.15	C, D	Caltrans crossing is a natural bottom bridge/box. Just downstream is a 5-ft concrete pipe through a gravel extraction/processing site.

A - Species diversity taken from CDFG surveys or direct observations from local fisheries biologists.
B - Length of habitat taken from CDFG surveys
C - Species diversity assumed by presence in downstream confluence channel, size and slope of creek or observation upon site visit
D - Length of habitat estimated using USGS topographic maps
E - Presumed not a significant anadromous fish stream
R - Obtained species diversity and habitat information from Ross Taylor & Associates, Humboldt County Culvert Inventory and Fish Passage Evaluation (2000), Del Norte County Culvert Inventory and Fish Passage Evaluation (2001), or Mendocino County Culvert Inventory and Fish Passage Evaluation (2001) reports
K1 - Species diversity from Karuk Tribal Fisheries
K2 - Habitat information from Karuk Tribal Fisheries

Table B3: District 1 Unsurveyed Site Status

County	Route	Post Mile	Stream Name	Presumed Species Diversity	Comments
Humboldt	**101**	0.48	Trib to South Fork Eel River	None	Small, steep channel. Assumed no fish.
Humboldt	**36**	19.09	Unnamed trib to Van Duzen Riv	Steelhead	Looks like a stream capable of supporting steelhead. No confirmation available from local biologists. Site was not surveyed because access permission was denied but outlet cascades over riprap and it is obviously impassable.
Humboldt	**36**	34.08	Unnamed trib to Little Van Duzen Riv	None	Stream crossing is in steep terrain and unlikely to be accessible to fish.
Humboldt	**36**	38.43	Unnamed trib to Little Van Duzen Riv	None	Stream crossing is in steep terrain and unlikely to be accessible to fish.
Humboldt	**36**	38.49	Unnamed trib to Little Van Duzen Riv	None	Stream crossing is in steep terrain and unlikely to be accessible to fish.
Humboldt	**36**	39.40	Unnamed trib to Little Van Duzen Riv	None	Stream crossing is in steep terrain and unlikely to be accessible to fish.
Humboldt	**36**	41.37	Unnamed trib to Van Duzen Riv	Resident trout	This tributary is above the limit of anadromy for the Van Duzen River but likely supports resident trout.
Humboldt	**36**	41.45	Unnamed trib to Van Duzen Riv	Resident trout	This tributary is above the limit of anadromy for the Van Duzen River and may support resident trout.
Humboldt	**36**	42.35	Unnamed trib to Van Duzen Riv	None	This tributary is above the limit of anadromy for the Van Duzen River and has been rerouted as drainage near the highway. Unlikely to support fish.
Humboldt	**101**	0.48	Trib to South Fork Eel River	None	Small, steep channel. Assumed no fish.
Humboldt	**101**	18.37	Eel River	None	Small, steep channel. Assumed no fish.
Humboldt	**101**	29.66	Truss Creek	None	The stream channel is steep at the HUM101 crossing. HUM101 crossing assumed to be upstream of feasible fish habitat
Humboldt	**101**	31.26	Feese Creek	None	The stream channel is steep at the HUM101 crossing. HUM101 crossing assumed to be upstream of feasible fish habitat
Humboldt	**101**	37.68	Eel River	None	Small, steep channel. Assumed no fish.
Humboldt	**101**	40.35	Chadd Creek fork	Steelhead	Wet weather assessment scheduled. Survey will be conducted if channel appears to be suitable habitat.
Humboldt	**101**	53.18		None	Small, steep channel. Assumed no fish.
Humboldt	**101**	63.09	Finch Creek	None	Small, steep channel. Assumed no fish.
Humboldt	**101**	64.33	Unnamed trib to Eel River	None	Small, steep channel. Assumed no fish.
Humboldt	**101**	65.25	Unnamed trib to Eel River	None	Small, steep channel. Assumed no fish.
Humboldt	**101**	65.70	Unnamed trib to Eel River	None	Small, steep channel. Assumed no fish.
Humboldt	**101**	68.68		None	Small, steep channel. Assumed no fish.
Humboldt	**101**	86.94	Jolly Giant Creek		Culvert is ~1/2 mile long and can not be surveyed.
Humboldt	**101**	87.55	Unnamed trib to Janes Creek	Coastal cutthroat trout	Culvert scheduled for survey. Coastal cutthroat trout confirmed by personal observation (M Lang, 25Sep04).
Humboldt	**101**	95.93	Patrick Creek	Coastal cutthroat trout	Culvert is almost completely filled with sediment and at most flows the culvert flows full. Can not be accurately surveyed and is not currently passable by fish.

Table B3: District 1 Unsurveyed Site Status

County	Route	Post Mile	Stream Name	Presumed Species Diversity	Comments
Mendocino	**20**		James Ck		Scott Harris (CDFG) sent info on Nov.18, 2004 of a channel stabilization fish passage barrier in James Creek that needs assessment. Needs to be scheduled..
Mendocino	**20**	29.23	Unnamed Trib to Broaddus Creek	None	Not surveyed, not a fish bearing stream (no habitat, very small).
Mendocino	**101**	0.31	Unnamed Trib to Russian R	None	Very small, steep channel. Assumed insignificant to fish.
Mendocino	**101**	3.08	Unnamed Trib to Russian R	None	Small channel with minimal upstream habitat. Assumed insignificant.
Mendocino	**101**	6.74	Unnamed Trib to Russian R	None	Very small, steep channel. Assumed insignificant to fish.
Mendocino	**101**	9.87	Unnamed Trib to Russian R	None	Topographic map suggests ~5000 ft of suitably sloped channel but upstream channel is very small and dry most of the year. Assumed insignificant.
Mendocino	**101**	10.06	Unnamed Trib to Russian R	None	No stream on map. Channel is ditched for drainage.
Mendocino	**101**	11.72	Unnamed Trib to Russian R	None	Topographic map suggests ~4000 ft of suitably sloped channel but upstream channel is small and channelized for drainage.
Mendocino	**101**	21.97	Unnamed Trib to Russian R	Unknown	Channelized stream through Ukiah. Could be surveyed if known to have fish.
Mendocino	**101**	44.07	Unnamed Trib to Haehl Ck	Unknown	Could be surveyed if known to have fish. Looks like possible fish stream.
Mendocino	**101**	44.32	Unnamed Trib to Haehl Ck	Unknown	Smaller tributary than the crossing at PM 44.07. Could be surveyed if known to have fish.
Mendocino	**101**	46.24	Baechtel Creek	Coho, Chinook, Steelhead	Permit to Enter denied.
Mendocino	**101**	52.25	Ryan Creek	Coho, Chinook, Steelhead	Permit to Enter denied. Preliminary results included in prioritization ranking.
Mendocino	**101**	52.36	Ryan Creek	Coho, Chinook, Steelhead	Scheduled for survey fall 2004. Preliminary results included in prioritization ranking.
Mendocino	**101**	55.55	Unnamed Trib to Outlet Ck	Unknown	Permit to Enter denied.
Mendocino	**101**	55.75	Unnamed Trib to Outlet Ck	None	No stream shown on map. Topographic map suggests channel would have sustained gradient of >8%.
Mendocino	**101**	56.45	Unnamed Trib to Outlet Ck	None	Small, steep channel. Assumed insignificant.
Mendocino	**101**	56.8	Unnamed Trib to Outlet Ck	None	Small, steep channel. Assumed insignificant.
Mendocino	**101**	59.8	Sam Watt Creek	None	Channel may be too steep. Could be surveyed if known to have fish.
Mendocino	**101**	63.47	Long Valley Creek		Bridge with weirs underneath
Mendocino	**101**	66.5	Ten Mile Creek	Coho, Chinook, Steelhead	Scheduled for survey fall 2004.
Mendocino	**101**	69.86	Unnamed Trib Ten Mile Ck	Steelhead	Scheduled for survey fall 2004.

Table B3: District 1 Unsurveyed Site Status

County	Route	Post Mile	Stream Name	Presumed Species Diversity	Comments
Mendocino	**101**	71.92	Wilson Creek	Chinook, Steelhead	Scheduled for survey fall 2004.
Mendocino	**101**	72.54	Unnamed Trib Ten Mile Ck	Unknown	Scheduled for survey fall 2004.
Mendocino	**101**	73.56			CDFG expects this site to rank high.
Mendocino	**101**	74.20	Sheep Camp Ck		Scheduled for survey fall 2004. Preliminary results included in prioritization ranking.
Mendocino	**101**	75.66	Steep Gulch	None	Channel may be too steep. Could be surveyed if known to have fish.
Mendocino	**101**	79.07	Rattlesnake Creek	Coho, Chinook, Steelhead	Scheduled for survey fall 2004.
Mendocino	**128**	11.78	Unnamed Trib Navarro Riv	None	Small stream/ditch. No water flowing during winter rains. Assumed insignificant.
Mendocino	**128**	19.36	Unnamed Trib Lazy Ck	None	Very small channel, ditched for drainage. Assumed insignificant
Mendocino	**128**	20.5	Unnamed Trib Navarro Riv	None	Very small channel, ditched for drainage. Assumed insignificant
Mendocino	**128**	26.45	Trib to Anderson Ck	None	Small overgrown channel. Assumed insignificant
Mendocino	**128**	26.51	Trib to Anderson Ck	None	Small overgrown channel. Assumed insignificant
Mendocino	**128**	27.14	Witherell Creek	Unknown	No CDFG files found to assess habitat or fish presence. From the Mendocino County assessment report (Taylor, 2001) Witherell Ck is described as "Dry channel, narrow and confined, thick growth of Himalayan blackberries, lots of trash."
Mendocino	**128**	37.09	No stream on map	None	No stream on map. Small, steep channel. Assumed insignificant.
Mendocino	**253**	5.44	Unnamed Trib to Soda Ck	None	Not surveyed, Permit to Enter denied.
Mendocino	**253**	13.47	Unnamed Trib to Robinson Ck	None	Not a fish stream. Culvert is placed on 25 ft natural bedrock barrier.
Mendocino	**253**	16.1	Unnamed Trib to Robinson Ck	None	Unlikely fish stream, channelized ditch.

Table B4: Del Norte County Stream Crossing Sites - Red and Gray Ranked Sites Prioritized for Remediation

ADJUSTED RANK	STANDARD RANK	County	Route	Post Mile	Stream Name	Calwater Unit Hydrologic Subarea (HSA)	Presumed Species Diversity	Species Diversity Score	Extent of Barrier Score	Current Sizing Score	Current Condition Score	Length of Upstream Habitat	Habitat Quantity Score	Habitat Quality Modifier	Total Habitat Score	TOTAL SCORE	Sources	Comments
1	**1**	**Del Norte**	**197**	5.00	Sultan Creek	Smith River Plain	Coho, Chinook, Steelhead, Coastal Cutthroat Trout	5	15	5	3	4,500	4.5	0.75	3.38	27.38	A, D	
2	**5**	**Del Norte**	**197**	6.15	Little Mill Creek	Smith River Plain	Coho, Chinook, Steelhead, Coastal Cutthroat Trout	5	15	2	0	4,900	4.9	0.5	2.45	26.45	A, D	Site moved up in the ranking by consensus of local fisheries biologists and watershed restoration professionals. Little Mill Creek has had significant restoration activity in recent years. Score increased from 23.45 to 26.45 to adjust Del Norte rankings to match professional consensus.
3	**2**	**Del Norte**	**101**	39.78	Dominie Creek	Smith River Plain	Coho, Steelhead, Coastal Cutthroat Trout	4	15	5	0	8,400	8.4	0.5	4.20	25.70	A, D	Maintenance work is needed to repair exposed and corroding rebar.
4	**3**	**Del Norte**	**199**	31.31	Griffin Creek	Middle Fork Smith River	Coho, Chinook, Steelhead, Coastal Cutthroat Trout	5	12	0	0	9,700	9.7	0.75	7.28	25.48	A, B	Site needs in channel work to improve rock weirs at the outlet to provide passage. Consider fixing earlier as this stream crossing fix is low cost and provides a good return for the effort. Score increased from 24.28 to 25.48 to adjust Del Norte rankings to match professional consensus.
5	**11**	**Del Norte**	**197**	2.12	Peacock Creek	Smith River Plain	Coho, Chinook, Steelhead, Coastal Cutthroat Trout	5	10	3	1	6,000	6	0.75	4.50	25.00	A, D	This crossing is predicted to allow significant adult anadromous fish passage (86%). Site moved up in the ranking by consensus of local fisheries biologists and watershed restoration professionals due to restoration activity in the watershed and habitat quantity/quality. Score increased from 21.50 to 25.00 to adjust Del Norte rankings to match professional consensus.
6	**4**	**Del Norte**	**101**	2.22	Waukell Creek	Klamath Glen	Coho, Steelhead, Coastal Cutthroat Trout	4	15	4	1	5,000	5	0.5	2.50	24.00	A, D	The highest priority barrier on Waukell Ck is the concrete channel (a > 25% slope) just downstream of the stream crossing at PM 2.22. The stream crossing should only be addressed before the concrete channel is passable if the Waukell Creek headwaters is determined to be unique habitat with a genetically significant coastal cutthroat trout population.
7	**6**	**Del Norte**	**197**	0.36	Rock Creek	Smith River Plain	Coho, Chinook, Steelhead, Coastal Cutthroat Trout	5	15	5	1	600	0.6	0.5	0.30	23.30	A, D	
8	**7**	**Del Norte**	**199**	2.56	Clarks Creek	Lower Smith River	Coho, Chinook, Steelhead, Coastal Cutthroat Trout	5	11	1	1	6,100	6.1	1	6.10	23.10	A, B, R	Clarks Creek has the most pristine habitat of any of the Del Norte County streams and is a high priority for fish access. The crossing has baffles and is predicted to pass adult salmonids but not resident or juvenile salmoinds.
9	**8**	**Del Norte**	**101**	35.56	Tryon Creek	Lower Smith River	Coho, Steelhead, Coastal Cutthroat Trout	4	15	5	0	1,400	1.4	0.5	0.70	22.20	A, D	
10	**9**	**Del Norte**	**101**	31.75	Brush or Bush Creek (local name)	Lower Smith River	Coho, Steelhead, Coastal Cutthroat Trout	4	15	4	0	1,800	1.8	0.5	0.90	21.90	A, R	
11	**10**	**Del Norte**	**199**	34.04	Broken Kettle Creek	Illinois River	Coho, Steelhead, Coastal Cutthroat Trout	4	15	0	1	3,000	3	0.75	2.25	21.75	A, D	
12	**12**	**Del Norte**	**101**	37.46	Unnamed trib to Morrison Ck	Lower Smith River	Coastal Cutthroat Trout	1	15	5	4	1,500	1.5	0.5	0.75	21.25	C, D	
13	**13**	**Del Norte**	**199**	34.79	Trib. to Broken Kettle Creek	Illinois River	Coho, Steelhead, Coastal Cutthroat Trout	4	15	2	1	1,400	1.4	0.5	0.70	21.20	C, D	

Table B4: Del Norte County Stream Crossing Sites - Red and Gray Ranked Sites Prioritized for Remediation

ADJUSTED RANK	STANDARD RANK	County	Route	Post Mile	Stream Name	Calwater Unit Hydrologic Subarea (HSA)	Presumed Species Diversity	Species Diversity Score	Extent of Barrier Score	Current Sizing Score	Current Condition Score	Length of Upstream Habitat	Habitat Quantity Score	Habitat Quality Modifier	Total Habitat Score	TOTAL SCORE	Sources	Comments
14	**14**	**Del Norte**	**101**	0.45	Unnamed trib to McGarvey Ck	Klamath Glen	Steelhead, Coastal Cutthroat Trout	2	15	3	1	4,200	4.2	0.5	2.10	21.10	C, D	
15	**15**	**Del Norte**	**101**	38.25	Morrison Creek	Lower Smith River	Coho, Chinook, Steelhead, Coastal Cutthroat Trout	5	11	5	0	4,800	4.8	0.5	2.40	20.90	A, B	
16	**16**	**Del Norte**	**101**	43.75	Lopez Creek	Winchuck River	Steelhead, Coastal Cutthroat Trout	2	15	4	0	2,800	2.8	0.5	1.40	20.40	R	
17	**17**	**Del Norte**	**101**	36.72	Unnamed trib to Smith River	Lower Smith River	Steelhead, Coastal Cutthroat Trout	2	15	5	0	1,600	1.6	0.5	0.80	20.30	C, D	
18	**18**	**Del Norte**	**199**	30.33	Trib. to Griffin Creek	Middle Fork Smith River	Steelhead, Coastal Cutthroat Trout	2	15	5	1	350	0	0.25	0	20.00	A, B	
19	**19**	**Del Norte**	**101**	41.41	Ritmer Creek	Smith River Plain	Steelhead, Coastal Cutthroat Trout	2	12	3	0	5,600	5.6	0.75	4.20	19.70	R	
20	**20**	**Del Norte**	**197**	6.83	Hutsinpillar Cr.	Smith River Plain	Steelhead, Coastal Cutthroat Trout	2	15	5	0	>8% slope	0	0	0.00	19.50	A, D	
21	**21**	**Del Norte**	**101**	31.11	Unnamed trib to Jordan Creek	Lower Smith River	Steelhead, Coastal Cutthroat Trout	2	15	2	0	2,000	2	0.5	1.00	19.00	C, D	
21	**21**	**Del Norte**	**101**	23.43	Unnamed trib drains to ocean	Smith River Plain	Coastal Cutthroat Trout	1	15	5	1	> 8% slope	0	0.25	0.00	19.00	E	
23	**23**	**Del Norte**	**199**	15.58	Trib. to Smith River	Middle Fork Smith River	Resident Trout	1	15	4	1	600	0.6	0.25	0.15	18.65	C, D	
24	**24**	**Del Norte**	**199**	10.04	Trib. to Smith River	Middle Fork Smith River	Resident Trout	1	15	5	0	300	0	0.25	0.00	18.50	C, D	
25	**25**	**Del Norte**	**199**	32.26	Trib. to Griffin Creek	Middle Fork Smith River	Steelhead, Resident Trout	2	15	1	1	700	0.7	0.5	0.35	18.35	C, D	
26	**26**	**Del Norte**	**199**	31.22	Trib. to Griffin Creek	Middle Fork Smith River	Coho, Steelhead, Coastal Cutthroat Trout	4	12	2	0	2,400	2.4	0.5	1.20	18.20	A, B	
27	**27**	**Del Norte**	**199**	31.81	Trib. to Griffin Creek	Middle Fork Smith River	Resident Trout	1	15	3	1	600	0.6	0.25	0.15	18.15	C, D	
28	**28**	**Del Norte**	**101**	30.12	Unnamed trib to Jordan Creek	Lower Smith River			15	5	1	0	0	0.25	0.00	18.00	E	
28	**28**	**Del Norte**	**197**	2.90	Unnamed Trib to Smith River	Smith River Plain			14	5	3	0	0	0.5	0.00	18.00	E, D	
30	**30**	**Del Norte**	**199**	12.86	Marys Creek	Middle Fork Smith River	Steelhead, Coastal Cutthroat Trout, Coho	4	12	0	0	2,400	2.4	0.75	1.8	17.80	C, D	
31	**31**	**Del Norte**	**199**	1.00	Trib to Jordan Creek	Lower Smith River	Resident Trout	1	15	2	1	Above Anadromy	0	0.25	0.00	17.50	E	
31	**31**	**Del Norte**	**199**	8.97	Trib. to Smith River	Middle Fork Smith River		0	15	5	0	0	0	0.25	0.00	17.50	E	
33	**33**	**Del Norte**	**101**	2.39	Unnamed trib to Waukell Ck	Klamath Glen	Coastal Cutthroat Trout	1	15	1	1	500	0.5	0.25	0.13	17.13	C, D	

Table B4: Del Norte County Stream Crossing Sites - Red and Gray Ranked Sites Prioritized for Remediation

ADJUSTED RANK	STANDARD RANK	County	Route	Post Mile	Stream Name	Calwater Unit Hydrologic Subarea (HSA)	Presumed Species Diversity	Species Diversity Score	Extent of Barrier Score	Current Sizing Score	Current Condition Score	Length of Upstream Habitat	Habitat Quantity Score	Habitat Quality Modifier	Total Habitat Score	TOTAL SCORE	Sources	Comments
34	**34**	**Del Norte**	**197**	4.34	Unnamed Trib to Smith River	Smith River Plain			15	3	1	200	0.2	0.25	0.05	17.05	E, D	
35	**35**	**Del Norte**	**199**	18.04	Trib. to Smith River	Middle Fork Smith River		0	15	3	1	0	0	0.25	0.00	17.00	E	
35	**35**	**Del Norte**	**199**	34.64	Trib. to Broken Kettle Creek	Illinois River		0	15	3	1	0	0	0.25	0.00	17.00	E	
37	**37**	**Del Norte**	**199**	34.94	Trib. to Broken Kettle Creek	Illinois River		0	15	3	0	0	0	0	0.00	16.50	E	
38	**38**	**Del Norte**	**101**	11.65	Unnamed trib to Lagoon Pond	Klamath Glen	Coastal Cutthroat Trout	1	13	4	0	700	0.7	0.25	0.18	16.18	C, D	
39	**39**	**Del Norte**	**199**	32.55	Trib. to Griffin Creek	Middle Fork Smith River		0	15	0	1	0	0	0.25	0.00	15.50	E	
39	**39**	**Del Norte**	**199**	33.89	Trib. to Broken Kettle Creek	Illinois River		0	15	0	1	0	0	0.25	0.00	15.50	E	
41	**41**	**Del Norte**	**199**	3.00	Trib. to Smith River	Lower Smith River	Resident Trout	1	11	4	1	800	0.8	0.25	0.20	14.70	C, D	
42	**42**	**Del Norte**	**101**	32.24	Yonkers Creek	Lower Smith River	Coho, Steelhead, Coastal Cutthroat Trout	4	4	0	0	4,400	4.4	0.5	2.20	10.20	R	
43	**43**	**Del Norte**	**199**	1.98	Trib to Clarks Creek	Lower Smith River	Resident Trout	1		0	1	Above Anadromy	0	0.25	0.00	1.50	E	

A - Species diversity taken from CDFG surveys or direct observations from local fisheries biologists. See Appendix B - Site Summaries for sources
B - Length of habitat taken from CDFG surveys
C - Species diversity assumed by presence in downstream confluence channel, size and slope of creek or observation upon site visit
D - Length of habitat estimated using USGS topographic maps
E - Presumed not a significant anadromous fish stream
R - Obtained specie diversity and habitat information from Ross Taylor & Associates Report: Del Norte County Culvert Inventory and Fish Passage Evaluation (2001)

Table B5: Del Norte County Green Ranked Stream Crossings

County	Route	Post Mile	Stream Name	Calwater Unit Hydrologic Subarea (HSA)	Presumed Species Diversity	Species Diversity Score	Extent of Barrier Score	Current Sizing Score	Current Condition Score	Length of Upstream Habitat	Habitat Quantity Score	Habitat Quality Modifier	Total Habitat Score	TOTAL SCORE	Comments
Del Norte	**101**	26.15	Elk Ck	Smith River Plain	Coho, Steelhead, Coastal Cutthroat Trout, Chinook	5	0	0	0	20,000	20	0.5	10.00	15.00	A
Del Norte	**101**	30.31	Jordan Creek	Lower Smith River	Coho, Steelhead, Coastal Cutthroat Trout	4	0	5	0	5,100	5.1	0.5	2.55	9.05	A, R
Del Norte	**101**	25.26	Unnamed trib drains to ocean	Smith River Plain	Coastal Cutthroat Trout	1	0	5	0	9,500	9.5	0.25	2.38	5.88	C, D
Del Norte	**101**	24.46	Unnamed trib drains to ocean	Smith River Plain	Coastal Cutthroat Trout	1	0	5	1	5,000	5	0.25	1.25	5.25	C, D
Del Norte	**101**	27.46	Unnamed trib to Elk Creek	Smith River Plain	Coastal Cutthroat Trout	1	0	2	0	300	0	0.25	0.00	2.00	E

Table B6: Humboldt County Stream Crossing Sites - Red and Gray Ranked Sites Prioritized for Remediation

RANK	County	Route	Post Mile	Stream Name	Calwater Unit Hydrologic Subarea (HSA)	Species Diversity	Species Diversity Score	Extent of Barrier Score	Current Sizing Score	Current Condition Score	Length of Upstream Habitat	Habitat Quantity Score	Habitat Quality Modifier	Total Habitat Score	TOTAL SCORE	Sources	Comments
1	**Humboldt**	**254**	4.18	Fish Creek	Weott	Coho, Chinook, Steelhead	6	15	5	1	8,600	8.6	0.75	5.00	29.00	A, B	
2	**Humboldt**	**299**	2.97	Essex Gulch	Blue Lake	Steelhead, Coho, Resident Trout	5	15	5	1	6,000	6	0.5	3.00	26.00	C, D	Essex Gulch is currently blocked by a county culvert approximately 100 feet downstream of the state highway culvert. The county culvert is perched about 5 feet. A joint project will be important if/when the county culvert is altered as any fix to the county culvert will influence the fish passage and hydraulics of the state highway culvert.
3	**Humboldt**	**101**	124.49	Little Lost Man Cr.	Orick	Coho, Chinook, Steelhead, Coastal Cutthroat Trout	7	14	3	0	4,200	4.2	0.75	3.15	25.65	A, D	
4	**Humboldt**	**101**	59.94	Strongs Creek	Ferndale	Coho, Steelhead, Coastal Cutthroat Trout	5	15	0	1	19,000	10	0.5	5.00	25.50	A, D	
5	**Humboldt**	**101**	95.60	Strawberry Creek	Blue Lake	Coho, Steelhead, Coastal Cutthroat Trout	5	12	4	0	18,000	10	0.5	5.00	24.00	A, R	Just upstream of this culvert, the stream is channelized in a steep trapezoidal, concrete channel along Central Avenue through McKinleyville. Fish access into the Strawberry Creek watershed requires remediation of both the state highway culvert and the concrete channel.
6	**Humboldt**	**36**	9.92	Flannigan Creek	Hydesville	Chinook, Coho, Steelhead	6	13	5	1	3,800	3.8	0.5	1.90	23.90	B, C	
7	**Humboldt**	**101**	99.03	Luffenholtz Creek	Big Lagoon	Steelhead, Coastal Cutthroat Trout	3	15	1	0	37,000	10	0.5	5.00	23.50	A, R	
8	**Humboldt**	**254**	40.83	Chadd Creek	Scotia	Coho, Chinook, Steelhead	6	11	4	1	4,000	4	0.75	3.00	22.50	A, B	
9	**Humboldt**	**101**	40.12	Chadd Creek	Scotia	Chinook, Coho, Steelhead	6	15	1	1	900	0.9	0.5	0.45	22.45	A, B	
10	**Humboldt**	**96**	36.88	Crawford Creek	Orleans	Steelhead	2	15	0	0	7,000	7	0.75	5.25	22.25	K1, K2	
11	**Humboldt**	**36**	5.18	Wilson Creek (sign)	Hydesville	Chinook, Coho, Steelhead	6	12	2	1	5,400	5.4	0.5	2.70	22.20	A, D	
12	**Humboldt**	**96**	36.35	Ullathorne Creek	Orleans	Steelhead	2	15	0	0	6,000	6	0.75	4.50	21.50	K1, K2	
13	**Humboldt**	**254**	15.04	Mowry Creek	Weott	Steelhead	2	15	5	3	900	0.9	0.5	0.45	21.45	C, D	
14	**Humboldt**	**299**	21.2	Lupton Creek	Beaver	Steelhead	2	15	1	0	5,000	5	0.75	3.75	21.25	C, D	
15	**Humboldt**	**36**	9.17	Fox Creek	Hydesville	Resident Trout	1	15	5	1	8,900	8.9	0.25	2.23	21.23	A, D	
15	**Humboldt**	**36**	18.57	Unnamed trib to Van Duzen Riv	Bridgeville	Steelhead	2	15	5	3	900	0.9	0.25	0.23	21.23	C, D	
17	**Humboldt**	**101**	30.46	Mowry Creek	Weott	Steelhead	2	15	3	3	700	0.7	0.75	0.53	20.53	A, D	
18	**Humboldt**	**96**	38.34	Wilder Gulch	Orleans		0	15	5	3	2,900	2.9	0.5	1.45	20.45	E, D	
19	**Humboldt**	**299**	31.07	Willow Creek	Wilow Creek	Steelhead	2	15	3	0	3,500	3.5	0.5	1.75	20.25	A, D	
19	**Humboldt**	**299**	30.36	Low Gap Creek	Wilow Creek	Resident Trout	1	15	5	3	500	0.5	0.5	0.25	20.25	A, D	

Table B6: Humboldt County Stream Crossing Sites - Red and Gray Ranked Sites Prioritized for Remediation

RANK	County	Route	Post Mile	Stream Name	Calwater Unit Hydrologic Subarea (HSA)	Species Diversity	Species Diversity Score	Extent of Barrier Score	Current Sizing Score	Current Condition Score	Length of Upstream Habitat	Habitat Quantity Score	Habitat Quality Modifier	Total Habitat Score	TOTAL SCORE	Sources	Comments
21	**Humboldt**	**254**	1.82	Anderson Creek	Weott	Coho, Steelhead	4	15	0	1	1,400	1.4	0.5	0.70	20.20	A, C, D	
22	**Humboldt**	**101**	101.71	Unnamed stream	Big Lagoon	Resident Trout	1	15	5	3	500	0.5	0.25	0.13	20.13	C, D	
23	**Humboldt**	**101**	1.61	Durphy Creek	Benbow	Chinook, Coho, Steelhead	6	6	3	3	10,560	10	0.5	5.00	20.00	A, B	
23	**Humboldt**	**101**	93.27	Widow White Creek	Blue Lake	Coho, Steelhead, Coastal Cutthroat Trout	5	11	2	1	12,500	10	0.25	2.50	20.00	A, R	
23	**Humboldt**	**36**	10.07	Unnamed trib to Van Duzen Riv	Hydesville	Steelhead	2	15	5	1	0	0	0.25	0.00	20.00	C, D	
23	**Humboldt**	**254**	41.76	Unnamed trib to Chadd Creek	Scotia	Steelhead	2	15	5	1	300	0	0.25	0.00	20.00	C, D	
23	**Humboldt**	**169**	32.74	Bens Creek	Klamath Glen	Steelhead	2	15	5	1	>8% slope	0	0.5	0.00	20.00	A, D	
28	**Humboldt**	**299**	41.27	Schoolhouse Creek	Wilow Creek	Steelhead	2	15	5	0	1,500	1.5	0.25	0.38	19.88	C, D	
29	**Humboldt**	**36**	3.99	Barber Creek	Hydesville	Steelhead	1	15	5	1	3,000	3	0.25	0.75	19.75	A, D	
29	**Humboldt**	**169**	22.37	Cappell Creek (bridge with concrete sill)	Klamath Glen	Steelhead, Chinook[1]	4	15	0	0	1,000	1	0.75	0.75	19.75	A,D	
31	**Humboldt**	**101**	103.88	Burris Creek	Big Lagoon	Coastal Cutthroat Trout	1	15	5	1	2,800	2.8	0.25	0.70	19.70	A, D	
32	**Humboldt**	**101**	99.43	Unnamed stream	Big Lagoon	Steelhead, Coastal Cutthroat Trout	3	15	3	0	700	0.7	0.25	0.18	19.68	C, D	
33	**Humboldt**	**101**	106.71	Unnamed stream	Big Lagoon	Coastal Cutthroat Trout	1	15	4	0	3,300	3.3	0.5	1.65	19.65	C, D	
34	**Humboldt**	**254**	15.75	Feese Creek	Weott	Steelhead	2	15	2	3	>8% Slope	0	0.25	0.00	19.50	A, D	
34	**Humboldt**	**169**	14.92	Knulthkarn Creek	Klamath Glen	Steelhead	2	15	5	0	>8% slope	0	0.5	0.00	19.50	C, D	
34	**Humboldt**	**169**	29.46	Burrill Creek		Steelhead	2	15	4	1	>8% slope	0	0.5	0.00	19.50	C, D	
37	**Humboldt**	**101**	11.71	Bear Canyon	Benbow	Chinook, Coho, Steelhead	6	8	5	0	5,800	5.8	0.5	2.90	19.40	A, D	
38	**Humboldt**	**101**	103.66	Savage Creek	Big Lagoon	Coastal Cutthroat Trout	1	15	5	1	1,500	1.5	0.25	0.38	19.38	A, D	
39	**Humboldt**	**101**	105.36	Beach Creek	Big Lagoon	Coastal Cutthroat Trout	1	15	3	3	1,400	1.4	0.25	0.35	19.35	A, D	
40	**Humboldt**	**101**	104.79	Unnamed stream	Big Lagoon	Coastal Cutthroat Trout	1	15	5	1	600	0.6	0.25	0.15	19.15	C, D	
41	**Humboldt**	**101**	17.23	Williams Creek	Benbow	Steelhead	2	15	3	1	550	0.5	0.25	0.13	19.13	C, B	
42	**Humboldt**	**36**	4.39	Fischer Creek	Hydesville	Steelhead	2	15	0	1	6,300	6.3	0.25	1.58	19.08	C, D	
43	**Humboldt**	**101**	105.64	Penn Creek	Big Lagoon	Coastal Cutthroat Trout	1	15	2	3	1,100	1.1	0.5	0.55	19.05	A, D	
44	**Humboldt**	**101**	0.86	Hartsook Creek	Benbow	Coho, Steelhead	4	12	3	1	2,000	2	0.5	1.00	19.00	A, B	

Table B6: Humboldt County Stream Crossing Sites - Red and Gray Ranked Sites Prioritized for Remediation

RANK	County	Route	Post Mile	Stream Name	Calwater Unit Hydrologic Subarea (HSA)	Species Diversity	Species Diversity Score	Extent of Barrier Score	Current Sizing Score	Current Condition Score	Length of Upstream Habitat	Habitat Quantity Score	Habitat Quality Modifier	Total Habitat Score	TOTAL SCORE	Sources	Comments
44	**Humboldt**	**101**	105.05	Unnamed Trib to Beach Ck	Big Lagoon		0	15	5	3	0	0	0	0.00	19.00	E	
44	**Humboldt**	**101**	106.13	Unnamed stream	Big Lagoon		0	15	5	3	0	0	0	0.00	19.00	E	
44	**Humboldt**	**36**	33.44	Unknown trib to Butte Creek	Bridgeville		0	15	5	3	0	0	0.25	0.00	19.00	E	
44	**Humboldt**	**254**	6.85	Unnamed trib to SF Eel River	Weott		0	15	5	3	>8% Slope	0	0.25	0.00	19.00	C, D	
44	**Humboldt**	**96**	38.89	Cheenitch Creek	Orleans	Steelhead	2	15	3	0	1,000	1	0.5	0.50	19.00	K1, D	
50	**Humboldt**	**101**	100.18	McConnahas Mill Creek	Big Lagoon	Resident Trout	1	15	4	1	1,200	1.2	0.25	0.30	18.80	A, D	
	Humboldt	**254**	7.69	Dry Creek	Weott	Steelhead	2	15	2	1	1,000	1	0.25	0.25	18.75	A, B	
	Humboldt	**101**	109.90	Unnamed Trib to Big Lagoon	Big Lagoon	Coastal Cutthroat Trout	1	15	5	0	900	0.9	0.25	0.23	18.73	C, D	
	Humboldt	**101**	12.11	Unnamed Trib to SF Eel River	Benbow	Steelhead	2	15	0	3	700	0.7	0.25	0.18	18.68	C, D	
	Humboldt	**101**	108.32	Unnamed Trib to Big Lagoon	Big Lagoon	Coastal Cutthroat Trout	1	15	4	0	1,700	1.7	0.25	0.43	18.43	C, D	
	Humboldt	**299**	32.61	Ruby Creek	Wilow Creek	Steelhead	2	15	2	0	1,300	1.3	0.25	0.33	18.33	C, D	
	Humboldt	**299**	40.3	China Creek	Wilow Creek	Steelhead	2	15	2	0	1,000	1	0.25	0.25	18.25	A, B	
	Humboldt	**169**	24.66	Mareep Creek	Klamath Glen	Steelhead	2	15	1	1	500	0.5	0.5	0.25	18.25	A, D	
	Humboldt	**101**	136.36	Unnamed Tribs to McGarvey Ck		Resident Trout	1	15	3	1	800	0.8	0.25	0.20	18.20	C, D	
	Humboldt	**36**	33.56	Unknown trib to Butte Creek	Bridgeville		0	15	3	3	800	0.8	0.25	0.20	18.20	E	
	Humboldt	**36**	6.57	Unnamed trib to Van Duzen Riv	Hydesville		0	15	5	1	700	0.7	0.25	0.18	18.18	E	
	Humboldt	**254**	16.44	Unnamed trib to SF Eel River	Weott		0	15	5	1	600	0.6	0.25	0.15	18.15	E	
	Humboldt	**299**	29.68	Mason Gulch	Wilow Creek	Resident Trout	1	15	4	0	500	0.5	0.25	0.13	18.13	C, D	
	Humboldt	**101**	102.69	McNeil Creek	Big Lagoon	Coastal Cutthroat Trout	1	15	1	3	400	0.4	0.25	0.10	18.10	A, D	
	Humboldt	**101**	1.97	Laurel Creek	Benbow		0	15	3	3	0	0	0.25	0.00	18.00	E	
	Humboldt	**101**	16.75	Tuttle Creek	Benbow	Steelhead	2	15	2	0	180	0	0.25	0.00	18.00	C, B	
	Humboldt	**101**	102.33	Unnamed stream	Big Lagoon		0	15	3	3	0	0	0	0.00	18.00	E	
	Humboldt	**299**	37.29	Boise Creek	Wilow Creek	Resident Trout	1	15	4	0	>8% slope	0	0.25	0.00	18.00	A, B	
	Humboldt	**101**	20.11	Unnamed Trib to SF Eel River	Weott	Steelhead	2	15	0	1	500	0.5	0.5	0.25	17.75	C, D	
	Humboldt	**101**	49.52	Unnamed Trib to Eel River	Scotia		0	15	2	3	0	0	0.25	0.00	17.50	E	
	Humboldt	**36**	30.19	Unknown trib to Muddy Creek	Bridgeville		0	15	4	1	>8% Slope	0	0.25	0.00	17.50	E	
	Humboldt	**36**	32.89	Unknown trib to Butte Creek	Bridgeville		0	15	5	0	0	0	0.25	0.00	17.50	E	
	Humboldt	**36**	33	Unknown trib to Butte Creek	Bridgeville		0	15	5	0	0	0	0.25	0.00	17.50	E	
	Humboldt	**254**	0.44	Rocky Glen Creek	Benbow	Steelhead	2	15	0	1	>8% Slope	0	0.5	0.00	17.50	C, D	
	Humboldt	**254**	14.07	Truss Creek	Weott		0	15	5	0	>8% Slope	0	0.25	0.00	17.50	E	
	Humboldt	**299**	41.01	Unnamed trib to Trinity River	Wilow Creek		0	15	5	0	>8% slope	0	0.25	0.00	17.50	E	

Table B6: Humboldt County Stream Crossing Sites - Red and Gray Ranked Sites Prioritized for Remediation

RANK	County	Route	Post Mile	Stream Name	Calwater Unit Hydrologic Subarea (HSA)	Species Diversity	Species Diversity Score	Extent of Barrier Score	Current Sizing Score	Current Condition Score	Length of Upstream Habitat	Habitat Quantity Score	Habitat Quality Modifier	Total Habitat Score	TOTAL SCORE	Sources	Comments
	Humboldt	**299**	41.12	Unnamed trib to Trinity River	Wilow Creek		0	15	5	0	>8% slope	0	0.25	0.00	17.50	E	
	Humboldt	**299**	41.39	Unnamed trib to Trinity River	Wilow Creek		0	15	4	1	>8% slope	0	0.25	0.00	17.50	E	
	Humboldt	**169**	27.57	Rube Creek (bridge with poured concrete lining channel)	Klamath Glen	Steelhead	2	15	0	1	>8% slope	0	0.5	0.00	17.50	A,D	
	Humboldt	**101**	19.68	Unnamed Trib to SF Eel River	Weott	Steelhead	2	15	0	0	600	0.6	0.5	0.30	17.30	C, D	
	Humboldt	**101**	43.91	Unnamed Trib to Eel River	Scotia		0	15	3	1	0	0	0.25	0.00	17.00	E	
	Humboldt	**101**	125.02	Unnamed Trib to Prairie Ck	Orick		0	15	3	1	0	0	0	0.00	17.00	E	
	Humboldt	**36**	19.09	Unnamed trib to Van Duzen Riv	Bridgeville	Steelhead	2	15		0				0.00	17.00	C	
	Humboldt	**254**	41.88	Unnamed trib to Chadd Creek	Scotia	Steelhead	2	15	0	0	200	0	0.25	0.00	17.00	C, D	
	Humboldt	**299**	6.54	Powers Creek	Blue Lake		0	15	3	1	>8% slope	0	0.25	0.00	17.00	A, B	
	Humboldt	**299**	14.55	Unnamed trib to Long Prairie Ck	North Fork Mad River		0	15	4	0	>8% slope	0	0.25	0.00	17.00	E	
	Humboldt	**299**	39.19	Bloody Nose Creek	Wilow Creek		0	15	4	0	0	0	0.25	0.00	17.00	E	
	Humboldt	**299**	34.41	Gregg Creek	Wilow Creek	Resident Trout	1	15	1	0	800	0.8	0.25	0.20	16.70	A, B	
	Humboldt	**101**	133.72	Unnamed Trib to NF Ah Pah Ck	Klamath Glen		0	15	2	1	0	0	0	0.00	16.50	E	
	Humboldt	**254**	22.87	Unnamed trib to SF Eel River	Scotia		0	15	0	3	>8% Slope	0	0.25	0.00	16.50	E	
	Humboldt	**254**	45.07	Unnamed trib to Eel River	Scotia		0	15	0	3	0	0	0.25	0.00	16.50	E	
	Humboldt	**101**	90.83	Mill Creek	Blue Lake	Chinook, Coho, Steelhead, Coastal Cutthroat Trout	7	5	5	1	2,600	2.6	0.5	1.30	16.30	A, B, R	
	Humboldt	**101**	98.69	Unnamed Trib to Luffenholtz Ck	Big Lagoon	Resident Trout	1	15	0	0	500	0.5	0.5	0.25	16.25	C, D	
	Humboldt	**101**	32.26	Robinson Creek	Weott	Above Anadromy	0	15	1	1	0	0	0	0.00	16.00	E	
	Humboldt	**101**	44.05	Unnamed Trib to Eel River	Scotia		0	15	1	1	0	0	0.25	0.00	16.00	E	
	Humboldt	**101**	50.38	Unnamed Trib to Eel River	Scotia		0	15	1	1	0	0	0.25	0.00	16.00	E	
	Humboldt	**101**	63.96	Unnamed Trib to Eel River	Ferndale		0	15	2	0	0	0	0	0.00	16.00	E	
	Humboldt	**101**	98.14	Unnamed stream	Little River	Coastal Cutthroat Trout	1	15	0	0	300	0	0.25	0.00	16.00	C, D	
	Humboldt	**101**	123.95	Unnamed Trib to Prairie Ck			0	15	1	1	0	0	0	0.00	16.00	E	
	Humboldt	**96**	41.46	Whitmore Creek	Orleans		0	15	2	0	>8% slope	0	0.25	0.00	16.00	K1, D	
	Humboldt	**254**	16.75	Robinson Creek	Weott		0	15	0	1	800	0.8	0.5	0.40	15.90	C, D	
	Humboldt	**101**	24.26	Eel River	Weott		0	15	0	1	0	0	0.25	0.00	15.50	E	
	Humboldt	**299**	15.28	Unnamed trib to Long Prairie Ck	North Fork Mad River		0	15	1	0	>8% slope	0	0.25	0.00	15.50	E	

Table B6: Humboldt County Stream Crossing Sites - Red and Gray Ranked Sites Prioritized for Remediation

RANK	County	Route	Post Mile	Stream Name	Calwater Unit Hydrologic Subarea (HSA)	Species Diversity	Species Diversity Score	Extent of Barrier Score	Current Sizing Score	Current Condition Score	Length of Upstream Habitat	Habitat Quantity Score	Habitat Quality Modifier	Total Habitat Score	TOTAL SCORE	Sources	Comments
	Humboldt	**101**	122.69	Skunk Cabbage Creek	Orick	Coho, Steelhead, Coastal Cutthroat Trout	5	3	0	0	9,500	9.5	0.75	7.13	15.13	A, D	
	Humboldt	**101**	126.22	May Creek	Orick	Coho, Steelhead, Coastal Cutthroat Trout	5	3	0	0	9,500	9.5	0.75	7.13	15.13	A, B	
	Humboldt	**101**	99.91	Unnamed stream	Big Lagoon		0	15	0	0	0	0	0	0.00	15.00	E	
	Humboldt	**101**	123.52	Unnamed Trib to Prairie Ck	Orick	Coho, Steelhead, Coastal Cutthroat Trout	5	9	1	1	350	0	0.25	0.00	15.00	C, D	
	Humboldt	**254**	8.13	Unnamed trib to SF Eel River	Weott		0	15	0	0	>8% Slope	0	0.25	0.00	15.00	E	
	Humboldt	**254**	41.92	Unnamed trib to Chadd Creek	Scotia		0	15		0	>8% Slope	0	0.25	0.00	15.00	E	
	Humboldt	**299**	12.33	Pine Creek	North Fork Mad River		0	15	0	0	>8% slope	0	0.5	0.00	15.00	A, B	
	Humboldt	**101**	22.80	Coon Creek	Weott	Steelhead	2	9	3	1	3,500	3.5	0.5	1.75	14.75	A, D	
	Humboldt	**101**	62.22	Palmer Creek	Ferndale		0	7	3	1	6,000	6	0.5	3.00	12.00	C, D	

A - Species diversity taken from CDFG surveys or direct observations from local fisheries biologists. See Appendix B - Site Summaries for sources
B - Length of habitat taken from CDFG surveys
C - Species diversity assumed by presence in downstream confluence channel, size and slope of creek or observation upon site visit
D - Length of habitat estimated using USGS topographic maps
E - Presumed not a significant anadromous fish stream
R - Obtained species diversity and habitat information from Ross Taylor & Associates Report: Humboldt County Culvert Inventory and Fish Passage Evaluation (2000)
K1 - Species diversity from Karuk Tribal Fisheries
K2 - Habitat information from Karuk Tribal Fisheries

Table B7: Humboldt County Green Ranked Stream Crossings

County	Route	Post Mile	Stream Name	Calwater Unit Hydrologic Subarea (HSA)	Species Diversity	Species Diversity Score	Extent of Barrier Score	Current Sizing Score	Current Condition Score	Length of Upstream Habitat	Habitat Quantity Score	Habitat Quality Modifier	Total Habitat Score	TOTAL SCORE	Sources	Comments
Humboldt	**36**	8.15	Cummings Creek	Hydesville	Chinook, Coho, Steelhead	6	0	3	0	10,500	10	0.5	5.00	12.50	A, D	
Humboldt	**36**	6.25	Cuddeback Creek	Hydesville	Chinook, Coho, Steelhead	6	0	5	1	2,700	2.7	0.5	1.35	10.35	A, D	
Humboldt	**36**	7.00	Fiedler Creek	Hydesville	Chinook, Coho, Steelhead	6	0	5	1	900	0.9	0.25	0.23	9.23	A, B	
Humboldt	**36**	1.62	Wolverton Gulch (sign)	Hydesville	Chinook, Coho, Steelhead	6	0	0	0	20,000	10	0.25	2.50	8.50	A, B	
Humboldt	**101**	83.61	Rocky Gulch	Eureka Plain	Coho, Steelhead, Coastal Cutthroat Trout	5	0	5	0	13,400	10	0.25	0.00	0.00	A, R	
Humboldt	**101**	110.34	Tom Creek	Big Lagoon	Coho, Steelhead, Coastal Cutthroat Trout	5	0	5	1	1,200	1.2	0.5	0.60	8.60	A, B	
Humboldt	**254**	45.38	Unnamed trib to Eel River	Scotia		0	0	4	1	0	0	0.25	0.00	2.50	E	
Humboldt	**254**	3.17	Unnamed trib to SF Eel River	Weott	Steelhead	2	0	0	0	500	0.5	0.5	0.25	2.25	C, D	
Humboldt	**254**	45.76	Unnamed trib to Eel River	Scotia		0	0	0	1	0	0	0.25	0.00	0.50	E	

Table B8: Humboldt County Unsurveyed Site Status

County	Route	Post Mile	Stream Name	Presumed Species Diversity	Comments
Humboldt	**101**	0.48	Trib to South Fork Eel River	None	Small, steep channel. Assumed no fish.
Humboldt	**36**	19.09	Unnamed trib to Van Duzen Riv	Steelhead	Looks like a stream capable of supporting steelhead. No confirmation available from local biologists. Site was not surveyed because access permission was denied but outlet cascades over riprap and it is obviously impassable.
Humboldt	**36**	34.08	Unnamed trib to Little Van Duzen Riv	None	Stream crossing is in steep terrain and unlikely to be accessible to fish.
Humboldt	**36**	38.43	Unnamed trib to Little Van Duzen Riv	None	Stream crossing is in steep terrain and unlikely to be accessible to fish.
Humboldt	**36**	38.49	Unnamed trib to Little Van Duzen Riv	None	Stream crossing is in steep terrain and unlikely to be accessible to fish.
Humboldt	**36**	39.40	Unnamed trib to Little Van Duzen Riv	None	Stream crossing is in steep terrain and unlikely to be accessible to fish.
Humboldt	**36**	41.37	Unnamed trib to Van Duzen Riv	Resident trout	This tributary is above the limit of anadromy for the Van Duzen River but likely supports resident trout.
Humboldt	**36**	41.45	Unnamed trib to Van Duzen Riv	Resident trout	This tributary is above the limit of anadromy for the Van Duzen River and may support resident trout.
Humboldt	**36**	42.35	Unnamed trib to Van Duzen Riv	None	This tributary is above the limit of anadromy for the Van Duzen River and has been rerouted as drainage near the highway. Unlikely to support fish.
Humboldt	**101**	0.48	Trib to South Fork Eel River	None	Small, steep channel. Assumed no fish.
Humboldt	**101**	18.37	Eel River	None	Small, steep channel. Assumed no fish.
Humboldt	**101**	29.66	Truss Creek	None	The stream channel is steep at the HUM101 crossing. HUM101 crossing assumed to be upstream of feasible fish habitat
Humboldt	**101**	31.26	Feese Creek	None	The stream channel is steep at the HUM101 crossing. HUM101 crossing assumed to be upstream of feasible fish habitat
Humboldt	**101**	37.68	Eel River	None	Small, steep channel. Assumed no fish.
Humboldt	**101**	40.35	Chadd Creek fork	Steelhead	Wet weather assessment scheduled. Survey will be conducted if channel appears to be suitable habitat.
Humboldt	**101**	53.18		None	Small, steep channel. Assumed no fish.
Humboldt	**101**	63.09	Finch Creek	None	Small, steep channel. Assumed no fish.
Humboldt	**101**	64.33	Unnamed trib to Eel River	None	Small, steep channel. Assumed no fish.
Humboldt	**101**	65.25	Unnamed trib to Eel River	None	Small, steep channel. Assumed no fish.
Humboldt	**101**	65.70	Unnamed trib to Eel River	None	Small, steep channel. Assumed no fish.
Humboldt	**101**	68.68		None	Small, steep channel. Assumed no fish.
Humboldt	**101**	86.94	Jolly Giant Creek		Jolly Giant Creek is a known anadromous stream that is currently culverted for a length of ~1/2 mile with sections owned (from downstream to upstream) by the City of Arcata, Caltrans and Humboldt State University. The culverted section is the historic spawning reach with limited spwaning habitat upstream. Jolly Giant Creek upstream of this barrier does support resident coastal cutthroat trout. This site should not be considered for fish passage remediation unless significant restoration is also planned by the other ownerships.
Humboldt	**101**	87.55	Unnamed trib to Janes Creek	Coastal cutthroat trout	Culvert scheduled for survey. Coastal cutthroat trout confirmed by personal observation (M Lang, 25Sep04).
Humboldt	**101**	95.93	Patrick Creek	Coastal cutthroat trout	Culvert is almost completely filled with sediment and at most flows the culvert flows full. Can not be accurately surveyed and is not currently passable by fish.

Table B9: Mendocino County Stream Crossing Sites - Red and Gray Ranked Sites Prioritized for Remediation

RANK	County	Route	Post Mile	Stream Name	Calwater Unit Hydrologic Subarea (HSA)	Species Diversity	Species Diversity Score	Extent of Barrier Score	Current Sizing Score	Current Condition Score	Length of Upstream Habitat	Habitat Quantity Score	Habitat Quality Modifier	Total Habitat Score	TOTAL SCORE	Sources	Comments
1	**Mendocino**	**101**	**52.25**	**Ryan Creek**		**Coho, Chinook, Steelhead**	**6**	**14**	**5**	**2**	**9,000**	**9**	**0.5**	**4.50**	**28.00**	**A, D**	RoE not obtained for site. Culvert is 5 ft diameter CMP with outlet at stream grade and a concrete lining but slope is unknown. Assumed some minimal adult passage for a barrier score of 14.
3	**Mendocino**	**101**	81.46	Rattlesnake Creek	Benbow	Steelhead, Coho, Chinook	6	12	3	1	41,000	10	0.75	7.50	27.50	A, B	
1	**Mendocino**	**101**	48.14	Upp Creek	Outlet Creek	Steelhead, Coho, Chinook	6	15	5	0	7,600	7.6	0.5	3.80	27.30	A, B	
4	**Mendocino**	**101**	83.99	Rattlesnake Creek	Benbow	Steelhead, Coho, Chinook	6	11	4	1	67,700	10	0.75	7.50	27.00	A, B	
4	**Mendocino**	**101**	89.04	Cedar Creek	Benbow	Steelhead, Coho, Chinook	6	12	3	0	42,200	10	0.75	7.50	27.00	A, B	
6	**Mendocino**	**101**	**52.36**	**Ryan Creek**		**Coho, Chinook, Steelhead**	**6**	**15**	**3**	**2**	**6,800**	**6.8**	**0.5**	**3.40**	**26.90**	**A, D**	Site not yet surveyed. Culvert is 5 ft diameter CMP with a 3 ft outlet perch at low flow and a concrete lining but slope is unknown. Assumed no passage for a barrier score of 15.
7	**Mendocino**	**1**	58.78	Digger Creek	Noyo River	Coho, Steelhead	4	15	5	0	11,000	10	0.5	5.00	26.50	A, D	
8	**Mendocino**	**101**	44.51	Unnamed Trib to Haehl Ck	Outlet Creek	Coho, Chinook, Steelhead	6	15	0	0	8,600	8.6	0.5	4.30	25.30	C, D	
9	**Mendocino**	**1**	54.62	Doyle Creek		Coho, Steelhead	4	15	1	1	12,500	10	0.5	5.00	25.00	A, D	
9	**Mendocino**	**1**	57.81	Mitchell Creek	Noyo River	Coho, Steelhead	4	15	2	0	13,000	10	0.5	5.00	25.00	A, B	
11	**Mendocino**	**1**	4.64	Fish Rock Gulch	Garcia River	Coho, Steelhead	4	15	4	3	2,900	2.9	0.75	2.18	24.68	A, D	
12	**Mendocino**	**20**	30.87	Unnamed Trib to Broaddus Creek	Outlet Creek	Coho, Chinook, Steelhead	6	15	1	1	3,700	3.7	0.5	1.85	23.85	C, D	
13	**Mendocino**	**101**	82.41	Elk Creek	Benbow	Steelhead	2	12	3	1	9,500	9.5	0.75	7.13	23.13	A, B	CDFG has evidence site provides some adult passage. Extent of barrier score decreased from 15 to 12.
14	**Mendocino**	**101**	81.17	Cummings Creek	Benbow	Steelhead, Coho	4	15	3	0	4,200	4.2	0.5	2.10	22.60	A, B	
15	**Mendocino**	**128**	21.80	Clow Creek	Navarro River	Steelhead	2	15	4	1	4,100	4.1	0.75	3.08	22.58	C, D	
16	**Mendocino**	**128**	20.15	Unnamed Trib Navarro R	Navarro River	Steelhead	2	15	5	1	5,000	5	0.5	2.50	22.50	C, D	
17	**Mendocino**	**101**	74.20	Unnamed Trib to Ten Mile Ck		Coho, Steelhead	4	15	2	2	2,500	2.5	0.5	1.25	22.25	A, D	Site not yet analyzed so results presumed from first pass observations. Culvert is 6 ft diameter SSP that outlets onto a cascade over riprap. There appears to be leakage/seepage around the culvert. Culvert is bit-lined. Assumed no passage for a barrier score of 15.
18	**Mendocino**	**1**	88.71	Unnamed trib to Cottaneva Creek	Rockport	Coho, Steelhead	4	15	5	0	1,200	1.2	0.5	0.60	22.10	C, D	
18	**Mendocino**	**128**	18.69	Lazy Creek	Navarro River	Steelhead	2	15	0	0	6,800	6.8	0.75	5.10	22.10	C, D	
20	**Mendocino**	**1**	47.07	Schoolhouse Creek	Albion	Steelhead	2	15	5	3	1,300	1.3	0.5	0.65	21.65	C, D	
21	**Mendocino**	**162**	1.72	Trib to Outlet Creek	Outlet Creek	Steelhead	2	15	5	3	700	0.7	0.25	0.18	21.18	C, D	
22	**Mendocino**	**20**	15.23	Unnamed Trib to Two Log Creek	Big River	Coho, Steelhead	4	15	0	3	1,300	1.3	0.5	0.65	21.15	C, D	
23	**Mendocino**	**1**	89.20	Unnamed trib to Cottaneva Creek	Rockport	Coho, Steelhead	4	15	3	1	200	0	0.5	0.00	21.00	C, D	
23	**Mendocino**	**20**	16.38	Unnamed Trib to North Fork Big River	Big River	Steelhead	2	15	4	3	2,000	2	0.25	0.50	21.00	C, D	Should have lower ranking. Goes dry in summer.
25	**Mendocino**	**1**	46.92	Buckhorn Creek	Albion	Coho, Steelhead	4	10	3	1	9,500	9.5	0.5	4.75	20.75	A, B	
26	**Mendocino**	**1**	70.70	Seaside Creek	Ten Mile River	Coho, Steelhead	4	13	2	0	5,000	5	0.5	2.50	20.50	A, B	
26	**Mendocino**	**128**	39.88	Beebe Creek	Navarro River	Steelhead	2	15	3	1	2,000	2	0.75	1.50	20.50	C, D	

Table B9: Mendocino County Stream Crossing Sites - Red and Gray Ranked Sites Prioritized for Remediation

RANK	County	Route	Post Mile	Stream Name	Calwater Unit Hydrologic Subarea (HSA)	Species Diversity	Species Diversity Score	Extent of Barrier Score	Current Sizing Score	Current Condition Score	Length of Upstream Habitat	Habitat Quantity Score	Habitat Quality Modifier	Total Habitat Score	TOTAL SCORE	Sources	Comments
26	**Mendocino**	**128**	43.30	Wattle Creek	Warm Springs	Resident trout	1	15	5	3	1,000	1	0.5	0.50	20.50	C, D, E, F	
29	**Mendocino**	**1**	44.98	Dark Gulch	Albion	Steelhead	2	14	4	1	2,600	2.6	0.75	1.95	20.45	A, B	
30	**Mendocino**	**128**	19.17	Trib to Lazy Creek	Navarro River	Steelhead	2	15	4	0	2,600	2.6	0.5	1.30	20.30	C, D	
31	**Mendocino**	**128**	25.54	Trib to Anderson Cr	Navarro River	Steelhead	2	15	5	1	1,100	1.1	0.25	0.28	20.28	C, D	
32	**Mendocino**	**20**	39.17	Cold Creek		Resident Trout	1	15	3	0	5,000	5	0.5	2.50	20.00	A, B	
32	**Mendocino**	**128**	27.54	Graveyard Creek	Navarro River	Steelhead	2	15	0	1	5,000	5	0.5	2.50	20.00	C, D	
32	**Mendocino**	**128**	39.37	Beebe Creek	Navarro River	Steelhead	2	15	0	1	5,000	5	0.5	2.50	20.00	C, D	
32	**Mendocino**	**128**	49.82	Edwards Creek	Geyserville	Steelhead	2	15	5	1	>8% slope	0	0.5	0.00	20.00	C, D	
36	**Mendocino**	**128**	4.30	Barton Gulch	Navarro River	Steelhead	2	15	5	0	600	0.6	0.5	0.30	19.80	A, B	
36	**Mendocino**	**253**	14.71	Trib to Robinson Creek	Ukiah	Steelhead	2	15	4	1	600	0.6	0.5	0.30	19.80	C, D	
38	**Mendocino**	**1**	104.82	Unnamed trib to SF Eel River	Benbow	Steelhead	2	15	4	1	500	0.5	0.5	0.25	19.75	C, D	
39	**Mendocino**	**20**	30.56	Unnamed Trib to Broaddus Creek	Outlet Creek	Chinook, Steelhead	4	15	0	1	300	0.5	0.25	0.13	19.63	C, D	
39	**Mendocino**	**20**	32.24	Unnamed Trib to Broaddus Creek	Outlet Creek	Chinook, Steelhead	4	15	0	1	350	0.5	0.25	0.13	19.63	C, D	
39	**Mendocino**	**101**	94.61	Unnamed Trib to Eel River	Benbow	Steelhead	2	15	5	0	500	0.5	0.25	0.13	19.63	C, D	
42	**Mendocino**	**128**	14.04	Soda Creek	Navarro River	Steelhead	2	15	0	3	2,020	2	0.5	1.00	19.50	A, D	
43	**Mendocino**	**1**	7.70	Signal Port Creek	Garcia River	Steelhead	2	15	3	0	1,600	1.6	0.5	0.80	19.30	C, D	
44	**Mendocino**	**101**	88.97	Big Dann Creek	Benbow	Steelhead	2	15	3	0	1,000	1	0.75	0.75	19.25	A, B	Habitat decreased to 1000 ft due to 12 ft rock falls upstream.
44	**Mendocino**	**162**	26.29	Trib to Turner Creek		Steelhead	2	12	4	0	6,500	6.5	0.5	3.25	19.25	A, D	Site has a fish ladder at outlet. Extent of barrier score decreased from 15 to 12.
46	**Mendocino**	**128**	43.67	Ward Creek - 2 pipes	Warm Springs	Resident trout	1	15	3	1	2,300	2.3	0.5	1.15	19.15	C, D, E, F	
46	**Mendocino**	**253**	6.17	Soda Creek	Navarro River	None[1]	0	15	5	3	600	0.6	0.25	0.15	19.15	A, D	
48	**Mendocino**	**128**	38.33	York Creek	Navarro River	Steelhead	2	15	3	1	300	0.3	0.25	0.08	19.08	C, D	
49	**Mendocino**	**20**	18.23	Unnamed Trib to North Fork Big River	Big River		0	15	5	3	0	0	0.25	0.00	19.00	E	
49	**Mendocino**	**20**	19.68	Unnamed Trib to North Fork Big River	Big River		0	15	5	3	0	0	0.25	0.00	19.00	E	
50	**Mendocino**	**128**	42.49	Unnamed Trib to Dry Ck	Warm Springs			15	5	1	1,800	1.8	0.5	0.90	18.90	C, D, E, F	
	Mendocino	**128**	45.09	Jungle Creek	Warm Springs	Resident trout	1	15	0	0	3,800	3.8	0.75	2.85	18.85	C, D, E, F	
	Mendocino	**128**	41.29	Unnamed Trib to Dry Ck	Warm Springs	Resident trout	1	15	0	1	4,600	4.6	0.5	2.30	18.80	C, D, E, F	
	Mendocino	**128**	21.54	Gowan Cr	Navarro River	Steelhead	2	15	0	1	2,500	2.5	0.5	1.25	18.75	C, D	
	Mendocino	**162**	15.48	Steep Creek	Eden Valley	Steelhead	2	15	1	0	5,000	5	0.25	1.25	18.75	A, B	
	Mendocino	**1**	3.33	St Orres Creek	Garcia River	Steelhead	2	15	1	0	2,000	2	0.5	1.00	18.50	C, D	
	Mendocino	**1**	35.02	Laurel Gulch	Greenwood Creek	Steelhead	2	15	3	0	>8% slope	0	0.5	0.00	18.50	C, D	
	Mendocino	**101**	83.25	Mad Creek	Benbow		0	15	4	3	>8% Slope	0	0.25	0.00	18.50	E	Remove from list, culvert sits on natural falls barrier.
	Mendocino	**128**	22.97	No stream on map	Navarro River			15	4	3	0	0	0.25	0.00	18.50	E	
	Mendocino	**1**	92.83	Dunn Creek	Rockport	Coho, Steelhead	4	10	4	3	1,200	1.2	0.75	0.90	18.40	C, D	

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RANK	County	Route	Post Mile	Stream Name	Calwater Unit Hydrologic Subarea (HSA)	Species Diversity	Species Diversity Score	Extent of Barrier Score	Current Sizing Score	Current Condition Score	Length of Upstream Habitat	Habitat Quantity Score	Habitat Quality Modifier	Total Habitat Score	TOTAL SCORE	Sources	Comments
	Mendocino	**128**	45.64	Unnamed Trib to Dry Ck	Warm Springs			15	5	1	800	0.8	0.5	0.40	18.40	C, D, E, F	
	Mendocino	**253**	4.25	Trib to Soda Creek	Navarro River	None[1]	0	15	4	1	1,800	1.8	0.5	0.90	18.40	A, D	
	Mendocino	**20**	29.04	Unnamed Trib to Broaddus Creek	Outlet Creek		0	15	4	0	2,700	2.7	0.5	1.35	18.35	C, D	Remove from list, not a fish stream (Harris,Nov 2004)
	Mendocino	**128**	39.95	John Hatt Creek	Navarro River			15	0	3	3,500	3.5	0.5	1.75	18.25	C, D, E	
	Mendocino	**253**	4.97	Trib to Soda Creek	Navarro River	None[1]	0	15	3	3	300	0.5	0.5	0.25	18.25	A, D	
	Mendocino	**128**	26.07	Trib to Anderson Cr	Navarro River	Steelhead	2	15	2	0	600	0.6	0.25	0.15	18.15	C, D	
	Mendocino	**1**	8.58	Slick Rock Creek	Garcia River	Steelhead	2	15	0	0	1,500	1.5	0.75	1.13	18.13	C, D	
	Mendocino	**128**	16.22	Peat Pasture Gulch	Navarro River	Steelhead	2	15	0	1	2,300	2.3	0.25	0.58	18.08	C, D	
	Mendocino	**128**	44.75	Morrow Creek	Warm Springs			15	5	1	100	0.1	0.25	0.03	18.03	C, D, E, F	
	Mendocino	**20**	41.87	Unnamed Trib to Cold Creek		Resident Trout	1	15	2	0	2,000	2	0.5	1.00	18.00	C, D	
	Mendocino	**20**	29.77	Unnamed Trib to Broaddus Creek	Outlet Creek		0	15	3	3	0	0	0	0.00	18.00	E	
	Mendocino	**128**	23.90	Unnamed Trib Navarro R	Navarro River	Steelhead	2	15	0	0	2,000	2	0.5	1.00	18.00	C, D	
	Mendocino	**128**	27.78	Trib to Anderson Cr	Navarro River	Steelhead	2	15	0	1	1,000	1	0.5	0.50	18.00	C, D	
	Mendocino	**128**	36.63	Lost Creek	Navarro River	Steelhead	2	15	0	1	1,000	1	0.5	0.50	18.00	C, D	
	Mendocino	**128**	44.14	Ingram Creek	Warm Springs	Resident trout	1	15	0	0	4,000	4	0.5	2.00	18.00	C, D, E, F	
	Mendocino	**1**	89.63	Unnamed trib to Cottaneva Creek	Rockport	Coho, Steelhead	4	11	4	1	900	0.9	0.5	0.45	17.95	C, D	
	Mendocino	**128**	40.10	John Hatt Creek	Navarro River			15	0	3	2,500	2.5	0.5	1.25	17.75	C, D, E	
	Mendocino	**253**	15.78	Trib to Robinson Creek	Ukiah			15	5	0	100	0.5	0.25	0.13	17.63	C, D	
	Mendocino	**128**	38.64	No stream on map	Navarro River	Steelhead	2	15	0	0	1,100	1.1	0.5	0.55	17.55	C, D	
	Mendocino	**128**	37.38	Trib to Rancheria Ck	Navarro River	Steelhead	2	15	0	1	100	0.1	0.25	0.03	17.53	C, D	
	Mendocino	**1**	1.27	Robinson Gulch	Garcia River	Steelhead	2	15	0	1	>8% slope	0	0.5	0.00	17.50	C, D	
	Mendocino	**101**	60.83	Long Valley Creek Trib	Outlet Creek		0	15	2	3	>8% Slope	0	0.25	0.00	17.50	E	
	Mendocino	**128**	8.68	Unnamed Trib NF Navarro	Navarro River			15	5	0	0	0	0.25	0.00	17.50	E	
	Mendocino	**253**	12.47	Trib to Robinson Creek	Ukiah			15	4	1	>8% slope	0	0.5	0.00	17.50	C, D	
	Mendocino	**1**	3.22	Glennen Gulch	Garcia River	Steelhead	2	15	0	0	500	0.5	0.75	0.38	17.38	C, D	
	Mendocino	**1**	6.17	Triplett Gulch	Garcia River	Steelhead	2	15	0	0	600	0.6	0.5	0.30	17.30	C, D	
	Mendocino	**1**	57.48	Ward Creek	Noyo River		0	15	3	1	500	0.5	0.5	0.25	17.25	C, D	
	Mendocino	**128**	24.84	Hannah Creek	Navarro River	Steelhead	2	14	1	1	900	1	0.25	0.25	17.25	C, D	
	Mendocino	**101**	55.12	Outlet Creek Trib	Outlet Creek	Steelhead??	2	15	0	0	500	0.5	0.25	0.13	17.13	C, D	
	Mendocino	**128**	32.77	Soda Creek	Navarro River	Steelhead	2	15	0	0	200	0.2	0.5	0.10	17.10	C, D	
	Mendocino	**101**	16.73	Unnamed Trib to Russian R	Ukiah		0	15	2	0	4,200	4.2	0.25	1.05	17.05	C, D	
	Mendocino	**1**	25.47	Mallo Pass Ck		Steelhead	2	9	1	1	13,000	10	0.5	5.00	17.00	A, D	
	Mendocino	**1**	75.33	Chadbourne Gulch	Ten Mile River	Steelhead	2	11	3	1	4,000	4	0.5	2.00	17.00	A, B	

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RANK	County	Route	Post Mile	Stream Name	Calwater Unit Hydrologic Subarea (HSA)	Species Diversity	Species Diversity Score	Extent of Barrier Score	Current Sizing Score	Current Condition Score	Length of Upstream Habitat	Habitat Quantity Score	Habitat Quality Modifier	Total Habitat Score	TOTAL SCORE	Sources	Comments
	Mendocino	**101**	94.66	Unnamed Trib to Eel River	Benbow		0	15	1	3	>8% Slope	0	0.25	0.00	17.00	E	
	Mendocino	**128**	9.94	Trib NF Navarro	Navarro River			15	3	1	0	0	0.25	0.00	17.00	E	
	Mendocino	**128**	24.65	Prather Creek	Navarro River			15	3	1	0	0	0.25	0.00	17.00	E	
	Mendocino	**128**	35.54	Elkins Creek	Navarro River			15	3	1	>8% slope	0	0.5	0.00	17.00	E	
	Mendocino	**128**	37.68	No stream on map	Navarro River			15	3	1	0	0	0.25	0.00	17.00	E	
	Mendocino	**162**	3.41	Trib to Outlet Creek	Outlet Creek		0	15	3	1	0	0	0.25	0.00	17.00	E	
	Mendocino	**128**	44.01	Dog Town Creek	Warm Springs	Resident trout	1	15	0	0	1,900	1.9	0.5	0.95	16.95	C, D, E, F	
	Mendocino	**1**	66.93	Unknown	Noyo River	Steelhead	2	10	5	3	2,000	2	0.25	0.50	16.50	C, D	
	Mendocino	**128**	47.19	Unnamed Trib to Dry Ck				15	0	3	0	0	0.5	0.00	16.50	C, D, E, F	
	Mendocino	**128**	9.07	No stream on map	Navarro River			15	3	0	0	0	0.25	0.00	16.50	E	
	Mendocino	**128**	17.51	No stream on map	Navarro River			15	0	3	0	0	0.25	0.00	16.50	E	
	Mendocino	**128**	32.98	Coon Creek	Navarro River			15	3	0	>8% slope	0	0.5	0.00	16.50	E	
	Mendocino	**128**	35.84	Wash Creek	Navarro River			15	3	0	>8% slope	0	0.25	0.00	16.50	E	
	Mendocino	**253**	12.06	Trib to South Branch Robinson Creek	Ukiah		0	15	3	0	>8% slope	0	0.5	0.00	16.50	C, D	
	Mendocino	**101**	68.8	Ten Mile Creek Trib	Laytonville	Steelhead	2	12	3	1	600	0.6	0.25	0.15	16.15	C, D	
	Mendocino	**20**	42.94	Unnamed Trib to Cold Creek		Resident Trout	1	15	0	0	100	0.5	0.25	0.13	16.13	Refuge from cold creek	
	Mendocino	**128**	45.31	Unnamed Trib to Dry Ck	Warm Springs			15	1	0	300	0.3	0.25	0.08	15.58	C, D, E, F	
	Mendocino	**20**	19.24	Unnamed Trib to North Fork Big River	Big River		0	15	0	1	0	0	0.25	0.00	15.50	E	
	Mendocino	**101**	79.2	Rattlesnake Creek	Benbow	Steelhead, Coho, Chinook	6		4	0	14,260	10	0.75	7.50	15.50	A, B	
	Mendocino	**128**	17.11	Floodgate Cr	Navarro River			15	0	1	0	0	0.25	0.00	15.50	E	
	Mendocino	**128**	32.08	No stream on map	Navarro River			15	1	0	>8% slope	0	0.25	0.00	15.50	E	
	Mendocino	**128**	33.78	No stream on map	Navarro River			15	0	1	>8% slope	0	0.25	0.00	15.50	E	
	Mendocino	**128**	37.82	Trib to Rancheria Ck	Navarro River			15	0	1	0	0	0.25	0.00	15.50	E	
	Mendocino	**162**	19.86	Sand Bank Creek	Eden Valley		0	15	1	0	0	0	0.25	0.00	15.50	E	
	Mendocino	**20**	27.64	Unnamed Trib to Broaddus Creek	Outlet Creek		0	15	0	0	0	0	0.25	0.00	15.00	E	Remove from list, not a fish stream (Harris,Nov 2004)
	Mendocino	**101**	1.4	Unnamed Trib to Russian R	Geyserville		0	15	0	0	>8% Slope	0		0.00	15.00	C, D	
	Mendocino	**101**	41.76	Unnamed Trib to Haehl Ck	Outlet Creek		0	15	0	0	0	0	0.25	0.00	15.00	E	
	Mendocino	**128**	32.34	No stream on map	Navarro River			15	0	0	>8% slope	0	0.25	0.00	15.00	E	
	Mendocino	**162**	14.00	Trib to Eel River	Eel River		0	15	0	0	0	0	0.25	0.00	15.00	E	
	Mendocino	**101**	72.73	Stapp Creek	Laytonville	Steelhead	2	10	0	1	1,700	1.7	0.5	0.85	13.35	C, D	
	Mendocino	**101**	12.76	Unnamed Trib to Russian R	Ukiah		0	5	5	0	4,600	4.6	0.25	1.15	8.65	C, D	
	Mendocino	**128**	7.27	Mustard Gulch	Navarro River	Steelhead	2	1	5	0	2,600	2.6	0.25	0.65	6.15	A, D	Site meets all passage criteria but ranks GRAY because inlet width < active channel width.
	Mendocino	**128**	10.18	Coon Creek	Navarro River	Steelhead	2	0	5	0	1,600	1.6	0.75	1.20	5.70	A, B	Site meets all passage criteria but ranks GRAY because inlet width < active channel width.

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RANK	County	Route	Post Mile	Stream Name	Calwater Unit Hydrologic Subarea (HSA)	Species Diversity	Species Diversity Score	Extent of Barrier Score	Current Sizing Score	Current Condition Score	Length of Upstream Habitat	Habitat Quantity Score	Habitat Quality Modifier	Total Habitat Score	TOTAL SCORE	Sources	Comments
	Mendocino	**253**	14.20	Trib to Robinson Creek	Ukiah	Steelhead	2	0	4	0	1,700	1.7	0.75	1.28	5.28	C, D	Site meets all passage criteria but ranks GRAY because inlet width < active channel width.

A - Species diversity taken from CDFG surveys or direct observations from local fisheries biologists.
B - Length of habitat taken from CDFG surveys
C - Species diversity assumed by presence in downstream confluence channel, size and slope of creek or observation upon site visit
D - Length of habitat estimated using USGS topographic maps
E - Presumed not a significant anadromous fish stream
R - Obtained species diversity and habitat information from Ross Taylor & Associates, Humboldt County Culvert Inventory and Fish Passage Evaluation (2000), Del Norte County Culvert Inventory and Fish Passage Evaluation (2001), or Mendocino County Culvert Inventory and Fish Passage Evaluation (2001) reports

Sites in Red are ranked based on first pass data or preliminary analyses.

Table B10: Mendocino County Green Ranked Stream Crossings

County	Route	Post Mile	Stream Name	Calwater Unit Hydrologic Subarea (HSA)	Species Diversity	Species Diversity Score	Extent of Barrier Score	Current Sizing Score	Current Condition Score	Length of Upstream Habitat	Habitat Quantity Score	Habitat Quality Modifier	Total Habitat Score	TOTAL SCORE	Sources	Comments
Mendocino	**1**	64.96	Mill Creek	Noyo River	Coho, Steelhead	4	5	0	0	9,200	9.2	0.75	6.90	15.90	A, B	
Mendocino	**1**	63.56	Virgin Creek	Noyo River	Coho, Steelhead	4	0	5	0	6,200	6.2	0.5	3.10	9.60	A, B	
Mendocino	**1**	71.29	Abalobadiah Creek	Ten Mile River	Steelhead	2	0	2	0	12,700	10	0.5	5.00	8.00	A, B	
Mendocino	**1**	12.36	Ross Creek	Garcia River	Steelhead	2	0	3	0	2,700	2.7	0.25	0.68	4.18	C, D	
Mendocino	**20**	32.41	Unnamed Trib to Broaddus Creek	Outlet Creek		0	15	0	3	0	0	0.25	0.00	16.50	E	
Mendocino	**101**	78.41	Rattlesnake Creek	Benbow	Steelhead, Coho, Chinook	6	0	2	1	5,800	5.8	0.75	4.35	11.85	A, B	
Mendocino	**128**	5.68	Ray,Roller Gulch	Navarro River	Steelhead	2	0	5	1	6,500	6.5	0.5	3.25	8.25	A, B	
Mendocino	**128**	9.49	Dead Horse Gulch	Navarro River	Coho, Steelhead	4	0	5	0	2,400	2.4	0.5	1.20	7.70	A, B	
Mendocino	**128**	21.07	Unnamed Trib Navarro R	Navarro River	Steelhead	2	0	5	1	3,500	3.5	0.5	1.75	6.75	C, D	
Mendocino	**128**	26.94	Con Creek	Navarro River	Steelhead	2	0	2	0	4,800	4.8	0.75	3.60	6.60	A, B	
Mendocino	**128**	49.66	Edwards Creek	Geyserville	Steelhead	2	0	3	1	>8% slope	0	0.5	0.00	4.00	C, D	
Mendocino	**128**	42.29	Elkhorn Creek	Warm Springs	Resident trout	1	0	0	0	2,100	2.1	0.5	1.05	2.05	C, D, E, F	
Mendocino	**162**	2.21	Corral Creek	Outlet Creek	Steelhead	2	0	0	0	600	0.6	0.25	0.15	2.15	C, D	Caltrans crossing is a natural bottom bridge/box. Just downstream is a 5-ft concrete pipe through a gravel extraction/processing site.

Table B11: Mendocino County Unsurveyed Sites Description/Status

County	Route	Post Mile	Stream Name	Presumed Species Diversity	Comments
Mendocino	**20**		James Ck		Scott Harris (CDFG) sent info on Nov.18, 2004 of a channel stabilization fish passage barrier in James Creek that needs assessment. Needs to be scheduled..
Mendocino	**20**	29.23	Unnamed Trib to Broaddus Creek	None	Not surveyed, not a fish bearing stream (no habitat, very small).
Mendocino	**101**	0.31	Unnamed Trib to Russian R	None	Very small, steep channel. Assumed insignificant to fish.
Mendocino	**101**	3.08	Unnamed Trib to Russian R	None	Small channel with minimal upstream habitat. Assumed insignificant.
Mendocino	**101**	6.74	Unnamed Trib to Russian R	None	Very small, steep channel. Assumed insignificant to fish.
Mendocino	**101**	9.87	Unnamed Trib to Russian R	None	Topographic map suggests ~5000 ft of suitably sloped channel but upstream channel is very small and dry most of the year. Assumed insignificant.
Mendocino	**101**	10.06	Unnamed Trib to Russian R	None	No stream on map. Channel is ditched for drainage.
Mendocino	**101**	11.72	Unnamed Trib to Russian R	None	Topographic map suggests ~4000 ft of suitably sloped channel but upstream channel is small and channelized for drainage.
Mendocino	**101**	21.97	Unnamed Trib to Russian R	Unknown	Channelized stream through Ukiah. Could be surveyed if known to have fish.
Mendocino	**101**	44.07	Unnamed Trib to Haehl Ck	Unknown	Could be surveyed if known to have fish. Looks like possible fish stream.
Mendocino	**101**	44.32	Unnamed Trib to Haehl Ck	Unknown	Smaller tributary than the crossing at PM 44.07. Could be surveyed if known to have fish.
Mendocino	**101**	46.24	Baechtel Creek	Coho, Chinook, Steelhead	Permit to Enter denied.
Mendocino	**101**	52.25	Ryan Creek	Coho, Chinook, Steelhead	Permit to Enter denied. Preliminary results included in prioritization ranking.
Mendocino	**101**	52.36	Ryan Creek	Coho, Chinook, Steelhead	Scheduled for survey fall 2004. Preliminary results included in prioritization ranking.
Mendocino	**101**	55.55	Unnamed Trib to Outlet Ck	Unknown	Permit to Enter denied.
Mendocino	**101**	55.75	Unnamed Trib to Outlet Ck	None	No stream shown on map. Topographic map suggests channel would have sustained gradient of >8%.
Mendocino	**101**	56.45	Unnamed Trib to Outlet Ck	None	Small, steep channel. Assumed insignificant.
Mendocino	**101**	56.80	Unnamed Trib to Outlet Ck	None	Small, steep channel. Assumed insignificant.
Mendocino	**101**	59.80	Sam Watt Creek	None	Channel may be too steep. Could be surveyed if known to have fish.
Mendocino	**101**	63.47	Long Valley Creek		Bridge with weirs underneath
Mendocino	**101**	66.50	Ten Mile Creek	Coho, Chinook, Steelhead	Scheduled for survey fall 2004.
Mendocino	**101**	69.86	Unnamed Trib Ten Mile Ck	Steelhead	Scheduled for survey fall 2004.
Mendocino	**101**	71.92	Wilson Creek	Chinook, Steelhead	Scheduled for survey fall 2004.
Mendocino	**101**	72.54	Unnamed Trib Ten Mile Ck	Unknown	Scheduled for survey fall 2004.
Mendocino	**101**	73.56			CDFG expects this site to rank high.
Mendocino	**101**	74.20	Sheep Camp Ck		Scheduled for survey fall 2004. Preliminary results included in prioritization ranking.
Mendocino	**101**	75.66	Steep Gulch	None	Channel may be too steep. Could be surveyed if known to have fish.
Mendocino	**101**	79.07	Rattlesnake Creek	Coho, Chinook, Steelhead	Scheduled for survey fall 2004.
Mendocino	**128**	11.78	Unnamed Trib Navarro Riv	None	Small stream/ditch. No water flowing during winter rains. Assumed insignificant.
Mendocino	**128**	19.36	Unnamed Trib Lazy Ck	None	Very small channel, ditched for drainage. Assumed insignificant
Mendocino	**128**	20.50	Unnamed Trib Navarro Riv	None	Very small channel, ditched for drainage. Assumed insignificant
Mendocino	**128**	26.45	Trib to Anderson Ck	None	Small overgrown channel. Assumed insignificant
Mendocino	**128**	26.51	Trib to Anderson Ck	None	Small overgrown channel. Assumed insignificant
Mendocino	**128**	27.14	Witherell Creek	Unknown	No CDFG files found to assess habitat or fish presence. From the Mendocino County assessment report (Taylor, 2001) Witherell Ck is described as "Dry channel, narrow and confined, thick growth of Himalayan blackberries, lots of trash."
Mendocino	**128**	37.09	No stream on map	None	No stream on map. Small, steep channel. Assumed insignificant.
Mendocino	**253**	5.44	Unnamed Trib to Soda Ck	None	Not surveyed, Permit to Enter denied.
Mendocino	**253**	13.47	Unnamed Trib to Robinson Ck	None	Not a fish stream. Culvert is placed on 25 ft natural bedrock barrier.
Mendocino	**253**	16.10	Unnamed Trib to Robinson Ck	None	Unlikely fish stream, channelized ditch.

Appendix C

Caltrans District 1 – Top 25 Sites
Culvert Site Summaries

Culvert Site Summaries	
Fish Creek, HUM254, PM 4.18	C-1
Ryan Creek, MEN101, PM 52.25	C-4
Rattlesnake Creek, MEN101, PM 81.46	C-6
Sultan Creek, DN197, PM 5.00	C-9
Upp Creek, MEN101, PM 48.14	C-13
Rattlesnake Creek, MEN101, PM 83.99	C-16
Cedar Creek, MEN101, PM 89.04	C-20
Ryan Creek, MEN101, PM 52.36	C-23
Digger Creek, MEN01, PM 58.78	C-26
Little Mill Creek, DN197, PM 6.15	C-29
Essex Gulch, HUM299, PM 2.97	C-32
Dominie Creek, DN101, PM 39.78	C-35
Little Lost Man Cr., HUM101, PM 124.49	C-38
Strongs Creek, HUM101, PM 59.94	C-41
Griffin Creek, DN199, PM 31.31	C-44
Unnamed Trib to Haehl Ck, MEN101, PM 44.51	C-47
Doyle Creek, MEN 001, PM 54.62	C-50
Mitchell Creek, MEN001, PM 57.81	C-53
Peacock Creek, DN 197, PM 2.12	C-56
Fish Rock Gulch, MEN 001, PM 4.64	C-60
Waukell Creek, DN 101, PM 2.22	C-63
Strawberry Creek, HUM101, PM 95.60	C-66
Flannigan Creek, HUM36, PM 9.92	C-69
Unnamed Trib to Broaddus Creek, MEN20, PM 30.87	C-72
Luffenholtz Creek, HUM101, PM 99.03	C-75

FISH PASSAGE EVALUATION SUMMARY SHEET

County: Humboldt **Route: 254** **Post Mile: 4.18 (Kilopost: 6.73)**

Survey Date: 8-Aug-01 **Survey Crew: HSU (A.Lubard,M.Apple,P.Donovan)**

			Latitude	Longitude	GPS Unit
Stream Name:	**Fish Creek**				
Tributary to:	**South Fork, Eel River**	**Site Coordinates**	40.22288 N	123.80131 W	Trimble Pathfinder
Basin:	**Eel River**	**(NAD 1983)**			
Quad name (1:24K):	**Miranda**	**GPS point location:**	Outlet milepost marker		

USGS Hydrologic Unit	18010106 (SF Eel River)	**CalWater Unit HA**	3 (SF Eel River)
CalWater Unit HU	11 (Eel River)	**CalWater Unit HSU**	1 (Weott)

Culvert Description

Culvert number: 1 of 1
Segment 1 of 1

Culvert or segment shape:	Box		Culvert/Segment Slope:	7.6%
Culvert or segment material:	Concrete		Culvert/Segment Roughness (n):	0.06 n increased for baffles
Culvert bottom material:	Concrete		Rustline Height	N/A ft
Inlet Type:	Wingwall		Outlet Type:	Straight Wingwalls
Height/Diameter	6	ft	Length (incl. aprons):	184 ft
Width	6	ft	Length (w/o aprons):	139 ft
Inlet Apron Length:	N/A	ft	Outlet Apron Length:	45.3 ft
US Inlet Apron Width	N/A	ft	Outlet Apron Slope:	-0.2%
DS Inlet Apron Width	N/A	ft	DS Outlet Apron Width	9 ft
Inlet Apron Slope:	N/A		US Outlet Apron Width	6.5 ft
Alignment of culvert inlet to channel	0-30 degrees		Alignment of culvert outlet to channel:	0-30 degrees
			Outlet configuration	At stream grade

Trash rack	None
Trash rack description	
Culvert Retrofits	8 ramp baffles
Culvert retrofit descriptions	1.2 meters wide, 0.66 meter hypotenuse and 0.64 meter notch width

Height of road prism above inlet invert: 16.2 ft Road fill volume: 4,230 yd^3

Comments: Cracks in the concrete have exposed rebar in the culvert bottom.

Channel Characteristics

Inlet channel gradient	4.4%	Natural tailwater control (TWC):	Pool tailout
Channel gradient at TWC	1.0%	Channel substrate at tailwater:	Cobble

Hydrology

Drainage Area:[1]	4.55	mi^2	Estimated 100-yr Flow:[3]	1,800 cfs
Mean annual precipitation:[2]	59	in/yr	Estimated 50-yr Flow:[3]	1,605 cfs
Potential Evapotranspiration:	37.2	in/yr	Estimated 25-yr Flow:[3]	1,320 cfs
Mean elevation:[1]	800	ft	Estimated 10-yr Flow:[3]	1,045 cfs
			Estimated 5-yr Flow:[3]	790 cfs
			Estimated 2-yr Flow:[3]	520 cfs

Culvert Flood Capacity Calculations (based on FHWA Charts)

ENTRANCE TYPE: Straight Wingwalls

Headwater = Top of Inlet

Face Control ($HW_{face}/D = 1.0$) = 264 cfs

Hydrology Explanation/Comments:

[1]Drainage area and mean elevation from USGS 1:24K topo maps

[2]Mean annual precip (PRISM 2002) and PET (Rantz 1964)

[3]Return period flows determined using regional regression equations (Waananen and Crippen, 1977). These are also in Caltrans Highway Design Manual (May 2001), Chap. 810, p. 810-19.

CDFG Matrix Site Ranking

Active Channel Width	20 ft	**Residual Inlet Depth**	-10.7 ft
Maximum slope	7.6%	**Residual Outlet Depth**	-0.2 ft
Baffles/Weirs (Yes or No)	Yes	**Substrate Throughout (YorN)**	No

Filter Result **GRAY** **Reason for filter result:** Slope > 3% but modified with baffles.

Filter result adjusted? **No** **Describe adjustment:** No adjustments were made.

Fish Passage Analysis

	Q_{LP} (cfs)	Q_{HP} (cfs)	Leap Barrier Range (cfs)	Depth Barrier Range (cfs)	Velocity Barrier Range (cfs)	Range of passable flows	% of passable flows
Adult Anadromous	3.0	140.0	None	< 23	> 43	23 - 43 cfs	15%
Adult Resident	2.0	51.6	None	< 11	>8.6	None	0%
Juvenile salmonids	1.0	21.4	None	< 5.2	Always	None	0%

Summaries

Culvert Condition

The culvert is in fair condition some baffles have been eroded and have exposed rebar.

Fish Evidence

CDFG survey in June 1999 found steelhead, chinook and coho in the outlet pool of the state highway culvert.

Stream Condition

Downstream a large outlet pool has formed due to scouring. Wide stream corridor downstream suggests large flows.

Barrier Status

No additional barriers are known. Upstream is state park.

Habitat Information

CDFG habitat survey conducted in June 1999 identified 12,500 ft of usable habitat upstream of the confluence with SF Eel River. The state highway culvert is located 320 ft upstream of the SF Eel River confluence and was noted as the only barrier.

Recommendations

Culvert has a steep slope (7.6%) and even with baffles is a partial barrier to adult salmonids and most likely a complete barrier to resident and juvenile salmonids. The culvert slope needs to be substantially reduced to improve passage.

Site Photos

Downstream channel

Culvert outlet

Culvert Inlet

Upstream channel

FISH PASSAGE EVALUATION SUMMARY SHEET

County: Mendocino **Route: 101** **Post Mile: 52.25 (Kilopost: 84.09)**

Survey Date: Not Surveyed ROE denied **Survey Crew:**

Stream Name:	**Ryan Creek (S Fork)**		**Latitude**	**Longitude**	**GPS Unit**
Tributary to:	**Outlet Creek**	**Site Coordinates**	39.481 N	123.361 W	
Basin	**Eel River**	**(NAD 1983)**			
Quad name (1:24K):	**Longvale**	**GPS point location:**	Estimated using Maptech		

USGS Hydrologic Unit	18010103 (Upper Eel River)	**CalWater Unit HA**	6 (Upper Main Eel River)
CalWater Unit HU	11 (Eel River)	**CalWater Unit HSA**	1 (Outlet Creek)

Culvert Description

Culvert number: 1 of 1
Segment 1 of 1

Culvert or segment shape:	Circular	Culvert/Segment Slope:	Unknown, not surveyed
Culvert or segment material:	CMP (68mm X 13mm)	Culvert/Segment Roughness (n):	
Culvert bottom material:	CMP (68mm X 13mm)	Rustline Height	Unknown ft
Inlet Type:	Headwall	Outlet Type:	Wingwall
Height/Diameter	5 ft	Length (incl. aprons):	Unknown ft
Width	ft	Length (w/o aprons):	Unknown ft
Inlet Apron Length:	N/A ft	Outlet Apron Length:	Unknown ft
US Inlet Apron Width	N/A ft	Outlet Apron Slope:	Unknown
DS Inlet Apron Width	N/A ft	DS Outlet Apron Width	Unknown ft
Inlet Apron Slope:	N/A	US Outlet Apron Width	Unknown ft
Alignment of culvert inlet to channel	0-30 degrees	Alignment of culvert outlet to channel:	0-30 degrees
		Outlet configuration	At stream grade

Trash rack	None
Trash rack description	
Culvert Retrofits	None
Culvert retrofit descriptions	

Height of road prism above the inlet invert: Unknown ft

Road fill volume: Unknown yd^3

Comments: Site not surveyed, Right of Entry denied. There is a fence between the road and the culvert outlet.

Channel Characteristics

Inlet channel gradient:	Unknown	Natural tailwater control (TWC):	Pool tailout
Channel gradient at TWC:	Unknown	Channel substrate at tailwater:	Gravel (0.08 - 2.5 inches)

Hydrology

Drainage Area:[1]	1.18 mi^2	Estimated 100-yr Flow:[3]	483 cfs
Mean annual precipitation:[2]	51 in/yr	Estimated 50-yr Flow:[3]	414 cfs
Potential Evapotranspiration:	42 in/yr	Estimated 25-yr Flow:[3]	325 cfs
Mean elevation:[1]	1600 ft	Estimated 10-yr Flow:[3]	242 cfs
		Estimated 5-yr Flow:[3]	175 cfs
		Estimated 2-yr Flow:[3]	106 cfs

Culvert Flood Capacity Calculations (based on FHWA Charts)

ENTRANCE TYPE: Headwall

Headwater = Top of Inlet

Face Control ($HW_{face}/D = 1.0$) = 135 cfs

Hydrology Explanation/Comments:

[1]Drainage area and mean elevation from USGS 1:24K topo maps

[2]Mean annual precip (PRISM 2002) and PET from Rantz (1964)

[3]Return period flows determined using regional regression equations (Waananen and Crippen, 1977). These are also in Caltrans Highway Design Manual (May 2001), Chap. 810, p. 810-19.

CDFG Matrix Site Ranking

Active Channel Width	Unknown ft	**Residual Inlet Depth**	Unknown ft
Maximum slope	Unknown	**Residual Outlet Depth**	Unknown ft
Baffles/Weirs (Yes or No)	No	**Substrate Throughout (YorN)**	No

Filter Result **Undetermined** **Reason for filter result:** Site not surveyed, access denied.

Filter result adjusted? **Describe adjustment:**

Fish Passage Analysis

	Q_{LP} (cfs)	Q_{HP} (cfs)	Leap Barrier Range (cfs)	Depth Barrier Range (cfs)	Velocity Barrier Range (cfs)	Range of passable flows	% of passable flows
Adult Anadromous Adult Resident Juvenile salmonids	**Fish Passage Analysis not conducted, site access denied.**						

Summaries

Culvert Condition	Culvert is in fair condition and has been lined with concrete to address rust.
Fish Evidence	A 1995 CDFG survey observed three-age classes of steelhead, Y-O-Y coho and pacific lamprey below the county culvert 500 ft downstream of the 101 crossings.
Stream Condition	Stream flows continuously at the state highway crossing year round.
Barrier Status	A county road culvert 500 ft downstream is currently a complete barrier. This crossing has been scheduled for replacement and received CDFG funds but Mendocino County failed to find matching funds to complete the work as initially scheduled. There is also a private road crossing 450 ft upstream of the 101 crossing.
Habitat Information	CDFG surveyed the South Fork of Ryan Creek in 1995 (NF was denied entry) and estimated 15,000 ft of upstream habitat. Using topographic maps, 9,000 ft was assumed for NF Ryan Creek. Habitat was rated as good.
Recommendations	Ryan Creek is known to support anadromous species and there is plentiful high quality habitat upstream of the 101 crossings (52.25 and 52.36). A county culvert scheduled for replacement is located downstream of both state highway crossings so state highway crossings should be a high priority fix once the county crossing is addressed.

Site Photos

No photographs are available for the culvert at post mile 52.25. Residences in the area have fenced the access and permission to survey was denied.

FISH PASSAGE EVALUATION SUMMARY SHEET

County: Mendocino **Route: 101** **Post Mile: 81.46 (Kilopost: 131.09)**

Survey Date: 17-Jul-02 **Survey Crew: HSU (F. Maisch, M. Apple, R. Gonzales)**

			Latitude	Longitude	GPS Unit
Stream Name:	**Rattlesnake Creek**				
Tributary to:	**South Fork Eel River**	**Site Coordinates**	39.82823 N	123.57596 W	Trimble Pathfinder
Basin	**Eel River**	**(NAD 1983)**			
Quad name (1:24K):	**TAN OAK PARK**	**GPS point location:**	Inlet milepost marker		

USGS Hydrologic Unit	18010106 (S Fork Eel River)	**CalWater Unit HA**	3 (S Fork Eel River)
CalWater Unit HU	11 (Eel River)	**CalWater Unit HSA**	2 (Benbow)

Culvert Description

Culvert number: 1 of 1
Segment 1 of 1

Culvert or segment shape:	Arch Concrete Floor	Culvert/Segment Slope:	-2.4%
Culvert or segment material:	Concrete (cast in place)	Culvert/Segment Roughness (n):	0.013
Culvert bottom material:	Concrete (cast in place)	Rustline Height:	N/A ft
Inlet Type:	Wingwall	Outlet Type:	Wingwall
Height/Diameter	20.5 ft	Length (incl. aprons):	114 ft
Width	21.5 ft	Length (w/o aprons):	114 ft
Inlet Apron Length:	N/A ft	Outlet Apron Length:	28.6 ft
US Inlet Apron Width	N/A ft	Outlet Apron Slope:	19.8%
DS Inlet Apron Width	N/A ft	DS Outlet Apron Width:	21.0 ft
Inlet Apron Slope:	N/A	US Outlet Apron Width:	14.5 ft
Alignment of culvert inlet to channel	30 - 45 degrees	Alignment of culvert outlet to channel:	0-30 degrees
		Outlet configuration:	Freefall into Pool

Trash rack	None
Trash rack description	
Culvert Retrofits	Yes
Culvert retrofit descriptions	Step-and-Pool Fishway

Height of road prism above the inlet invert: 25.8 ft

Road fill volume: 40,625 yd^3

Comments: Fishway has hole in side where water leaks out. Outlet apron has large holes present.

Channel Characteristics

Inlet channel gradient:	2.8%	Natural tailwater control (TWC):	Pool tailout
Channel gradient at TWC:	3.6%	Channel substrate at tailwater:	Cobble (2.5 - 10")

Hydrology

Drainage Area:[1]	17.87 mi^2	Estimated 100-yr Flow:[3]	7,277 cfs
Mean annual precipitation:[2]	73 in/yr	Estimated 50-yr Flow:[3]	6,124 cfs
Potential Evapotranspiration:	40 in/yr	Estimated 25-yr Flow:[3]	4,707 cfs
Mean elevation:[1]	2000 ft	Estimated 10-yr Flow:[3]	3,520 cfs
		Estimated 5-yr Flow:[3]	2,553 cfs
		Estimated 2-yr Flow:[3]	1,550 cfs

Culvert Flood Capacity Calculations (based on FHWA Charts)

ENTRANCE TYPE: Wingwall

Headwater = Top of Inlet

Face Control ($HW_{face}/D = 1.0$) = 3600 cfs

Hydrology Explanation/Comments:

[1]Drainage area and mean elevation from USGS 1:24K topo maps

[2]Mean annual precip (PRISM 2002) and PET from Rantz (1964)

[3]Return period flows determined using regional regression equations (Waananen and Crippen, 1977). These are also in Caltrans Highway Design Manual (May 2001), Chap. 810, p. 810-19.

CDFG Matrix Site Ranking

Active Channel Width	25.4 ft	**Residual Inlet Depth**	3.2 ft
Maximum slope	-2.4%	**Residual Outlet Depth**	0.5 ft
Baffles/Weirs (Yes or No)	No	**Substrate Throughout (YorN)**	Yes

Filter Result **GRAY**

Reason for filter result: Fish ladder present at outlet.

Filter result adjusted? **Yes**

Describe adjustment: Changed to GRAY due to fish ladder at outlet. Note that the residual inlet and outlet depths are calculated using the fish ladder outlet elevation because this elevation controls the water level in the culvert barrel. The culvert barrel itself is ranked GREEN.

Fish Passage Analysis

	Q_{LP} (cfs)	Q_{HP} (cfs)	Leap Barrier Range (cfs)	Depth Barrier Range (cfs)	Velocity Barrier Range (cfs)	Range of passable flows	% of passable flows
Adult Anadromous	3.0	780	**Fish passage analysis not conducted because of the fish ladder. Some adult and resident passage was assumed for a barrier score of 12 of 15.**				
Adult Resident	2.0	264					
Juvenile salmonids	1.0	135					

Summaries

Culvert Condition	The fishway and apron show signs of wear and their function is diminished by holes and leakage. The culvert is in fair condition.
Fish Evidence	Resident adult salmonid in outlet pool, juveniles (<10) observed up and downstream of site, one < 3" & one > 6" observed in the fish ladder (HSU, July 2002). Electrofished: 2 sites, juvenile SH were present 26,960 feet upstream (Goodfield & Mitchell, 1993). Carcass survey: found CHIN present (Jones, Flosi & Gilroy, 1987/88). Survey: juvenile COH and SH were observed (Ayers and Peters, 1968).
Stream Condition	Stream flows continuously year round at the state highway crossing.
Barrier Status	Upstream: Many tributaries have RED ranked culverts. Mainstem has 3 crossings with one Green., one Gray and one unsurveyed crossing. Downstream: Culvert crossings at pm 83.24 with an unknown status, and pm 83.99 which permits some passage.
Habitat Information	Approximately 41,000 feet, including tributaries, of good spawning and rearing habitat (CDFG).
Recommendations	Rattlesnake Creek is a major anadromous fish supporting tributary of the S Fork Eel River. The fish ladder maintenance issues should be addressed and the ability of the fish ladder and adjacent roughened channel at the outlet to pass all anadromous species should be evaluated. The culvert barrel is adversely sloped so in culvert conditions allow easy fish passage and resting after fish negotiate the ladder.

Site Photos

Downstream Channel

Culvert Outlet

Site Photos cont'd

Culvert Inlet

Upstream Channel

Outlet Fishway and Apron

FISH PASSAGE EVALUATION SUMMARY SHEET

County: Del Norte **Route: 197** **Post Mile: 5.00 (Kilopost: 8.05)**

Survey Date: 5-Aug-02 **Survey Crew: HSU (B. Hodgson, J. Walker)**

Stream Name:	**Sultan Ck**		**Latitude**	**Longitude**	**GPS Unit**
Tributary to:	**Smith River**	**Site Coordinates**	41.85857 N	124.11768 W	Trimble Pathfinder
Basin:	**Smith River**	**(NAD 1983)**			
Quad name (1:24K):	**Hiouchi**	**GPS point location:**	Inlet milepost marker		

USGS Hydrologic Unit:	18010101	**CalWater Unit HA:**	1 (Lower Smith River)
CalWater Unit HU:	3 (Smith River)	**CalWater Unit HSU:**	1 (Smith River Plain)

Culvert Description

Culvert number: 1 of 2
Segment 1 of 2

Culvert or segment shape:	Pipe Arch	Culvert/Segment Slope:	3.7%	
Culvert or segment material:	CMP (Annular, 68 mm x 13 mm)	Culvert/Segment Roughness (n):	0.06	increased for baffles
Culvert bottom material:	same as segment material	Rustline Height	1.2	ft
Inlet Type:	Segment Connection	Outlet Type:	Headwall	
Height/Diameter:	4 ft	Length (incl. aprons):	60	ft
Width:	6 ft	Length (w/o aprons):	60	ft
Inlet Apron Length:	N/A ft	Outlet Apron Length:	N/A	ft
US Inlet Apron Width:	N/A ft	Outlet Apron Slope:	N/A	
DS Inlet Apron Width:	N/A ft	DS Outlet Apron Width	N/A	ft
Inlet Apron Slope:	N/A	US Outlet Apron Width	N/A	ft
		Alignment of culvert outlet to channel:	0-30 degrees	
		Outlet configuration	Freefall into pool	

Culvert number: 1 of 2
Segment 2 of 2

Culvert or segment shape:	Pipe Arch	Culvert/Segment Slope:	1.9%	
Culvert or segment material:	CMP (Annular, 68 mm x 13 mm)	Culvert/Segment Roughness (n):	0.06	increased for baffles
Culvert bottom material:	same as segment material	Rustline Height	1.2	ft
Inlet Type:	Headwall	Outlet Type:	Segment Connection	
Height/Diameter:	4 ft	Length (incl. aprons):	11	ft
Width:	6 ft	Length (w/o aprons):	11	ft
Inlet Apron Length:	N/A ft	Outlet Apron Length:	N/A	ft
US Inlet Apron Width:	N/A ft	Outlet Apron Slope:	N/A	
DS Inlet Apron Width:	N/A ft	DS Outlet Apron Width	N/A	ft
Inlet Apron Slope:	N/A	US Outlet Apron Width	N/A	ft
Alignment of culvert inlet to channel:	0-30 degrees			

Culvert number: 2 of 2
Segment 1 of 3

Culvert or segment shape:	Pipe Arch	Culvert/Segment Slope:	4.1%	
Culvert or segment material:	CMP (Annular, 68 mm x 13 mm)	Culvert/Segment Roughness (n):	0.032	
Culvert bottom material:	same as segment material	Rustline Height	1.2	ft
Inlet Type:	Segment Connection	Outlet Type:	Headwall	
Height/Diameter:	4 ft	Length (incl. aprons):	16	ft
Width:	6 ft	Length (w/o aprons):	16	ft
Inlet Apron Length:	N/A ft	Outlet Apron Length:	N/A	ft
US Inlet Apron Width:	N/A ft	Outlet Apron Slope:	N/A	
DS Inlet Apron Width:	N/A ft	DS Outlet Apron Width	N/A	ft
Inlet Apron Slope:	N/A	US Outlet Apron Width	N/A	ft
Alignment of culvert inlet to channel:	N/A	Alignment of culvert outlet to channel:	0-30 degrees	
		Outlet configuration	Freefall into pool	

Culvert number:	**2**	**of**	**2**			
Segment	**2**	**of**	**3**			
Culvert or segment shape:	Pipe Arch			Culvert/Segment Slope:	2.4%	
Culvert or segment material:	CMP (Annular, 68 mm x 13 mm)			Culvert/Segment Roughness (n):	0.032	
Culvert bottom material:	same as segment material			Rustline Height	1.2	ft
Inlet Type:	Segment Connection			Outlet Type:	Segment Connection	
Height/Diameter:	4	ft		Length (incl. aprons):	40	ft
Width:	6	ft		Length (w/o aprons):	40	ft
Inlet Apron Length:	N/A	ft		Outlet Apron Length:	N/A	ft
US Inlet Apron Width:	N/A	ft		Outlet Apron Slope:	N/A	
DS Inlet Apron Width:	N/A	ft		DS Outlet Apron Width	N/A	ft
Inlet Apron Slope:	N/A			US Outlet Apron Width	N/A	ft
Alignment of culvert inlet to channel:		N/A				

Culvert number:	**2**	**of**	**2**			
Segment	**3**	**of**	**3**			
Culvert or segment shape:	Pipe Arch			Culvert/Segment Slope:	9.2%	
Culvert or segment material:	CMP (Annular, 68 mm x 13 mm)			Culvert/Segment Roughness (n):	0.032	
Culvert bottom material:	same as segment material			Rustline Height	1.2	ft
Inlet Type:	Headwall			Outlet Type:	Segment Connection	
Height/Diameter:	4	ft		Length (incl. aprons):	13	ft
Width:	6	ft		Length (w/o aprons):	13	ft
Inlet Apron Length:	N/A	ft		Outlet Apron Length:	N/A	ft
US Inlet Apron Width:	N/A	ft		Outlet Apron Slope:	N/A	
DS Inlet Apron Width:	N/A	ft		DS Outlet Apron Width	N/A	ft
Inlet Apron Slope:	N/A			US Outlet Apron Width	N/A	ft
Alignment of culvert inlet to channel:		0-30 degrees				

Trash rack	None
Trash rack description	
Culvert Retrofits	Yes
Culvert retrofit descriptions	Culvert 1 has ramp baffles, culvert 2 has one wood weir ~ 5 ft downstream from the inlet.

Elevation of the road prism 4.5 ft
(assumes culvert inlet invert at 0.0 ft)

Road fill volume: 740 yd^3

Comments: Culverts share an outlet apron and outlet beam.

Channel Characteristics

Inlet channel gradient:	0.8%	Natural tailwater control (TWC):	Pool tailout
Channel gradient at TWC:	2.8%	Channel substrate at tailwater:	Gravel (0.08 - 2.5")

Hydrology

Drainage Area:[1]	2.40	mi^2	Estimated 100-yr Flow:[3]	1,400	cfs
Mean annual precipitation:[2]	81	in/yr	Estimated 50-yr Flow:[3]	1,250	cfs
Potential Evapotranspiration:	28	in/yr	Estimated 25-yr Flow:[3]	1,020	cfs
Mean elevation:[1]	600	ft	Estimated 10-yr Flow:[3]	800	cfs
			Estimated 5-yr Flow:[3]	600	cfs
			Estimated 2-yr Flow:[3]	390	cfs

Culvert Flood Capacity Calculations (based on FHWA Charts)

ENTRANCE TYPE: Headwall

Headwater = Top of Inlet

Face Control ($HW_{face}/D = 1.0$) = 304 cfs *sum of both culverts*

Hydrology Explanation/Comments:

[1] Drainage area and mean elevation from USGS 1:24K topo maps

[2] Mean annual precip (PRISM 2002) and PET from Rantz (1964)

[3] Return period flows determined using regional regression equations (Waananen and Crippen, 1977). These are also in Caltrans Highway Design Manual (May 2001), Chap. 810, p. 810-19.

CDFG Matrix Site Ranking

Active Channel Width:	13.5	ft	**Residual Inlet Depth:**	-3.2	ft
Maximum slope:	3.7%	*Max slope culvert 1*	**Residual Outlet Depth:**	-0.8	ft
Baffles/Weirs (Yes or No):	Yes		**Substrate Throughout (YorN):**	No	

Filter Result: **GRAY**

Reason for filter result: Culvert has slope slightly greater than 3% but is modified with baffles to enhance fish passage.

Filter result adjusted? **No**

Describe adjustment: Characteristics of culvert 1, the baffled culvert, were used to determine the ranking and for fish passage analysis.

Fish Passage Analysis

	Q_{LP} (cfs)	Q_{HP} (cfs)	Leap Barrier Range (cfs)	Depth Barrier Range (cfs)	Velocity Barrier Range (cfs)	Range of Passable Flows	% of Passable Flows
Adult Anadromous	4.4	125	None	< 13	> 66	13 - 66 cfs	44%
Adult Resident	2	57	< 31	< 4.2	> 6.9	None	0%
Juvenile salmonids	1	35	< 31	< 1.7	> 0.5	None	0%

Summaries

Culvert Condition

Culvert bottoms are very rusty and the culverts are beginning to get chewed up at the outlet.

Fish Evidence

Many CDFG surveys (1977, 1993-1996) identify Sultan Creek as a spawning and nursery stream for anadromous salmonids. Chinook, coho, steelhead and cutthroat trout are all confirmed present. The culvert is low in the system and within the good spawning habitat for adult anadromous salmonids.

Stream Condition

Appears in good condition near the culvert, well-formed channel w/nice gravels.

Barrier Status

No known barriers. State highway is downstream most road crossing.

Habitat Information

CDFG surveys indicate that 4500 ft of habitat is available upstream of the state highway culvert.

Recommendations

This site is the highest ranking site for remediation on State Route 197 in Del Norte County. Even with the baffles, the water velocities through culvert 1 meet current design guidelines for only 44% of the fish passage flows for adult anadromous salmonids and do not meet guidelines for resident or juvenile fish. In addition, the outlet of culvert 1 is perched almost one foot (0.8 ft); eliminating the outlet perch would improve passage for resident fish and may allow some juvenile fish passage. Culvert 2 does not meet current design guidelines for any species or lifestage.

Site Photos

Downstream channel

Culvert outlets

Culvert inlets

Upstream Channel

Weirs in Culvert 1

Ramp baffles in Culvert 2

FISH PASSAGE EVALUATION SUMMARY SHEET

County: Mendocino **Route: 101** **Post Mile: 48.14 (Kilopost: 77.47)**

Survey Date: 29-Jul-02 **Survey Crew: HSU (A.Lubard,R.Gonzales,J.Wolf)**

Stream Name:	**Upp Creek**		**Latitude**	**Longitude**	**GPS Unit**
Tributary to:	**Outlet Creek**	**Site Coordinates**	39.428 N	123.357 W	Trimble
Basin	**Eel River**	**(NAD 1983)**			
Quad name (1:24K):	**Willits**	**GPS point location:**	Outlet milepost marker		

USGS Hydrologic Unit	18010103 (Upper Eel River)	**CalWater Unit HA**	6 (Upper Main Eel River)
CalWater Unit HU	11 (Eel River)	**CalWater Unit HSA**	1 (Outlet Creek)

Culvert Description

Culvert number: 1 of 2
Segment 1 of 1

Culvert or segment shape:	Box	Culvert/Segment Slope:	4.4%
Culvert or segment material:	Concrete	Culvert/Segment Roughness (n):	0.013
Culvert bottom material:	Concrete	Rustline Height	N/A ft
Inlet Type:	Headwall	Outlet Type:	Wingwall
Height/Diameter	5 ft	Length (incl. aprons):	71 ft
Width	10 ft	Length (w/o aprons):	71 ft
Inlet Apron Length:	N/A ft	Outlet Apron Length:	N/A ft
US Inlet Apron Width	N/A ft	Outlet Apron Slope:	N/A
DS Inlet Apron Width	N/A ft	DS Outlet Apron Width	N/A ft
Inlet Apron Slope:	N/A	US Outlet Apron Width	N/A ft
Alignment of culvert inlet to channel	0-30 degrees	Alignment of culvert outlet to channel:	Straight
		Outlet configuration	Cascade over riprap

Culvert number: 2 of 2
Segment 1 of 1

Culvert or segment shape:	Box	Culvert/Segment Slope:	4.9%
Culvert or segment material:	Concrete	Culvert/Segment Roughness (n):	0.013
Culvert bottom material:	Concrete	Rustline Height	N/A ft
Inlet Type:	Headwall	Outlet Type:	Wingwall
Height/Diameter	5 ft	Length (incl. aprons):	71 ft
Width	10 ft	Length (w/o aprons):	71 ft
Inlet Apron Length:	N/A ft	Outlet Apron Length:	N/A ft
US Inlet Apron Width	N/A ft	Outlet Apron Slope:	N/A
DS Inlet Apron Width	N/A ft	DS Outlet Apron Width	N/A ft
Inlet Apron Slope:	N/A	US Outlet Apron Width	N/A ft
Alignment of culvert inlet to channel	0-30 degrees	Alignment of culvert outlet to channel:	Straight
		Outlet configuration	Cascade over riprap

Trash rack	None
Trash rack description	
Culvert Retrofits	None
Culvert retrofit descriptions	

Height of road prism above the inlet invert: 10.36 ft Road fill volume: 1,260 yd^3

Comments:

Channel Characteristics

Inlet channel gradient:	2.3%	Natural tailwater control (TWC):	Pool tailout
Channel gradient at TWC:	8.4%	Channel substrate at tailwater:	Cobble (2.5 - 10 inches)

Hydrology

Drainage Area:[1]	1.65 mi^2	Estimated 100-yr Flow:[3]	1,240 cfs
Mean annual precipitation:[2]	49 in/yr	Estimated 50-yr Flow:[3]	1,075 cfs
Potential Evapotranspiration:	42 in/yr	Estimated 25-yr Flow:[3]	855 cfs
Mean elevation:[1]	1500 ft	Estimated 10-yr Flow:[3]	645 cfs
		Estimated 5-yr Flow:[3]	470 cfs
		Estimated 2-yr Flow:[3]	290 cfs

Culvert Flood Capacity Calculations (based on FHWA Charts)

ENTRANCE TYPE: Headwall

Headwater = Top of Inlet

Face Control ($HW_{face}/D = 1.0$) = 580 cfs

Hydrology Explanation/Comments:

[1]Drainage area and mean elevation from USGS 1:24K topo maps

[2]Mean annual precip (PRISM 2002) and PET from Rantz (1964)

[3]Return period flows determined using regional regression equations (Waananen and Crippen, 1977). These are also in Caltrans Highway Design Manual (May 2001), Chap. 810, p. 810-19.

CDFG Matrix Site Ranking

Active Channel Width	15.2 ft	**Residual Inlet Depth**	-4.1 ft
Maximum slope	4.9%	**Residual Outlet Depth**	-1.0 ft
Baffles/Weirs (Yes or No)	No	**Substrate Throughout (YorN)**	No

Filter Result RED **Reason for filter result:** Slope > 3%

Filter result adjusted? **No** **Describe adjustment:** No adjustments were made.

Fish Passage Analysis

	Q_{LP} (cfs)	Q_{HP} (cfs)	Leap Barrier Range (cfs)	Depth Barrier Range (cfs)	Velocity Barrier Range (cfs)	Range of passable flows	% of passable flows
Adult Anadromous	3.0	34.7	**Fish Passage Analysis unnecessary, Red-ranked site does not meet fish passage guidelines.**				0%
Adult Resident	2.0	11.7					0%
Juvenile salmonids	1.0	6.0					0%

Summaries

Culvert Condition

The culverts are in good condition.

Fish Evidence

A Chinook carcass was observed by Jones (1985) below the MEN101 culvert, extent in creek is unknown. Steelhead, coho and Chinook were assumed due to easy access from Outlet Creek. No fish observed during survey (July 2002).

Stream Condition

Stream was completely dry in July 2002 but a clear, active channel exists.

Barrier Status

No additional barriers have been assessed. A reservoir appears on maps 1.45 miles upstream of the MEN101 crossing and a railroad crossing exists downstream on either Upp or Outlet Creeks.

Habitat Information

No CDFG habitat surveys were available for Upp Creek. The length of usable habitat estimated from USGS topographic maps was 7600 feet. A small reservoir appears on the map and was assumed to be the upper limit of access.

Recommendations

These box culverts have steep slopes and a difficult outlet condition. Both of these fish passage problems could be addressed without full replacement such as the addition of baffles and rock or concrete weirs downstream of the outlet.

Site Photos

Downstream channel

Culvert outlet

Culvert Inlet

Upstream channel

FISH PASSAGE EVALUATION SUMMARY SHEET

County: Mendocino **Route: 101** **Post Mile: 83.99 (Kilopost: 135.17)**

Survey Date: 18-Jul-02 **Survey Crew: HSU (F. Maisch, M. Apple, R. Gonzales)**

Stream Name:	**Rattlesnake Creek**		**Latitude**	**Longitude**	**GPS Unit**
Tributary to:	**South Fork Eel River**	**Site Coordinates**	39.83227 N	123.61808 W	Trimble Pathfinder
Basin	**Eel River**	**(NAD 1983)**			
Quad name (1:24K):	**TAN OAK PARK**	**GPS point location:**	Inlet milepost marker		

USGS Hydrologic Unit	18010106 (S Fork Eel River)	**CalWater Unit HA**	3 (S Fork Eel River)
CalWater Unit HU	11 (Eel River)	**CalWater Unit HSA**	2 (Benbow)

Culvert Description

Culvert number: 1 of 2
Segment 1 of 3

Culvert or segment shape:	Arch Concrete Floor	Culvert/Segment Slope:	0.2%
Culvert or segment material:	Concrete (cast in place)	Culvert/Segment Roughness (n):	0.013
Culvert bottom material:	Concrete (cast in place)	Rustline Height:	N/A ft
Inlet Type:	Segment connection	Outlet Type:	Wingwall
Height/Diameter	17 ft	Length (incl. aprons):	84 ft
Width	18 ft	Length (w/o aprons):	84 ft
Inlet Apron Length:	N/A ft	Outlet Apron Length:	N/A ft
US Inlet Apron Width	N/A ft	Outlet Apron Slope:	N/A
DS Inlet Apron Width	N/A ft	DS Outlet Apron Width:	N/A ft
Inlet Apron Slope:	N/A	US Outlet Apron Width:	N/A ft
Alignment of culvert inlet to channel	30 - 45 degrees	Alignment of culvert outlet to channel:	0 - 30 degrees
		Outlet configuration:	At Stream Grade

Culvert number: 1 of 2
Segment 2 of 3

Culvert or segment shape:	Arch Concrete Floor	Culvert/Segment Slope:	0.6%
Culvert or segment material:	Concrete (cast in place)	Culvert/Segment Roughness (n):	0.013
Culvert bottom material:	Concrete (cast in place)	Rustline Height:	N/A
Inlet Type:	Segment connection	Outlet Type:	Segment connection
Height/Diameter	17 ft	Length (incl. aprons):	109
Width	18 ft	Length (w/o aprons):	109
Inlet Apron Length:	N/A ft	Outlet Apron Length:	28.6
US Inlet Apron Width	N/A ft	Outlet Apron Slope:	N/A
DS Inlet Apron Width	N/A ft	DS Outlet Apron Width:	N/A
Inlet Apron Slope:	N/A	US Outlet Apron Width:	N/A
Alignment of culvert inlet to channel	30 - 45 degrees	Alignment of culvert outlet to channel:	0 - 30 degrees
		Outlet configuration:	At Stream Grade

Culvert number: 1 of 2
Segment 3 of 3

Culvert or segment shape:	Arch Concrete Floor	Culvert/Segment Slope:	0.2%
Culvert or segment material:	Concrete (cast in place)	Culvert/Segment Roughness (n):	0.013
Culvert bottom material:	Concrete (cast in place)	Rustline Height:	N/A
Inlet Type:	Wingwall	Outlet Type:	Segment connection
Height/Diameter	17 ft	Length (incl. aprons):	55
Width	18 ft	Length (w/o aprons):	55
Inlet Apron Length:	N/A ft	Outlet Apron Length:	N/A
US Inlet Apron Width	N/A ft	Outlet Apron Slope:	N/A
DS Inlet Apron Width	N/A ft	DS Outlet Apron Width:	N/A
Inlet Apron Slope:	N/A	US Outlet Apron Width:	N/A
Alignment of culvert inlet to channel	30 - 45 degrees	Alignment of culvert outlet to channel:	0 - 30 degrees
		Outlet configuration:	At Stream Grade

Culvert Description cont'd

Culvert number:	**2 of 2**		
Segment	**1 of 1**		
Culvert or segment shape:	Arch Concrete Floor	Culvert/Segment Slope:	0.7%
Culvert or segment material:	Concrete (cast in place)	Culvert/Segment Roughness (n):	0.013
Culvert bottom material:	Concrete (cast in place)	Rustline Height:	N/A
Inlet Type:	Wingwall	Outlet Type:	Wingwall
Height/Diameter	17 ft	Length (incl. aprons):	241
Width	18 ft	Length (w/o aprons):	241
Inlet Apron Length:	N/A ft	Outlet Apron Length:	N/A
US Inlet Apron Width	N/A ft	Outlet Apron Slope:	N/A
DS Inlet Apron Width	N/A ft	DS Outlet Apron Width:	N/A
Inlet Apron Slope:	N/A	US Outlet Apron Width:	N/A
Alignment of culvert inlet to channel	30 - 45 degrees	Alignment of culvert outlet to channel:	0 - 30 degrees
		Outlet configuration:	At Stream Grade

Trash rack	None
Trash rack description	
Culvert Retrofits	None
Culvert retrofit descriptions	

Height of road prism above the inlet invert: 63.0 ft

Road fill volume: 88,826 yd^3

Comments: Upstream channel is bedrock and concrete for ~50 ft. Outlet beam at end of outlet wingwalls, could be called a downstream weir also.

Channel Characteristics

Inlet channel gradient:	2.9%	Natural tailwater control (TWC):	Pool tailout
Channel gradient at TWC:	0.9%	Channel substrate at tailwater:	Cobble (2.5 - 10")

Hydrology

Drainage Area:[1]	34.3 mi^2	Estimated 100-yr Flow:[3]	13,162 cfs
Mean annual precipitation:[2]	75 in/yr	Estimated 50-yr Flow:[3]	11,119 cfs
Potential Evapotranspiration:	39 in/yr	Estimated 25-yr Flow:[3]	8,582 cfs
Mean elevation:[1]	1900 ft	Estimated 10-yr Flow:[3]	6,491 cfs
		Estimated 5-yr Flow:[3]	4,755 cfs
		Estimated 2-yr Flow:[3]	2,922 cfs

Culvert Flood Capacity Calculations (based on FHWA Charts)

ENTRANCE TYPE: Wingwall

Headwater = Top of Inlet

Face Control ($HW_{face}/D = 1.0$) = 4800 cfs

Hydrology Explanation/Comments:

[1]Drainage area and mean elevation from USGS 1:24K topo maps

[2]Mean annual precip (PRISM 2002) and PET from Rantz (1964)

[3]Return period flows determined using regional regression equations (Waananen and Crippen, 1977). These are also in Caltrans Highway Design Manual (May 2001), Chap. 810, p. 810-19.

CDFG Matrix Site Ranking

Active Channel Width	44.4 ft	**Residual Inlet Depth**	-1.8 ft
Maximum slope	0.7%	**Residual Outlet Depth**	-0.9 ft
Baffles/Weirs (Yes or No)	No	**Substrate Throughout (YorN)**	No

Filter Result **GRAY**

Reason for filter result: Residual Inlet Depth < 0.5', AC > Inlet width

Filter result adjusted? **No**

Describe adjustment:

Fish Passage Analysis

	Q_{LP} (cfs)	Q_{HP} (cfs)	Leap Barrier Range (cfs)	Depth Barrier Range (cfs)	Velocity Barrier Range (cfs)	Range of passable flows	% of passable flows
Adult Anadromous	3.0	1570.9	None	< 33	> 307	33 - 307	**17%**
Adult Resident	2.0	531.0	< 1.7	< 18	> 307	18 - 307	**55%**
Juvenile salmonids	1.0	271.9	< 4	< 10	> 5.2	-	**0%**

Summaries

Culvert Condition

Culvert is in Fair condition some rebar has been exposed due to scouring by bedload.

Fish Evidence

Resident adult salmonid in outlet pool, juveniles (<10) observed up and downstream of site, one < 3" & one > 6" observed in the fish ladder (HSU, July 2002). Electrofished: 2 sites, juvenile SH were present 26,960 feet upstream (Goodfield & Mitchell, 1993). Carcass survey: found CHIN present (Jones, Flosi & Gilroy, 1987/88). Survey: juvenile COH and SH were observed (Ayers and Peters, 1968).

Stream Condition

Rattlesnake Creek is a large, perennial stream.

Barrier Status

Upstream: Many tributaries have RED ranked culverts. Mainstem has 5 crossings with no RED sites.
Downstream: No known barriers on the mainstem.

Habitat Information

Approximately 67,700 feet, including tributaries, of good spawning and rearing habitat (CDFG).

Recommendations

The culvert provides good passage conditions for adult and resident salmonids. However, the debris rack upstream of the inlet poses a challenge to passage. Passage through the debris rack would likely be improved with a widened channel and removal of excess/broken concrete. The 17% passable flows for adult salmonids means 17% of the fish passage flow range. Because adult passage occurs in the lower end of this range, adult passage is likely provided for a significant percent of the time during migration. Determining the percent of time for adult passage requires hydrologic monitoring of Rattlesnake Creek. Juvenile passage through the culvert barrel could be provided by a low flow channel or the addition of baffles.

Site Photos

Downstream Channel

Culvert Outlet

Culvert Inlet

Upstream Channel

Outlet Apron and Notch

Upstream Debris Rack

FISH PASSAGE EVALUATION SUMMARY SHEET

County: Mendocino **Route: 101** **Post Mile: 89.04 (Kilopost: 143.29)**

Survey Date: 23-Jul-02 **Survey Crew: HSU (F. Maisch, A. Lubard, B. Hodgson)**

Stream Name:	**Cedar Creek**		**Latitude**	**Longitude**	**GPS Unit**
Tributary to:	**South Fork Eel River**	**Site Coordinates**	39.8469 N	123.7010 W	Trimble Pathfinder
Basin	**Eel River**	**(NAD 1983)**			
Quad name (1:24K):	**LEGGETT**	**GPS point location:**	Inlet milepost marker		

USGS Hydrologic Unit	18010106 (S Fork Eel River)	**CalWater Unit HA**	3 (S Fork Eel River)
CalWater Unit HU	11 (Eel River)	**CalWater Unit HSA**	2 (Benbow)

Culvert Description

Culvert number: 1 of 1
Segment 1 of 1

Culvert or segment shape:	Arch Concrete Floor	Culvert/Segment Slope:	1.8%
Culvert or segment material:	Concrete (cast in place)	Culvert/Segment Roughness (n):	0.013
Culvert bottom material:	Concrete (cast in place)	Rustline Height:	N/A ft
Inlet Type:	Wingwall	Outlet Type:	Wingwall
Height/Diameter	30 ft	Length (incl. aprons):	873 ft
Width	22.8 ft	Length (w/o aprons):	828 ft
Inlet Apron Length:	N/A ft	Outlet Apron Length:	45.3 ft
US Inlet Apron Width	N/A ft	Outlet Apron Slope:	5.6%
DS Inlet Apron Width	N/A ft	DS Outlet Apron Width:	25.0 ft
Inlet Apron Slope:	N/A	US Outlet Apron Width:	22.8 ft
Alignment of culvert inlet to channel	0 - 30 degrees	Alignment of culvert outlet to channel:	30 - 45 degrees
		Outlet configuration:	Frefall into pool

Trash rack	None
Trash rack description	
Culvert Retrofits	Yes
Culvert retrofit descriptions	Denil Fish Ladder

Height of road prism above the inlet invert: - ft Road fill volume: - yd^3

Comments: Fill was not surveyed, fill volume is extremely large. Denil fish ladder present at outlet, Length = 26.5 ft. Slope = 21.1 %

Channel Characteristics

Inlet channel gradient:	1.8%	Natural tailwater control (TWC):	Pool tailout
Channel gradient at TWC:	5.5%	Channel substrate at tailwater:	Cobble (2.5 - 10")

Hydrology

Drainage Area:[1]	14.6 mi^2	Estimated 100-yr Flow:[3]	6,113 cfs
Mean annual precipitation:[2]	73 in/yr	Estimated 50-yr Flow:[3]	5,237 cfs
Potential Evapotranspiration:	39 in/yr	Estimated 25-yr Flow:[3]	4,107 cfs
Mean elevation:[1]	1600 ft	Estimated 10-yr Flow:[3]	3,135 cfs
		Estimated 5-yr Flow:[3]	2,310 cfs
		Estimated 2-yr Flow:[3]	1,437 cfs

Culvert Flood Capacity Calculations (based on FHWA Charts)

ENTRANCE TYPE: Wingwall

Headwater = Top of Inlet

Face Control ($HW_{face}/D = 1.0$) = 4000 cfs

Hydrology Explanation/Comments:

[1]Drainage area and mean elevation from USGS 1:24K topo maps

[2]Mean annual precip (PRISM 2002) and PET from Rantz (1964)

[3]Return period flows determined using regional regression equations (Waananen and Crippen, 1977). These are also in Caltrans Highway Design Manual (May 2001), Chap. 810, p. 810-19.

CDFG Matrix Site Ranking

Active Channel Width	32.8 ft	**Residual Inlet Depth**	8.3 ft
Maximum slope	1.0%	**Residual Outlet Depth**	0.0 ft
Baffles/Weirs (Yes or No)	No	**Substrate Throughout (YorN)**	No
Filter Result	**GRAY**	**Reason for filter result:**	Outlet perch > 2 ft, Change filter output to GRAY due to fish ladder
Filter result adjusted?	**Yes**	**Describe adjustment:**	Changed to GRAY due to denil fish ladder. Residual inlet and outlet depths calculated assuming the outlet beam controlled the in-culvert water depths. Water depths are likely higher due to the presence of weirs.

Fish Passage Analysis

	Q_{LP} (cfs)	Q_{HP} (cfs)	Leap Barrier Range (cfs)	Depth Barrier Range (cfs)	Velocity Barrier Range (cfs)	Range of passable flows	% of passable flows
Adult Anadromous	3.0	643.9	**Hydraulic analysis not conducted due to the denil fish ladder at outlet and 25 weirs within pipe. Partial passage of adults assumed and confirmed by observations of chinook upstream of the culvert. However, slope of the fish ladder would exclude juveniles and possibly residents.**				
Adult Resident	2.0	217.6					
Juvenile salmonids	1.0	111.4					

Summaries

Culvert Condition	Culvert in good condition.
Fish Evidence	Juveniles (<3") observed upstream, unknown species, #s 10-50 (HSU, July 2002). Prior to 1964 a CDFG COH hatchery existed on the east side of the South Fork Eel River near the mouth of Cedar Creek. This hatchery derived its source of water from Cedar Creek. COH were present in Cedar Creek at that time but are not at this time. Cedar Creek has a near excellent supply of cool summer water. Chinook carcasses have been observed above the HWY 101 culvert (Jones, 1997). Electrofished: juvenile SH were found 43, 434 feet (8.2 mi.) upstream (Goodfield & Coyle, 1993). Carcass survey: found 22 CHIN carcasses, no COH (Walton and Gilroy, 1987/88). Juvenile SH were found ranging from 1 to 10 inches in an abundance of about 300 fish/100 feet of stream. COH were said to have once been present but were not observed during this survey (Jones, Johnson and Montoya, 1981). Survey: juvenile SH were present, however, salmonids found high in the drainage, above 5 miles were believed to be resident rainbow (Ayres and Peters, 1968).
Stream Condition	Perennial stream with very good spawning habitat.
Barrier Status	Hwy 271 crossing ~700 ft upstream is a bridge. No known barriers downstream.
Habitat Information	42,200 ft of very good quality anadromous habitat available upstream (CDFG) of the state highway crossing on MEN101.
Recommendations	Passage through this culvert provides important access to good habitat. Confirm the ability of the current fish ladder and weir system to pass adult fish, without significant delay, over the range of fish passage flows (3 - 640 cfs). Consider modifications to improve resident and juvenile passage.

Site Photos

Downstream Channel

Culvert Outlet

Culvert Inlet

Upstream Channel

Outlet Fishway and Apron

Fish Ladder

FISH PASSAGE EVALUATION SUMMARY SHEET

County: Mendocino **Route: 101** **Post Mile: 52.36 (Kilopost: 84.26)**

Survey Date: Not Surveyed ROE denied **Survey Crew:**

Stream Name:	**Ryan Creek (N Fork)**		**Latitude**	**Longitude**	**GPS Unit**
Tributary to:	**Outlet Creek**	**Site Coordinates**	39.479 N	123.361 W	
Basin	**Eel River**	**(NAD 1983)**			
Quad name (1:24K):	**Longvale**	**GPS point location:**	Estimated using Maptech		

USGS Hydrologic Unit	18010103 (Upper Eel River)	**CalWater Unit HA**	6 (Upper Main Eel River)
CalWater Unit HU	11 (Eel River)	**CalWater Unit HSA**	1 (Outlet Creek)

Culvert Description

Culvert number: 1 of 1
Segment 1 of 1

Culvert or segment shape:	Circular	Culvert/Segment Slope:	Unknown, not surveyed
Culvert or segment material:	CMP (68mm X 13mm)	Culvert/Segment Roughness (n):	
Culvert bottom material:	CMP (68mm X 13mm)	Rustline Height	Unknown ft
Inlet Type:	Headwall	Outlet Type:	Wingwall
Height/Diameter	5 ft	Length (incl. aprons):	Unknown ft
Width	ft	Length (w/o aprons):	Unknown ft
Inlet Apron Length:	N/A ft	Outlet Apron Length:	Unknown ft
US Inlet Apron Width	N/A ft	Outlet Apron Slope:	Unknown
DS Inlet Apron Width	N/A ft	DS Outlet Apron Width	Unknown ft
Inlet Apron Slope:	N/A	US Outlet Apron Width	Unknown ft
Alignment of culvert inlet to channel	0-30 degrees	Alignment of culvert outlet to channel:	0-30 degrees
		Outlet configuration	Freefall into pool

Trash rack	None
Trash rack description	
Culvert Retrofits	None
Culvert retrofit descriptions	

Height of road prism above the inlet invert: Unknown ft

Road fill volume: Unknown yd^3

Comments: Site not surveyed, Right of Entry denied. There is a fence between the road and the culvert outlet.

Channel Characteristics

Inlet channel gradient:	Unknown	Natural tailwater control (TWC):	Pool tailout
Channel gradient at TWC:	Unknown	Channel substrate at tailwater:	Gravel (0.08 - 2.5 inches)

Hydrology

Drainage Area:[1]	0.65 mi^2	Estimated 100-yr Flow:[3]	cfs
Mean annual precipitation:[2]	51 in/yr	Estimated 50-yr Flow:[3]	cfs
Potential Evapotranspiration:	42 in/yr	Estimated 25-yr Flow:[3]	cfs
Mean elevation:[1]	1600 ft	Estimated 10-yr Flow:[3]	cfs
		Estimated 5-yr Flow:[3]	cfs
		Estimated 2-yr Flow:[3]	cfs

Culvert Flood Capacity Calculations (based on FHWA Charts)

ENTRANCE TYPE: Headwall

Headwater = Top of Inlet

Face Control ($HW_{face}/D = 1.0$) = 135 cfs

Hydrology Explanation/Comments:

[1]Drainage area and mean elevation from USGS 1:24K topo maps

[2]Mean annual precip (PRISM 2002) and PET from Rantz (1964)

[3]Return period flows determined using regional regression equations (Waananen and Crippen, 1977). These are also in Caltrans Highway Design Manual (May 2001), Chap. 810, p. 810-19.

CDFG Matrix Site Ranking

Active Channel Width	Unknown ft	**Residual Inlet Depth**	Unknown ft
Maximum slope	Unknown	**Residual Outlet Depth**	~2.5 ft
Baffles/Weirs (Yes or No)	No	**Substrate Throughout (YorN)**	No

Filter Result **Undetermined** **Reason for filter result:** Site not surveyed, access denied.

Filter result adjusted? **Describe adjustment:**

Fish Passage Analysis

	Q_{LP} (cfs)	Q_{HP} (cfs)	Leap Barrier Range (cfs)	Depth Barrier Range (cfs)	Velocity Barrier Range (cfs)	Range of passable flows	% of passable flows
Adult Anadromous	**Fish Passage Analysis not conducted, site access denied.**						
Adult Resident							
Juvenile salmonids							

Summaries

Culvert Condition

Culvert is in fair condition and has been lined with concrete to address rust.

Fish Evidence

A 1995 CDFG survey observed three-age classes of steelhead, Y-O-Y coho and pacific lamprey below the county culvert 500 ft downstream of the 101 crossings.

Stream Condition

Stream flows continuously at the state highway crossing year round.

Barrier Status

A county road culvert 500 ft downstream is currently a complete barrier. This crossing has been scheduled for replacement and received CDFG funds but Mendocino County failed to find matching funds to complete the work as initially scheduled. There is also a private road crossing 450 ft upstream of the 101 crossing.

Habitat Information

CDFG surveyed the South Fork of Ryan Creek in 1995 (NF was denied entry) and estimated 15,000 ft of upstream habitat. Using topographic maps, 9,000 ft was assumed for NF Ryan Creek. Habitat was rated as good.

Recommendations

Ryan Creek is known to support anadromous species and there is plentiful high quality habitat upstream of the 101 crossings (52.25 and 52.36). A county scheduled for replacement is located downstream of both state highway crossings so state highway crossings should be a high priority fix once the county crossing is addressed.

Site Photos

Culvert Outlet

Culvert Inlet

FISH PASSAGE EVALUATION SUMMARY SHEET

County: Mendocino **Route: 1** **Post Mile: 58.78 (Kilopost: 94.64)**
Survey Date: 24-May-04 **Survey Crew: HSU (F.Maisch,A.Siade)**

Stream Name:	**Digger Creek**		**Latitude**	**Longitude**	**GPS Unit**
Tributary to:	**Pacific Ocean**	**Site Coordinates**	39.406 N	123.808 W	* Used maptech and stream name
Basin	**Digger Creek**	**(NAD 1983)**			
Quad name (1:24K):	**Fort Bragg**	**GPS point location:**			

USGS Hydrologic Unit	18010108 (BIG-NAVARRO-GARCIA)	**CalWater Unit HA**	2 (Noyo River)
CalWater Unit HU	13 (Mendocino Coast)	**CalWater Unit HSA**	0 (Noyo River)

Culvert Description

Culvert number: 1 of 1
Segment 1 of 1

Culvert or segment shape:	Box	Culvert/Segment Slope:	0.5%
Culvert or segment material:	Concrete	Culvert/Segment Roughness (n):	0.013
Culvert bottom material:	Concrete	Rustline Height	N/A ft
Inlet Type:	Wingwall	Outlet Type:	Wingwall
Height/Diameter	5 ft	Length (incl. aprons):	76 ft
Width	5 ft	Length (w/o aprons):	76 ft
Inlet Apron Length:	8 ft	Outlet Apron Length:	6 ft
US Inlet Apron Width	5 ft	Outlet Apron Slope:	1%
DS Inlet Apron Width	5 ft	DS Outlet Apron Width	5 ft
Inlet Apron Slope:	4%	US Outlet Apron Width	5 ft
Alignment of culvert inlet to channel	0-30 degrees	Alignment of culvert outlet to channel:	Straight
		Outlet configuration	Freefall into pool

Trash rack	None
Trash rack description	
Culvert Retrofits	None
Culvert retrofit descriptions	

Height of road prism above the inlet invert: 14.1 ft Road fill volume: 1,400 yd^3

Comments:

Channel Characteristics

Inlet channel gradient:	-3.2%	Natural tailwater control (TWC):	Pool tailout
Channel gradient at TWC:	3.3%	Channel substrate at tailwater:	Boulder (> 10 inches)

Hydrology

Drainage Area:[1]	1.49 mi^2	Estimated 100-yr Flow:[3]	479 cfs
Mean annual precipitation:[2]	41 in/yr	Estimated 50-yr Flow:[3]	428 cfs
Potential Evapotranspiration:	37 in/yr	Estimated 25-yr Flow:[3]	355 cfs
Mean elevation:[1]	200 ft	Estimated 10-yr Flow:[3]	279 cfs
		Estimated 5-yr Flow:[3]	211 cfs
		Estimated 2-yr Flow:[3]	137 cfs

Culvert Flood Capacity Calculations (based on FHWA Charts)
ENTRANCE TYPE: Wingwall

Headwater = Top of Inlet
Face Control ($HW_{face}/D = 1.0$) = 165 cfs

Hydrology Explanation/Comments:

[1]Drainage area and mean elevation from USGS 1:24K topo maps

[2]Mean annual precip (PRISM 2002) and PET from Rantz (1964)

[3]Return period flows determined using regional regression equations (Waananen and Crippen, 1977). These are also in Caltrans Highway Design Manual (May 2001), Chap. 810, p. 810-19.

CDFG Matrix Site Ranking

Active Channel Width	8.2 ft	**Residual Inlet Depth**	-3.8 ft
Maximum slope	0.5%	**Residual Outlet Depth**	-3.5 ft
Baffles/Weirs (Yes or No)	No	**Substrate Throughout (YorN)**	No

Filter Result RED **Reason for filter result:** Outlet perch > 2 ft

Filter result adjusted? **No** **Describe adjustment:** No adjustments were made.

Fish Passage Analysis

	Q_{LP} (cfs)	Q_{HP} (cfs)	Leap Barrier Range (cfs)	Depth Barrier Range (cfs)	Velocity Barrier Range (cfs)	Range of passable flows	% of passable flows
Adult Anadromous	3.0	23.2	**Hydraulic Analysis not conducted, Red-ranked sites do not meet fish passage design criteria.**				0%
Adult Resident	2.0	7.8					0%
Juvenile salmonids	1.0	4.0					0%

Summaries

Culvert Condition

This culvert is in good condition.

Fish Evidence

A 1999 CDFG survey found coho and steelhead. Highway 1 culvert was noted as a barrier (Jones 2000). No fish observed during surveys.

Stream Condition

This culvert is close to the ocean and the stream has good canopy and substrate.

Barrier Status

A county culvert approximately 700 feet downstream on Ocean Drive was replaced in 2003 leaving the Highway 1 culvert as the primary barrier to upstream passage.

Habitat Information

Approximately 11,000 ft of suitably sloped habitat above the Highway 1 culvert was identified using 1:24K topographic maps.

Recommendations

The outlet perch needs to be eliminated because the culvert is a leap barrier for all species and lifestages. Recommend backwatering the outlet, if possible, to maintain water depths sufficient for fish passage over the range of fish passage flows.

Site Photos

Downstream channel

Culvert outlet

Culvert Inlet

Upstream channel

FISH PASSAGE EVALUATION SUMMARY SHEET

County: Del Norte **Route: 197** **Post Mile: 6.15 (Kilopost: 9.90)**
Survey Date: 5-Aug-02 **Survey Crew: HSU (B. Hodgson, J. Walker)**

			Latitude	Longitude	GPS Unit
Stream Name:	**Little Mill Creek**				
Tributary to:	**Smith River**	**Site Coordinates**	41.87364 N	124.12363 W	Trimble Pathfinder
Basin:	**Smith River**	**(NAD 1983)**			
Quad name (1:24K):	**Hiouchi**	**GPS point location:**	Inlet milepost marker		

USGS Hydrologic Unit: 18010101 **CalWater Unit HA:** 1 (Lower Smith River)
CalWater Unit HU: 3 (Smith River) **CalWater Unit HSU:** 1 (Smith River Plain)

Culvert Description

Culvert number: 1 of 1
Segment 1 of 1

Culvert or segment shape:	Circular		Culvert/Segment Slope:	2.3%	
Culvert or segment material:	SSP (Annular, 152 mm x 51 mm)		Culvert/Segment Roughness (n):	0.06	increased for baffles
Culvert bottom material:	same as segment material		Rustline Height	3	ft
Inlet Type:	Wingwall		Outlet Type:	Headwall	
Height/Diameter:	14.0	ft	Segment Length (incl. aprons):	86	ft
Width:	---	ft	Segment Length (w/o aprons):	86	ft
Inlet Apron Length:	N/A	ft	Outlet Apron Length:	1.6	ft
US Inlet Apron Width:	N/A	ft	Outlet Apron Slope:	12.0%	
DS Inlet Apron Width:	N/A	ft	DS Outlet Apron Width:	27.0	ft
Inlet Apron Slope:	N/A		US Outlet Apron Width:	27.0	ft
Alignment of culvert inlet to channel:	0-30 degrees		Alignment of culvert outlet to channel:	0-30 degrees	
			Outlet configuration:	Freefall into pool	

Trash rack None
Trash rack description
Culvert Retrofits Yes
Culvert retrofit descriptions Corner baffles along the right side.

Elevation of the road prism 24 ft
(assumes culvert inlet invert at 0.0 ft)

Road fill volume: 5,790 yd^3

Comments: Outlet apron is really just a small ledge it's steep slope is ignored in passage analysis because of the short length.

Channel Characteristics

Inlet channel gradient: 9.1%
Channel gradient at TWC: 6.6%

Natural tailwater control (TWC): Pool tailout
Channel substrate at tailwater: Gravel (0.08 - 2.5")

Hydrology

Drainage Area:[1]	3.70	mi^2	Estimated 100-yr Flow:[3]	2,000	cfs
Mean annual precipitation:[2]	79	in/yr	Estimated 50-yr Flow:[3]	1,770	cfs
Potential Evapotranspiration:	28	in/yr	Estimated 25-yr Flow:[3]	1,450	cfs
Mean elevation:[1]	680	ft	Estimated 10-yr Flow:[3]	1,140	cfs
			Estimated 5-yr Flow:[3]	860	cfs
			Estimated 2-yr Flow:[3]	560	cfs

Culvert Flood Capacity Calculations (based on FHWA Charts)
ENTRANCE TYPE: Wingwall

Headwater = Top of Inlet
Face Control ($HW_{face}/D = 1.0$) = 1600 cfs

Hydrology Explanation/Comments:
[1] Drainage area and mean elevation from USGS 1:24K topo maps
[2] Mean annual precip (PRISM 2002) and PET from Rantz (1964)
[3] Return period flows determined using regional regression equations (Waananen and Crippen, 1977). These are also in Caltrans Highway Design Manual (May 2001), Chap. 810, p. 810-19.

CDFG Matrix Site Ranking

Active Channel Width	23.2 ft	**Residual Inlet Depth**	-2.7 ft
Maximum slope	2.3%	**Residual Outlet Depth**	-1.6 ft
Baffles/Weirs (Yes or No)	Yes - corner baffles on right side	**Substrate Throughout (YorN)**	No

Filter Result GRAY

Reason for filter result: Culvert modified by corner baffles

Filter result adjusted? Yes

Describe adjustment: Ignored a steep slope on the outlet apron because the "apron" is a ledge less than 2 ft in length. Residual outlet depth is calculated using the TWC and the outlet apron elevation rather than the outlet invert elevation.

Fish Passage Analysis

	Q_{LP} (cfs)	Q_{HP} (cfs)	Leap Barrier Range (cfs)	Depth Barrier Range (cfs)	Velocity Barrier Range (cfs)	Range of Passable Flows	% of Passable Flows
Adult Anadromous	5.9	166	> 42	< 8.5	> 85	8.5 - 42 cfs	21%
Adult Resident	2	75	Always	< 3.2	> 13.4	None	0%
Juvenile salmonids	1	46	Always	< 1.0	> 1.3	None	0%

Summaries

Culvert Condition

Good

Fish Evidence

Numerous CDFG surveys (1981, 1988, 1995, 1996) confirm stream has chinook, coho, steelhead, and cutthroat trout.

Stream Condition

Very good condition. Stream has good flow in August. Culvert appears to be backwatered by Smith River at high flows.

Barrier Status

No other road crossings or barriers known.

Habitat Information

CDFG surveys indicate 4900 feet of anadromous habitat upstream of the state highway culvert.

Recommendations

The culvert barrel conditions are predicted to meet design guidelines and allow some passage for all species and lifestages. However, the outlet is perched 1.6 ft above the tailwater control creating a leap barrier over all fish passage flows for resident trout and juvenile salmonids and for flows above 42 cfs for adult anadromous salmonids. The culvert outlet perch should be eliminated to provide some passage for resident trout and juvenile salmonids and improve passage for adult anadromous salmonids.

Site Photos

Downstream channel

Culvert outlet

Culvert inlet

Upstream channel

FISH PASSAGE EVALUATION SUMMARY SHEET

County: Humboldt **Route: 299** **Post Mile: 2.97 (4.78 Kilopost)**

Survey Date: 4-Jun-03 **Survey Crew: HSU (AS, JWALK, TDG)**

			Latitude	Longitude	GPS Unit
Stream Name:	**Essex Gulch**				
Tributary to:	**Mad River**	**Site Coordinates**	40.90716 N	124.03724 W	Trimble Pathfinder
Basin:	**Mad River**	**(NAD 1983)**			
Quad name (1:24K):	**Arcata North**	**GPS point location:**	At culvert inlet		

USGS Hydrologic Unit	18010102 MAD-REDWOOD	**CalWater Unit HA**	1 (Blue Lake)
CalWater Unit HU	9 (Mad River)	**CalWater Unit HSA**	0 (Blue Lake)

Culvert Description

Culvert number: 1 of 1
Segment 1 of 1

Culvert or segment shape:	Circular	Culvert/Segment Slope:	2.1%
Culvert or segment material:	SSP (152mmx51mm)	Culvert/Segment Roughness (n):	0.028
Culvert bottom material:	SSP (152mmx51mm)	Rustline Height	1 ft
Inlet Type:	Wingwall	Outlet Type:	Wingwall
Height/Diameter	6 ft	Length (incl. aprons):	605 ft
Width	N/A ft	Length (w/o aprons):	593 ft
Inlet Apron Length:	N/A ft	Outlet Apron Length:	12.0 ft
US Inlet Apron Width	N/A ft	Outlet Apron Slope:	2.3%
DS Inlet Apron Width	N/A ft	DS Outlet Apron Width	18 ft
Inlet Apron Slope:	N/A	US Outlet Apron Width	6 ft
Alignment of culvert inlet to channel	0-30 degrees	Alignment of culvert outlet to channel:	0-30 degrees
		Outlet configuration	Freefall into pool

Trash rack	None
Trash rack description	
Culvert Retrofits	None
Culvert retrofit descriptions	

Height of road prism above inlet invert 48.8 ft

Road fill volume: 40,850 yd^3

Comments:

Channel Characteristics

Inlet channel gradient	-0.8%	Natural tailwater control (TWC):	Pool tailout
Channel gradient at TWC	5.4%	Channel substrate at tailwater:	Gravel (0.08-0.25")

Hydrology

Drainage Area:[1]	1.28 mi^2	Estimated 100-yr Flow:[3]	500 cfs
Mean annual precipitation:[2]	49 in/yr	Estimated 50-yr Flow:[3]	440 cfs
Potential Evapotranspiration:	32 in/yr	Estimated 25-yr Flow:[3]	370 cfs
Mean elevation:[1]	<1000 ft	Estimated 10-yr Flow:[3]	390 cfs
		Estimated 5-yr Flow:[3]	220 cfs
		Estimated 2-yr Flow:[3]	140 cfs

Culvert Flood Capacity Calculations (based on FHWA Charts)

ENTRANCE TYPE: < 30° Wingwalls

Headwater = Top of Inlet

Face Control ($HW_{face}/D = 1.0$) = 213 cfs

Hydrology Explanation/Comments:

[1]Drainage area and mean elevation from USGS 1:24K topo maps

[2]Mean annual precip PRISM (2002) and PET from Rantz (1964)

[3]Return period flows determined using regional regression equations (Waananen and Crippen, 1977). These are also in Caltrans Highway Design Manual (May 2001), Chap. 810, p. 810-19.

CDFG Matrix Site Ranking

Active Channel Width	5.6 ft	**Residual Inlet Depth**	-12.4 ft
Maximum slope	2.1%	**Residual Outlet Depth**	-0.1 ft
Baffles/Weirs (Yes or No)	No	**Substrate Throughout (YorN)**	No

Filter Result **GRAY** **Reason for filter result:** Residual inlet depth < 0.5 ft

Filter result adjusted? **No** **Describe adjustment:** No adjustments were made.

Fish Passage Analysis

	Q_{LP} (cfs)	Q_{HP} (cfs)	Leap Barrier Range (cfs)	Depth Barrier Range (cfs)	Velocity Barrier Range (cfs)	Range of passable flows	% of passable flows
Adult Anadromous	3.0	22.7	None	< 10	> 18.6	10 - 18.6 cfs	44%
Adult Resident	2.0	10.2	None	< 4	> 3.3	None	0%
Juvenile salmonids	1.0	6.3	None	< 1.4	None	None	0%

Summaries

Culvert Condition

Culvert is in good condition.

Fish Evidence

No CDFG surveys were found for this stream and no fish were observed during surveys. The culverts are less than 100 ft from the Mad River. Ross Taylor (Humboldt County fisheries consultant) believes the stream does or should support coho, steelhead and coastal cutthroat trout. Two residents concerned with the stream report observations of resident trout but no redds during anadromous spawning periods.

Stream Condition

Upstream of the state highway culvert is in fair condition. The primary activity in the watershed is timber harvest and there are significant fines in the stream channel. The stream has a gravel substrate downstream from the county culvert outlet.

Barrier Status

A county culvert 85 ft downstream of the state highway culvert is a barrier. The county culvert has a 7.7% slope and an outlet perch greater than 6 feet.

Habitat Information

Essex Gulch is the only low gradient stream crossed by HUM299 that is a culvert rather than a bridge. Using USGS 1:24K topographic maps, approximately 6000 feet of suitable gradient habitat exists upstream of the HUM299 crossing.

Recommendations

The state highway culvert is in good shape and meets design passage guidelines for adult anadromous salmoninds over 44% of the fish passage design flows. Recommend no action until the county culvert is replaced. When the county culvert is replaced, Caltrans should consider a joint project to improve passage through the two culverts.

Site Photos

Photos are arranged from downstream to upstream through the two consecutive culverts.

Downstream channel

County culvert outlet (Essex Road)

Site Photos

County Culvert Inlet

Highway Culvert Outlet (HUM299)

Highway Culvert Inlet

FISH PASSAGE EVALUATION SUMMARY SHEET

County: Del Norte **Route: 101** **Post Mile: 39.78 (Kilopost: 64.02)**

Survey Date: 11-Jun-02 **Survey Crew: HSU (J. Walker, J. Wolf, R. Gonzalez)**

			Latitude	Longitude	GPS Unit
Stream Name:	**Dominie Creek**				
Tributary to:	**Rowdy Creek**	**Site Coordinates**	41.92975	124.14517	Trimble Pathfinder
Basin:	**Smith River**	**(NAD 1983)**			
Quad name (1:24K):	**Smith River**	**GPS point location:**	Inlet milepost marker		

USGS Hydrologic Unit 18010101 (Smith - CA, OR) **CalWater Unit HA** 1 (Lower Smith River)
CalWater Unit HU 3 (Smith River) **CalWater Unit HSA** 1 (Smith River Plain)

Culvert Description

Culvert number: 1 of 1
Segment: 1 of 1

Culvert or segment shape:	Box	Culvert/Segment Slope	1.4%
Culvert or segment material:	concrete	Culvert/Segment Roughness (n):	0.013
Culvert bottom material:	concrete	Rustline Height:	N/A ft
Inlet Type:	Wingwall (one at 90º and one at 60º)	Outlet Type:	Wingwall (one at 90º and one at 60º)
Height/Diameter:	7.6 ft	Length (incl. aprons):	78 ft
Width:	11 ft	Length (w/o aprons):	69 ft
Inlet Apron Length:	N/A ft	Outlet Apron Length:	8.4 ft
US Inlet Apron Width:	N/A ft	Outlet Apron Slope:	10.4%
DS Inlet Apron Width:	N/A ft	DS Outlet Apron Width	11.0 ft
Inlet Apron Slope:	N/A	US Outlet Apron Width	11.0 ft
Alignment of culvert inlet to channel:	Approximately 0º	Alignment of culvert outlet to channel:	Approximately 0º
		Outlet configuration:	Freefall into pool (weir at the end of apron)

Trash rack None
Trash rack description
Culvert Retrofits None
Culvert retrofit descriptions

Height of road prism above the inlet invert: 14.1 ft Road fill volume: 3,450 yd^3

Comments: There is a concrete weir in fair condition at the end of the outlet apron.

Channel Characteristics

Inlet channel gradient:	2.5%	Natural tailwater control (TWC):	Pool Tailout
Channel gradient at TWC:	3.5%	Channel substrate at tailwater:	Gravel (0.08 - 2.5")

Hydrology

Drainage Area:[1]	3.63 mi^2	Estimated 100-yr Flow:	1,963 cfs
Mean annual precipitation:[2]	79 in/yr	Estimated 50-yr Flow:[3]	1,745 cfs
Potential Evapotranspiration:	28 in/yr	Estimated 25-yr Flow:[3]	1,426 cfs
Mean elevation:[1]	<1000 ft	Estimated 10-yr Flow:[3]	1,124 cfs
		Estimated 5-yr Flow:[3]	846 cfs
		Estimated 2-yr Flow:[3]	549 cfs

Culvert Flood Capacity Calculations (based on FHWA Charts)
ENTRANCE TYPE: Wingwall (one at 90º and one at 60º)

Headwater = Top of Inlet
Face Control (HW_{face}/D = 1.0) = 650 cfs

Hydrology Explanation/Comments:
[1]Drainage area and mean elevation from USGS 1:24K topo maps
[2]Mean annual precip (PRISM 2002) and PET from Rantz (1964)
[3]Return period flows determined using regional regression equations (Waananen and Crippen, 1977). These are also in Caltrans Highway Design Manual (May 2001), Chap. 810, p. 810-19.

CDFG Matrix Site Ranking

Active Channel Width	11.2 ft	**Residual Inlet Depth**	-2.8 ft
Maximum slope	1.4%	**Residual Outlet Depth**	-1.9 ft
Baffles/Weirs (Yes or No)	No	**Substrate Throughout (YorN)**	No

Filter Result GRAY

Reason for filter result: Residual inlet depth < 0.5 ft

Filter result adjusted? Yes

Describe adjustment: The residual inlet and outlet depths were calculated using the outlet weir elevation. The elevation difference between the natural TWC and the outlet is also 1.9 ft so there are two consecutive leaps of almost two feet.

Fish Passage Analysis

	Q_{LP} (cfs)	Q_{HP} (cfs)	Leap Barrier Range (cfs)	Depth Barrier Range (cfs)	Velocity Barrier Range (cfs)	Range of passable flows	% of passable flows
Adult Anadromous	3.0	145.5	None	< 70	> 49	None	0%
Adult Resident	2.0	68.1	< 29	< 40	> 3.7	None	0%
Juvenile salmonids	1.0	42.2	< 29	< 17	> 0.5	None	0%

Summaries

Culvert Condition

The culvert is in fair condition. The concrete weir below the outlet is beginning to fail and has exposed rebar.

Fish Evidence

Dominie Creek is known to support coho, steelhead and coastal cutthroat trout (CDFG surveys). Juvenile (<3") fish were observed both upstream and downstream of culvert at the time of survey (11-June-02).

Stream Condition

A portion of the upstream channel is engineered with a concrete bottom and riprap bottom and sandbag sides. There are well defined channels both upstream and downstream of culvert. Stream was flowing and continuous at time of survey.

Barrier Status

No additional barriers are known.

Habitat Information

Using the 1:24K USGS topographic map, available upstream habitat was estimated at 8,400 ft before the stream channel becomes too steep.

Recommendations

The leaps at the outlet weir and culvert outlet need to be reduce to improve passage. The concrete box culvert also does not have sufficient water depth to pass fish over almost 50% of their fish passage flows. Recommend improving the outlet conditions to backwater the culvert.

Site Photos

Downstream channel

Culvert outlet

Culvert Inlet

Upstream channel

FISH PASSAGE EVALUATION SUMMARY SHEET

County: Humboldt **Route: 101** **Post Mile: 124.49(Kilopost: 200.3)**

Survey Date: 3-Jun-02 **Survey Crew: HSU (B. Hodgson, F. Maisch)**

			Latitude	Longitude	GPS Unit
Stream Name:	**Little Lost Man Creek**				
Tributary to:	**Prairie Creek**	**Site Coordinates**	41.32822	124.03016	Trimble Pathfinder
Basin:	**Redwood Creek**	**(NAD 1983)**			
Quad name (1:24K):	**Orick**	**GPS point location:**	Inlet milepost marker		

USGS Hydrologic Unit 18010102 (Mad-Redwood) **CalWater Unit HA** 1 (Orick)
CalWater Unit HU 7 (Redwood Creek) **CalWater Unit HSA** 0 (Orick)

Culvert Description

Culvert number: 1 of 2
Segment: 1 of 1

Culvert or segment shape:	Box	Culvert/Segment Slope:	0.9%
Culvert or segment material:	concrete	Culvert/Segment Roughness (n):	0.013
Culvert bottom material:	concrete	Rustline Height:	N/A ft
Inlet Type:	Headwall	Outlet Type:	Headwall
Height/Diameter:	8.2 ft	Length (incl. aprons):	36 ft
Width:	8 ft	Length (w/o aprons):	36 ft
Inlet Apron Length:	N/A ft	Outlet Apron Length:	N/A ft
US Inlet Apron Width:	N/A ft	Outlet Apron Slope:	N/A
DS Inlet Apron Width:	N/A ft	DS Outlet Apron Width:	N/A ft
Inlet Apron Slope:	N/A	US Outlet Apron Width:	N/A ft
Alignment of culvert inlet to channel:	0 - 30 degrees	Alignment of culvert outlet to channel:	0 - 30 degrees
		Outlet configuration:	Freefall into pool

Culvert number: 2 of 2
Segment: 1 of 1

Culvert or segment shape:	Box	Culvert/Segment Slope:	1.4%
Culvert or segment material:	concrete	Culvert/Segment Roughness (n):	0.013
Culvert bottom material:	concrete	Rustline Height:	N/A ft
Inlet Type:	Headwall	Outlet Type:	Headwall
Height/Diameter:	8 ft	Length (incl. aprons):	36 ft
Width:	8 ft	Length (w/o aprons):	36 ft
Inlet Apron Length:	N/A ft	Outlet Apron Length:	N/A ft
US Inlet Apron Width:	N/A ft	Outlet Apron Slope:	N/A
DS Inlet Apron Width:	N/A ft	DS Outlet Apron Width:	N/A ft
Inlet Apron Slope:	N/A	US Outlet Apron Width:	N/A ft
Alignment of culvert inlet to channel:	0 - 30 degrees	Alignment of culvert outlet to channel:	0 - 30 degrees
		Outlet configuration:	Freefall into pool

Trash rack	None
Trash rack description	
Culvert Retrofits	Internal broad crested weir/baffle
Culvert retrofit descriptions	A wooden "L - shaped" weir is present in each culvert.

Height of road prism above the inlet invert: 12.2 ft Road fill volume: 880 yd^3

Comments: Culvert 2 is partially embedded inside culvert 10 ft in from inlet and extends to the wooden weir. The maximum depth of embedding is 8 in; the substrate is gravel (0.08 - 2.5").

Channel Characteristics

Inlet channel gradient:	0.06%	Natural tailwater control (TWC):	Pool tailout
Channel gradient at TWC:	5.8%	Channel substrate at tailwater:	Gravel (0.08 - 2.5")

Hydrology

Drainage Area:[1]	3.84 mi^2	Estimated 100-yr Flow:[3]	1,706 cfs
Mean annual precipitation:[2]	65 in/yr	Estimated 50-yr Flow:[3]	1,520 cfs
Potential Evapotranspiration:	30 in/yr	Estimated 25-yr Flow:[3]	1,246 cfs
Mean elevation:[1]	1000 ft	Estimated 10-yr Flow:[3]	985 cfs
		Estimated 5-yr Flow:[3]	745 cfs
		Estimated 2-yr Flow:[2]	485 cfs

Culvert Flood Capacity Calculations (based on FHWA Charts)

ENTRANCE TYPE: Headwall

Headwater = Top of Inlet

Face Control ($HW_{face}/D = 1.0$) = 944 cfs Includes both culverts

Hydrology Explanation/Comments:

[1]Drainage area and mean elevation from USGS 1:24K topo maps

[2]Mean annual precip (PRISM 2002) and PET from Rantz (1964)

[3]Return period flows determined using regional regression equations (Waananen and Crippen, 1977). These are also in Caltrans Highway Design Manual (May 2001), Chap. 810, p. 810-19.

CDFG Matrix Site Ranking

			culvert 1	culvert 2
Active Channel Width	21 ft	**Residual Inlet Depth**	-1.6 ft	-1.7 ft
Maximum slope	1.4%	**Residual Outlet Depth**	-1.3 ft	-1.2 ft
Baffles/Weirs (Yes or No)	Yes	**Substrate Throughout (YorN)**	No	

Filter Result **GRAY** **Reason for filter result:** Contains weirs, residual inlet depth < 0.5 ft

Filter result adjusted? **No** **Describe adjustment:** No adjustments were made.

Fish Passage Analysis

	Q_{LP} (cfs)	Q_{HP} (cfs)	Leap Barrier Range (cfs)	Depth Barrier Range (cfs)	Velocity Barrier Range (cfs)	Range of passable flows	% of passable flows
Adult Anadromous	3.0	114.9	< 7.0	< 35.5	> 41.5	35.5 - 41.5	5%
Adult Resident	2.0	48.9	< 75.0	< 17.0	> 13.5	None	0%
Juvenile salmonids	1.0	29.7	< 75.0	< 7.0	> 1.0	None	0%

Summaries

Culvert Condition

Culvert is in good condition. There is a wooden broad crested weir in each culvert. Culvert 2 is partially embedded inside culvert 10 ft in from inlet and extends to the wooden weir. The maximum depth of embedding is 8 in; the substrate is gravel (0.08 - 2.5"). The culverts, especially culvert 1, had significant debris trapped at the inlet.

Fish Evidence

Coho, Chinook, steelhead and coastal cutthroat trout are all known to be present in Little Lost Man Creek (CDFG surveys). Several juvenile fish were observed upstream of the culvert at the time of survey (3-June-02).

Stream Condition

There is a well-defined channel both upstream and downstream of the culvert. Little Lost Man Creek is a perennial stream.

Barrier Status

There is a state parks road crossing 1100 ft upstream of the state highway crossing. Fish passage status for this crossing is unknown.

Habitat Information

Using the 1:24K USGS topographic map, available upstream habitat was estimated at 4,200 ft before the stream channel becomes too steep.

Recommendations

Depth and water velocity limits adult passage through these box culverts. Additional baffles or weirs could improve adult passage. Resident and juvenile passage are hindered by a leap at the culvert outlet. Removing or reducing this leap could allow some passage. Backwatering the culvert outlet would also improve depth and velocity conditions for all life stages.

Site Photos

Downstream channel

Culvert outlet

Culvert Inlet

Upstream Channel

FISH PASSAGE EVALUATION SUMMARY SHEET

County: Humboldt **Route: 101** **Post Mile: 59.94(Kilopost: 96.5)**

Survey Date: 19-Mar-03 **Survey Crew: HSU (J. Walker, T. Grey, A. Kelly)**

			Latitude	Longitude	GPS Unit
Stream Name:	**Strongs Creek**				
Tributary to:	**Eel River**	**Site Coordinates**	40.58072	124.15059	Trimble Pathfinder
Basin:	**Eel River**	**(NAD 1983)**			
Quad name (1:24K):	**Fortuna**	**GPS point location:**	Inlet milepost marker		

USGS Hydrologic Unit	18010105 (Lower Eel River)	**CalWater Unit HA**	1 (Lower Eel River)
CalWater Unit HU	11 (Eel River)	**CalWater Unit HSA**	1 (Ferndale)

Culvert Description

Culvert number: 1 of 1
Segment: 1 of 1

Culvert or segment shape:	box	Culvert/Segment Slope:	1.1%
Culvert or segment material:	concrete	Culvert/Segment Roughness (n):	0.013
Culvert bottom material:	concrete	Rustline Height	N/A ft
Inlet Type:	Wingwall - angle varies (see photo)	Outlet Type:	Wingwall - angle varies (see photo)
Height/Diameter	13.5 ft - inlet 15.5 ft - oulet	Length (incl. aprons):	154 ft
Width	38 ft - inlet 25 ft - oulet	Length (w/o aprons):	154 ft
Inlet Apron Length:	N/A ft	Outlet Apron Length:	N/A ft
US Inlet Apron Width	N/A ft	Outlet Apron Slope:	N/A
DS Inlet Apron Width	N/A ft	DS Outlet Apron Width	N/A ft
Inlet Apron Slope:	N/A	US Outlet Apron Width	N/A ft
Alignment of culvert inlet to channel:	0 - 30 degrees	Alignment of culvert outlet to channel:	0 - 30 degrees
		Outlet configuration	At stream grade

Trash rack None
Trash rack description
Culvert Retrofits None
Culvert retrofit descriptions

Height of road prism above the inlet invert: Minimal, less than 5 ft

Road fill volume: No fill, just road and road base above the culvert

Comments: Culvert has non-uniform geometry with narrowing walls and wingwalls at various angles.

Channel Characteristics

Inlet channel gradient:	-8.2%	Natural tailwater control (TWC):	No Control Point
Channel gradient at TWC:	1.4%	Channel substrate at tailwater:	Gravel (0.08 - 2.5")

Hydrology

Drainage Area:[1]	9.68 mi^2	Estimated 100-yr Flow:[3]	2,555 cfs
Mean annual precipitation:[2]	43 in/yr	Estimated 50-yr Flow:[3]	2,285 cfs
Potential Evapotranspiration:	32 in/yr	Estimated 25-yr Flow:[3]	1,889 cfs
Mean elevation:[1]	<1000 ft	Estimated 10-yr Flow:[3]	1,513 cfs
		Estimated 5-yr Flow:[3]	1,165 cfs
		Estimated 2-yr Flow:[2]	772 cfs

Culvert Flood Capacity Calculations (based on FHWA Charts)

ENTRANCE TYPE: Wingwalls - various angles

Headwater = Top of Inlet

Face Control ($HW_{face}/D = 1.0$) = 3500 cfs

Rough estimate given the non-uniform culvert geometry.

Hydrology Explanation/Comments:

[1]Drainage area and mean elevation from USGS 1:24K topo maps

[2]Mean annual precip (PRISM 2002) and PET from Rantz (1964)

[3]Return period flows determined using regional regression equations (Waananen and Crippen, 1977). These are also in Caltrans Highway Design Manual (May 2001), Chap. 810, p. 810-19.

CDFG Matrix Site Ranking

Active Channel Width	13.5 ft	**Residual Inlet Depth**	-2.3 ft
Maximum slope	1.8% <- slope of embedded portion	**Residual Outlet Depth**	-0.3 ft
Baffles/Weirs (Yes or No)	No	**Substrate Throughout (YorN)**	No

Filter Result **GRAY** **Reason for filter result:** Residual inlet depth > 0.5 ft

Filter result adjusted? **No** **Describe adjustment:** No adjustments were made.

Fish Passage Analysis

	Q_{LP} (cfs)	Q_{HP} (cfs)	Leap Barrier Range (cfs)	Depth Barrier Range (cfs)	Velocity Barrier Range (cfs)	Range of passable flows	% of passable flows
Adult Anadromous	3.0	139.1	None	< 148	> 75	None	0%
Adult Resident	2.0	59.3	None	< 70	> 27	None	0%
Juvenile salmonids	1.0	36.0	None	< 30	> 2	None	0%

Summaries

Culvert Condition

Culvert is in fair condition. The culvert is partially embedded from a depth of 0 ft to 0.5 ft with gravel (0.08"-2.5") substrate. Culvert has non-uniform geometry with narrowing walls and wingwalls at various angles. The wingwalls, inlet and outlet are in fair condition.

Fish Evidence

Coho, steelhead and coastal cutthroat trout are all known to be present in Strongs Creek (CDFG surveys). No fish were observed at the time of survey (19-Mar-03).

Stream Condition

Strongs Creek is a perennial stream that flows through Fortuna. The downstream section is an urban creek.

Barrier Status

No additional barriers are known. A railroad bridge exists just upstream of the state highway crossing (see pictures).

Habitat Information

Strongs Creek flows through Fortuna and is an urban stream at the downstream end. The habitat improves upstream. Using the 1:24K USGS topographic map, available upstream habitat was estimated at 19,000 ft before the stream channel becomes too steep.

Recommendations

Strongs Creek may be ranked too high for remediation. The culvert is predicted to predominately be a depth barrier using conservative fish passage design criteria. Fish are likely passing this culvert better than predicted. However, passage could be improved by the addition of baffles or weirs or by minimally backwatering the culvert outlet to increase water depths at fish passage flows.

Site Photos

Downstream channel

Culvert outlet

Culvert Inlet

Upstream channel

FISH PASSAGE EVALUATION SUMMARY SHEET

County: Del Norte **Route: 199** **Post Mile: 31.31(Kilopost: 50.39)**

Survey Date: 11-Jun-03 **Survey Crew: HSU (F. Maisch, A. Siade)**

			Latitude	Longitude	GPS Unit
Stream Name:	**Griffin Creek**				
Tributary to:	**Smith River**	**Site Coordinates**	41.93948	123.75267	Trimble Pathfinder
Basin:	**Smith River**	**(NAD 1983)**			
Quad name (1:24K):	**Shelly Creek Ridge**	**GPS point location:**	Inlet milepost marker		

USGS Hydrologic Unit	18010101 (Smith - CA, OR)	**CalWater Unit HA**	3 (Middle Fork Smith River)
CalWater Unit HU	3 (Smith River)	**CalWater Unit HSA**	0 (Middle Fork Smith River)

Culvert Description

Culvert number: 1 of 1
Segment: 1 of 1

Culvert or segment shape:	Circular	Culvert/Segment Slope:	1.2%
Culvert or segment material:	SSP (152mm X 51mm)	Culvert/Segment Roughness (n):	0.028
Culvert bottom material:	SSP (152mm X 51mm)	Rustline Height:	3.25 ft
Inlet Type:	Wingwall at 45º	Outlet Type:	Wingwall at 45º
Height/Diameter:	12 ft	Length (incl. aprons):	423 ft
Width:	N/A ft	Length (w/o aprons):	406 ft
Inlet Apron Length:	N/A ft	Outlet Apron Length:	17.3 ft
US Inlet Apron Width:	N/A ft	Outlet Apron Slope:	4.8%
DS Inlet Apron Width:	N/A ft	DS Outlet Apron Width:	22.5 ft
Inlet Apron Slope:	N/A	US Outlet Apron Width:	14.0 ft
Alignment of culvert inlet to channel:	0 - 30 degrees	Alignment of culvert outlet to channel:	0 - 30 degrees
		Outlet configuration:	Freefall into pool

Trash rack	Debris blocker
Trash rack description	Large concrete wall used to block large debris
Culvert Retrofits	Baffles
Culvert retrofit descriptions	There are 13 corner baffles located throughout the last half of the culvert.

Height of road prism above the inlet invert: 73.9 ft Road fill volume: 147,500 yd^3

Comments: Outlet apron information is based on the apron that extends from the outlet to the first weir. There are a series of three concrete weirs and then one boulder weir that is considered the tailwater control. The first weir also contains a small concrete fish ladder (see photo). The culvert is partially embedded with an inlet depth of 1 ft and then ends at the first baffle. An inlet apron may be present and buried in substrate.

Channel Characteristics

Inlet channel gradient:	5.8%	Natural tailwater control (TWC):	Pool Tailout
Channel gradient at TWC:	2.2%	Channel substrate at tailwater:	Boulder (<10")

Hydrology

Drainage Area:[1]	1.68 mi^2	Estimated 100-yr Flow:[3]	1,078 cfs
Mean annual precipitation:[2]	85 in/yr	Estimated 50-yr Flow:[3]	914 cfs
Potential Evapotranspiration:	30 in/yr	Estimated 25-yr Flow:[3]	707 cfs
Mean elevation:[1]	1800 ft	Estimated 10-yr Flow:[3]	521 cfs
		Estimated 5-yr Flow:[3]	371 cfs
		Estimated 2-yr Flow:[3]	222 cfs

Culvert Flood Capacity Calculations (based on FHWA Charts)

ENTRANCE TYPE: Wingwalls at 45º

Headwater = Top of Inlet

Face Control ($HW_{face}/D = 1.0$) = 1,204 cfs

Hydrology Explanation/Comments:

[1]Drainage area and mean elevation from USGS 1:24K topo maps

[2]Mean annual precip (PRISM 2002) and PET from Rantz (1964)

[3]Return period flows determined using regional regression equations (Waananen and Crippen, 1977). These are also in Caltrans Highway Design Manual (May 2001), Chap. 810, p. 810-19.

CDFG Matrix Site Ranking

Active Channel Width	16.3 ft	**Residual Inlet Depth**	-4.2 ft[A]	
Maximum slope	1.2% (water is pooled above this slope)	**Residual Outlet Depth**	0.6 ft[A]	-1.9 ft[B]
Baffles/Weirs (Yes or No)	Yes	**Substrate Throughout (YorN)**	No	

Filter Result **GRAY** **Reason for filter result:** Crossing has baffles and weirs.

Filter result adjusted? **No** **Describe adjustment:** No adjustments were made.

Notes: A) These values are calculated using the 1st weir and the inlet/outlet invert elevations to assess culvert barrel conditions.
B) This value is calculated using the 3rd (last) concrete weir and the boulder weir as the tailwater control to assess the maximum leap through the crossing.

Fish Passage Analysis

	Q_{LP} (cfs)	Q_{HP} (cfs)	Leap Barrier Range (cfs)	Depth Barrier Range (cfs)	Velocity Barrier Range (cfs)	Range of passable flows	% of passable flows
Adult Anadromous	3.0	82.1	None	< 7.0	> 85	7 - 82.1	95%
Adult Resident	2.0	37.2	Always	< 2.5	> 13.5	None	0%
Juvenile salmonids	1.0	10.4	Always	< 0.9	> 1.1	None	0%

Summaries

Culvert Condition

The culvert, wingwalls, inlet, outlet and baffles are in good condition. There are a series of three concrete weirs and then one boulder weir that is considered tailwater control; all weirs are in good condition and performing well. The fish ladder associated with the first weir is in good condition and performing well. The culvert is partially embedded with an inlet depth of 1 ft and then ends at the first baffle. The inlet debris blocker is in good condition.

Fish Evidence

Coho, Chinook, steelhead and coastal cutthroat trout are all present in Clark's Creek and have been observed above the state highway culvert (CDFG surveys). Several (<10) juvenile fish (<3") were observed both upstream and downstream at the time of survey (11-June-03).

Stream Condition

Griffin Creek is a large perennial tributary of the Middle Fork Smith River.

Barrier Status

There are three state highway crossings on Griffin Creek tributaries upstream of this crossing at postmiles: 31.81, 32.26, and 32.55. All of these crossings are barriers.

Habitat Information

CDFG habitat surveys indicate 9,700 ft of good to excellent salmonid habitat exists upstream of the state highway crossing.

Recommendations

The Griffin Creek crossing is an easy fix as conditions at the outlet are the only impediments to fish passage. Replacing/reforming the boulder weir below the last concrete weir to minimize the leap should allow passage for all species and lifestages.

Site Photos

Downstream channel

Culvert outlet and weir system

Culvert Inlet and debris blocker

Culvert Inlet and debris blocker

Upstream channel

Fish ladder

FISH PASSAGE EVALUATION SUMMARY SHEET

County: Mendocino **Route: 101** **Post Mile: 44.51 (Kilopost: 71.63)**

Survey Date: 29-Jul-02 **Survey Crew: HSU (A.Larter,R.Gonzales,J.Wolf)**

Stream Name:	**Unnamed**		**Latitude**	**Longitude**	**GPS Unit**
Tributary to:	**Haehl Creek**	**Site Coordinates**	39.379 N	123.34 W	Trimble
Basin	**Eel River**	**(NAD 1983)**			
Quad name (1:24K):	**Willits**	**GPS point location:**	Outlet milepost marker		

USGS Hydrologic Unit	18010103 (Upper Eel River)	**CalWater Unit HA**	6 (Upper Main Eel River)
CalWater Unit HU	11 (Eel River)	**CalWater Unit HSA**	1 (Outlet Creek)

Culvert Description

Culvert number: 1 of 1
Segment 1 of 1

Culvert or segment shape:	Box	Culvert/Segment Slope:	0.7%
Culvert or segment material:	Concrete	Culvert/Segment Roughness (n):	0.013
Culvert bottom material:	Concrete	Rustline Height	N/A ft
Inlet Type:	Wingwall	Outlet Type:	Wingwall
Height/Diameter	8 ft	Length (incl. aprons):	101 ft
Width	10 ft	Length (w/o aprons):	80 ft
Inlet Apron Length:	N/A ft	Outlet Apron Length:	22 ft
US Inlet Apron Width	N/A ft	Outlet Apron Slope:	3.5%
DS Inlet Apron Width	N/A ft	DS Outlet Apron Width	13 ft
Inlet Apron Slope:	N/A	US Outlet Apron Width	10 ft
Alignment of culvert inlet to channel	0-30 degrees	Alignment of culvert outlet to channel:	Straight
		Outlet configuration	Freefall into pool

Trash rack	None
Trash rack description	
Culvert Retrofits	None
Culvert retrofit descriptions	

Height of road prism above the inlet invert: 23.2 ft Road fill volume: 2,970 yd^3

Comments:

Channel Characteristics

Inlet channel gradient:	1.5%	Natural tailwater control (TWC):	Pool tailout
Channel gradient at TWC:	0.4%	Channel substrate at tailwater:	Gravel (0.08 - 2.5 inches)

Hydrology

Drainage Area:[1]	7.3 mi^2	Estimated 100-yr Flow:[3]	2,270 cfs
Mean annual precipitation:[2]	49 in/yr	Estimated 50-yr Flow:[3]	1,960 cfs
Potential Evapotranspiration:	42 in/yr	Estimated 25-yr Flow:[3]	1,560 cfs
Mean elevation:[1]	1500 ft	Estimated 10-yr Flow:[3]	1,190 cfs
		Estimated 5-yr Flow:[3]	885 cfs
		Estimated 2-yr Flow:[3]	560 cfs

Culvert Flood Capacity Calculations (based on FHWA Charts)

ENTRANCE TYPE: Wingwall

Headwater = Top of Inlet

Face Control ($HW_{face}/D = 1.0$) = 680 cfs

Hydrology Explanation/Comments:

[1]Drainage area and mean elevation from USGS 1:24K topo maps

[2]Mean annual precip (PRISM 2002) and PET from Rantz (1964)

[3]Return period flows determined using regional regression equations (Waananen and Crippen, 1977). These are also in Caltrans Highway Design Manual (May 2001), Chap. 810, p. 810-19.

CDFG Matrix Site Ranking

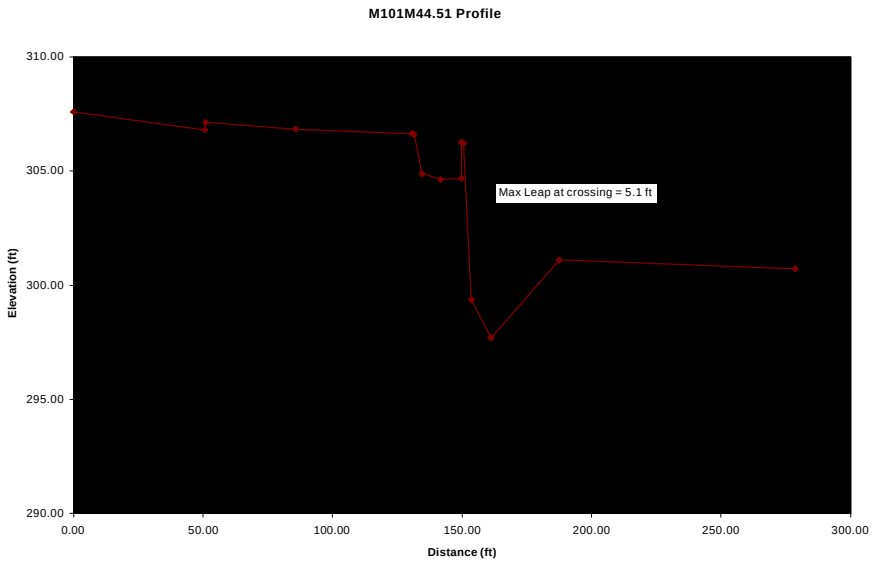
Active Channel Width	13 ft	**Residual Inlet Depth**	-0.9[A] ft
Maximum slope	0.7%	**Residual Outlet Depth**	-5.1[B] ft
Baffles/Weirs (Yes or No)	No	**Substrate Throughout (YorN)**	No

Filter Result **RED** **Reason for filter result:** Outlet perch > 2 ft

Filter result adjusted? **No** **Describe adjustment:** No adjustments were made.

Notes: A) The residual inlet depth is calculated using the inlet invert and outlet weir elevations.
B) The residual outlet depth is calculated using the outlet apron ds elevation and the tailwater control elevation. This represents the maximum leap height at the stream crossing (see site profile next page).

Site Profile



Fish Passage Analysis

	Q_{LP} (cfs)	Q_{HP} (cfs)	Leap Barrier Range (cfs)	Depth Barrier Range (cfs)	Velocity Barrier Range (cfs)	Range of passable flows	% of passable flows
Adult Anadromous	3.0	154.0	**Fish Passage Analysis unnecessary, Red-ranked site does not meet fish passage guidelines.**				0%
Adult Resident	2.0	52.0					0%
Juvenile salmonids	1.0	26.6					0%

Summaries

Culvert Condition	This culvert is in good condition.
Fish Evidence	No CDFG surveys of this tributary were found. Coho, Chinook and steelhead were assumed given their presence in Haehl Creek. None observed (July 2002).
Stream Condition	Major tributary to Haehl Creek, probably goes dry at lower elevations with intermittent pools.
Barrier Status	No additional barriers are known but this tributary crosses 101 in Willits so is likely crossed by other county and private roads.
Habitat Information	Using USGS 1:24K topographic maps, approximately 8600 feet of suitable gradient habitat was estimated upstream of this crossing.
Recommendations	The current culvert and outlet weir perch are complete barriers to fish passage. Recommend habitat assessment to confirm length of anadromous habitat and presence of additional barriers. This Haehl Creek tributary should support fish but the MEN 101 crossing is located just upstream of the confluence with Haehl Creek.

Site Photos

Downstream channel

Culvert outlet

Culvert Inlet

Upstream channel

FISH PASSAGE EVALUATION SUMMARY SHEET

County: Mendocino **Route: 1** **Post Mile: 54.62 (Kilopost: 87.94)**

Survey Date: 22-Nov-04 **Survey Crew: HSU (T.Grey, A.Siade, D.VanDyke)**

			Latitude	Longitude	GPS Unit
Stream Name:	**Doyle Creek**				
Tributary to:	**Pacific Ocean**	**Site Coordinates**	39.35707 N	123.80713 W	Trimble Pathfinder
Basin:	**Doyle Creek**	**(NAD 1983)**			
Quad name (1:24K):	**MENDOCINO**	**GPS point location:**	Inlet milepost marker		

USGS Hydrologic Unit	18010108 (Big-Navarro-Garcia)	**CalWater Unit HA**	3 (Big River)
CalWater Unit HU	13 (Mendocino Coast)	**CalWater Unit HSA**	0 (Big River)

Culvert Description

Culvert number: 1 of 1
Segment 1 of 1

Culvert or segment shape:	Circular	Culvert/Segment Slope:	2.5%
Culvert or segment material:	Annular, Steel Structural Plate (152mm x 51mm)	Culvert/Segment Roughness (n):	0.028
Culvert bottom material:	Annular, Steel Structural Plate (152mm x 51mm)	Rustline Height:	1.8 ft
Inlet Type:	Wingwall	Outlet Type:	Wingwall
Height/Diameter:	7 ft	Length (incl. aprons):	741 ft
Width:	N/A ft	Length (w/o aprons):	726 ft
Inlet Apron Length:	N/A ft	Outlet Apron Length:	14.7 ft
US Inlet Apron Width:	N/A ft	Outlet Apron Slope:	2.0%
DS Inlet Apron Width:	N/A ft	DS Outlet Apron Width:	16 ft
Inlet Apron Slope:	N/A	US Outlet Apron Width:	7 ft
Alignment of culvert inlet to channel:	0-30 degrees	Alignment of culvert outlet to channel:	0-30 degrees
		Outlet configuration:	Freefall to Apron

Trash rack	Yes
Trash rack description	Debris Deflector
Culvert Retrofits	None
Culvert retrofit descriptions	

Height of road prism above the inlet invert: Unknown ft Road fill volume: Unknown yd^3

Comments: No fill measurements taken due to enormous amount of fill. Debris deflector at inlet.

Channel Characteristics

Inlet channel gradient:	2.6%	Natural tailwater control (TWC):	Pool Tailout
Channel gradient at TWC:	1.3%	Channel substrate at tailwater:	Cobble (2.5-10")

Hydrology

Drainage Area:[1]	1.19 mi^2	Estimated 100-yr Flow:[3]	394 cfs
Mean annual precipitation:[2]	41 in/yr	Estimated 50-yr Flow:[3]	352 cfs
Potential Evapotranspiration:	37 in/yr	Estimated 25-yr Flow:[3]	292 cfs
Mean elevation:[1]	238 ft	Estimated 10-yr Flow:[3]	229 cfs
		Estimated 5-yr Flow:[3]	173 cfs
		Estimated 2-yr Flow:[3]	112 cfs

Culvert Flood Capacity Calculations (based on FHWA Charts)

ENTRANCE TYPE: Wingwall

Headwater = Top of Inlet

Face Control ($HW_{face}/D = 1.0$) = 313 cfs

Hydrology Explanation/Comments:

[1]Drainage area and mean elevation from USGS 1:24K topo maps

[2]Mean annual precip (PRISM 2002) and PET from Rantz (1964)

[3]Return period flows determined using regional regression equations (Waananen and Crippen, 1977). These are also in Caltrans Highway Design Manual (May 2001), Chap. 810, p. 810-19.

CDFG Matrix Site Ranking

Active Channel Width	17 ft		**Residual Inlet Depth**	-19.8 ft
Maximum slope	2.5%[A]	33%[B]	**Residual Outlet Depth**	-1.6 ft
Baffles/Weirs (Yes or No)	Yes		**Substrate Throughout (YorN)**	No

Filter Result RED

Reason for filter result:

Filter result adjusted? Yes

Describe adjustment: Changed filter output from GRAY to RED due to 11.5 ft long ~33% sloped outlet apron and the length of the culvert is >700 ft.

Notes: A) Culvert slope
B) Outlet apron slope ofr an 11.5 ft section of outlet apron right at the outlet invert (See attached photos)

Fish Passage Analysis

	Q_{LP} (cfs)	Q_{HP} (cfs)	Leap Barrier Range (cfs)	Depth Barrier Range (cfs)	Velocity Barrier Range (cfs)	Range of passable flows	% of passable flows
Adult Anadromous	3.0	18.5	**Hydraulic Analysis not conducted, Red-ranked sites do not meet fish passage criteria.**				0%
Adult Resident	2.0	6.3					0%
Juvenile salmonids	1.0	3.2					0%

Summaries

Culvert Condition

Culvert is in good condition.

Fish Evidence

CDFG surveys have found coho and steelhead below the Men 01 culvert, no coho above the culvert. CDFG believes that the juvenile coho found probably accessed Doyle Creek via the ocean from Caspar Creek because no spawning habitat exists below the Men 01 crossing (Jones, 1996). One Juvenile 3-6" unknown species was observed downstream during survey (Nov, 2004)

Stream Condition

Culvert outlet is approximately 3,000 ft from the ocean. Fair fish habitat. Nice spawning areas just upstream of culvert, did not walk upstream more than 100 feet.

Barrier Status

There are no known barriers up or downstream.

Habitat Information

Using USGS 1:24K topographic maps, approximately 12,500 feet of suitable gradient habitat was estimated upstream of this crossing.

Recommendations

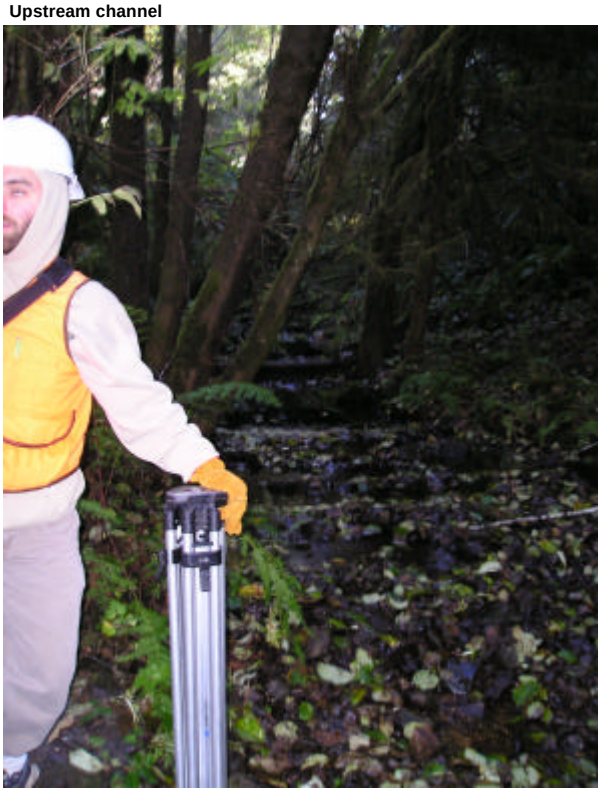
The Doyle Creek culvert is very long at > 700 feet and has a slope just under the Red-ranked criteria of 3%. At minimum, the addition of internal baffles or weirs to slow water velocities and provide resting areas is needed to pass adult fish through the crossing. In addition to any internal modifications, the outlet apron slope should also be eliminated. Observations of coho in Doyle Creek and known populations in Caspar Creek suggest that repopulation of Doyle Creek is likely if passage through the state highway culvert can be provided.

Site Photos

Downstream channel

Culvert outlet

Upstream channel



Culvert Inlet

FISH PASSAGE EVALUATION SUMMARY SHEET

County: Mendocino **Route: 1** **Post Mile: 57.81 (Kilopost: 93.07)**

Survey Date: 22-Jan-03 **Survey Crew: HSU (T.Grey,A.Kelly)**

			Latitude	Longitude	GPS Unit
Stream Name:	**Mitchell Creek**				
Tributary to:	**Pacific Ocean**	**Site Coordinates**	39.39156 N	123.81117 W	Trimble Pathfinder
Basin:	**Mitchell Creek**	**(NAD 1983)**			
Quad name (1:24K):	**Fort Bragg**	**GPS point location:**	Outlet milepost marker		

USGS Hydrologic Unit	18010108 (BIG-NAVARRO-GARCIA)	**CalWater Unit HA**	2 (Noyo River)
CalWater Unit HU	13 (Mendocino Coast)	**CalWater Unit HSA**	0 (Noyo River)

Culvert Description

Culvert number: 1 of 1
Segment 1 of 1

Culvert or segment shape:	Arch - Concrete floor	Culvert/Segment Slope:	1.0%
Culvert or segment material:	Concrete	Culvert/Segment Roughness (n):	0.013
Culvert bottom material:	Concrete	Rustline Height	N/A ft
Inlet Type:	Wingwall	Outlet Type:	Wingwall
Height/Diameter	10 ft	Length (incl. aprons):	373 ft
Width	10 ft	Length (w/o aprons):	318 ft
Inlet Apron Length:	46 ft This is a concrete, trapezoidal channel	Outlet Apron Length:	9.7 ft
US Inlet Apron Width	10 ft	Outlet Apron Slope:	3.2%
DS Inlet Apron Width	10 ft	DS Outlet Apron Width	? ft
Inlet Apron Slope:	2%	US Outlet Apron Width	? ft
Alignment of culvert inlet to channel	0-30 degrees	Alignment of culvert outlet to channel:	45 Degrees
		Outlet configuration	At stream grade

Trash rack	Yes
Trash rack description	Debris rack above the inlet channel had created a > 5-ft high, impenetrable debris jam at time of survey.
Culvert Retrofits	None
Culvert retrofit descriptions	

Height of road prism above the inlet invert: 72.8 ft Road fill volume: 72,100 yd^3

Comments: A concrete, trapezoidal channel approximately 50 ft long extends upstream from the culvert inlet. This culvert is partially embedded with silt/clay on the outlet side.

Channel Characteristics

Inlet channel gradient:	1.9%	Natural tailwater control (TWC):	Pool tailout
Channel gradient at TWC:	0.1%	Channel substrate at tailwater:	Bedrock

Hydrology

Drainage Area:[1]	2.63 mi^2	Estimated 100-yr Flow:[3]	785 cfs
Mean annual precipitation:[2]	41 in/yr	Estimated 50-yr Flow:[3]	702 cfs
Potential Evapotranspiration:	37 in/yr	Estimated 25-yr Flow:[3]	581 cfs
Mean elevation:[1]	250 ft	Estimated 10-yr Flow:[3]	460 cfs
		Estimated 5-yr Flow:[3]	350 cfs
		Estimated 2-yr Flow:[3]	229 cfs

Culvert Flood Capacity Calculations (based on FHWA Charts)

ENTRANCE TYPE: Wingwall

Headwater = Top of Inlet

Face Control ($HW_{face}/D = 1.0$) = 930 cfs

Hydrology Explanation/Comments:

[1]Drainage area and mean elevation from USGS 1:24K topo maps

[2]Mean annual precip (PRISM 2002) and PET from Rantz (1964)

[3]Return period flows determined using regional regression equations (Waananen and Crippen, 1977). These are also in Caltrans Highway Design Manual (May 2001), Chap. 810, p. 810-19.

CDFG Matrix Site Ranking

Active Channel Width	10.8 ft	**Residual Inlet Depth**	-2.8 ft
Maximum slope	1.0%	**Residual Outlet Depth**	0.3 ft
Baffles/Weirs (Yes or No)	No	**Substrate Throughout (YorN)**	No

Filter Result **GRAY** **Reason for filter result:** Residual inlet depth < 0.5 ft

Filter result adjusted? **No** **Describe adjustment:** No adjustments were made.

Fish Passage Analysis

	Q_{LP} (cfs)	Q_{HP} (cfs)	Leap Barrier Range (cfs)	Depth Barrier Range (cfs)	Velocity Barrier Range (cfs)	Range of passable flows	% of passable flows
Adult Anadromous	3.0	41.0	None	<52.4	>27	None	0%
Adult Resident	2.0	13.9	None	<23.8	>14.8	None	0%
Juvenile salmonids	1.0	7.1	None	<10.1	>1	None	0%

Summaries

Culvert Condition

Debris rack upstream of the inlet channel has captured debris creating a >5-ft jam that appears impassable. Otherwise this site is in good condition.

Fish Evidence

A 1973 CDFG survey found coho and steelhead (Jones 2000). No fish observed during surveys.

Stream Condition

Stream is in good condition with well developed canopy, some small bedrock falls present.

Barrier Status

No other barriers are known.

Habitat Information

CDFG survey indicates 13,000 ft of habitat available in Mitchell Creek almost all of which is upstream of the Highway 1 culvert.

Recommendations

The two impediments to fish passage through this crossing are the length of the culvert and the debris jams created by the upstream trash rack. Recommend the addition of internal weirs or baffles to increase the water depth and slow velocities through the culvert barrel and provide resting areas in the culvert. The debris rack should have a frequent maintenance schedule to prevent long-term debris barriers from developing.

Site Photos

Downstream channel

Culvert outlet

Culvert Inlet

Upstream channel

FISH PASSAGE EVALUATION SUMMARY SHEET

County: Del Norte **Route: 197** **Post Mile: 2.12 (Kilopost: 3.41)**

Survey Date: 8-Jun-02 **Survey Crew: HSU (P. Donovan, A. Clemento, J. Walker)**

Stream Name:	**Peacock Ck**		**Latitude**	**Longitude**	**GPS Unit**
Tributary to:	**Smith River**	**Site Coordinates**	41.82721 N	124.10335 W	Trimble Pathfinder
Basin:	**Smith River**	**(NAD 1983)**			
Quad name (1:24K):	**Hiouchi**	**GPS point location:**	Inlet milepost marker		

USGS Hydrologic Unit: 18010101 **CalWater Unit HA:** 1 (Lower Smith River)
CalWater Unit HU: 3 (Smith River) **CalWater Unit HSU:** 1 (Smith River Plain)

Culvert Description

Culvert number: 1 of 1
Segment 1 of 1

Culvert or segment shape:	Pipe Arch	Culvert/Segment Slope:	3.1%
Culvert or segment material:	SSP (Annular, 152 mm x 51 mm)	Culvert/Segment Roughness (n):	0.06
Culvert bottom material:	same as segment material	Rustline Height	2 ft
Inlet Type:	Wingwall	Outlet Type:	Wingwall
Height/Diameter:	8 ft	Length (incl. aprons):	75 ft
Width:	13 ft	Length (w/o aprons):	75 ft
Inlet Apron Length:	None ft	Outlet Apron Length:	None ft
US Inlet Apron Width:	N/A ft	Outlet Apron Slope:	N/A
DS Inlet Apron Width:	N/A ft	DS Outlet Apron Width	N/A ft
Inlet Apron Slope:	N/A	US Outlet Apron Width	N/A ft
Alignment of culvert inlet to channel:	0-30 degrees	Alignment of culvert outlet to channel:	0-30 degrees
		Outlet configuration	At stream grade

Trash rack None
Trash rack description
Culvert Retrofits None
Culvert retrofit descriptions

Elevation of the road prism 14.1 ft
(assumes culvert inlet invert at 0.0 ft)

Road fill volume: 1360 yd^3

Comments: Culvert contains 7 sets of wooden blocks to form weirs that span the entire culvert width. The blocks are placed so that a notch alternates from side to side. Roughness coefficient was increased to 0.060 to account for the wood weirs.

Channel Characteristics

Inlet channel gradient:	4.3%	Natural tailwater control (TWC):	Pool tailout
Channel gradient at TWC:	2.7%	Channel substrate at tailwater:	Gravel (0.08 - 2.5")

Hydrology

Drainage Area:[1]	2.10 mi^2	Estimated 100-yr Flow:[3]	1,280 cfs
Mean annual precipitation:[2]	83.0 in/yr	Estimated 50-yr Flow:[3]	1,140 cfs
Potential Evapotranspiration:	28.0 in/yr	Estimated 25-yr Flow:[3]	930 cfs
Mean elevation:[1]	520 ft	Estimated 10-yr Flow:[3]	730 cfs
		Estimated 5-yr Flow:[3]	540 cfs
		Estimated 2-yr Flow:[3]	350 cfs

Culvert Flood Capacity Calculations (based on FHWA Charts)
ENTRANCE TYPE: Wingwall

Headwater = Top of Inlet
Face Control ($HW_{face}/D = 1.0$) = 800 cfs

Hydrology Explanation/Comments:

[1] Drainage area and mean elevation from USGS 1:24K topo maps

[2] Mean annual precip (PRISM 2002) and PET from Rantz (1964)

[3] Return period flows determined using regional regression equations (Waananen and Crippen, 1977). These are also in Caltrans Highway Design Manual (May 2001), Chap. 810, p. 810-19.

CDFG Matrix Site Ranking

Active Channel Width: 13.5 ft
Maximum slope: 3.1%
Baffles/Weirs (Yes or No): Yes

Residual Inlet Depth: -1.8 ft
Residual Outlet Depth (culvert barrel): 0.5 ft
Residual Outlet Depth (outlet weir): -0.4 ft

NOTE: An outlet weir controls the water depths in the culvert barrel so the outlet weir elev was used to determine Residual Inlet and Outlet Depths for the culvert barrel. The Residual Outlet Depth for the outlet weir is calculated as the natural TWC elev - the outlet weir elevation.

Substrate Throughout (YorN): No

Filter Result: GRAY

Reason for filter result: Culvert has slope slightly greater than 3% but is modified with baffles to enhance fish passage.

Filter result adjusted? No

Describe adjustment: No adjustments were made.

Fish Passage Analysis

	Q_{LP} (cfs)	Q_{HP} (cfs)	Leap Barrier Range (cfs)	Depth Barrier Range (cfs)	Velocity Barrier Range (cfs)	Range of Passable Flows	% of Passable Flows
Adult Anadromous	3.6	101	None	< 17	> 101	17 - 101	86%
Adult Resident	2	46	Always [A]	< 6	> 42	None	0%
Juvenile salmonids	1	28	Always [A]	< 1.9	> 2.4	None	0%

[A] The leap barrier was assessed using the Residual Outlet Depth (outlet weir) between the natural tailwater control and the outlet weir. This value represents the maximum leap encountered for passage through the crossing.

Summaries

Culvert Condition

The culvert is in good condition but wooden block weirs are showing signs of wear.

Fish Evidence

1995 dive survey by HSU graduate student found juvenile steelhead and 2 YOY coho. 1989 CDFG electrofishing survey found steelhead and cutthroat trout. 1987 CDFG electrofishing survey found steelhead and cuttthroat trout. Chinook presence was assumed by Ross Taylor and Assoc for the Del Norte County fish passage assessment.

Stream Condition

Creek has good spawning substrate and rearing habitat.

Barrier Status

A county road culvert ~350 ft downstream of the state highway culvert was replaced by a stream simulation culvert in 2003. This restoration project could significantly enhance the importance of passage through the Caltrans culvert.

Habitat Information

The Del Norte county stream crossing assessment identified approximately 6000 ft of usable habitat above this culvert.

Recommendations

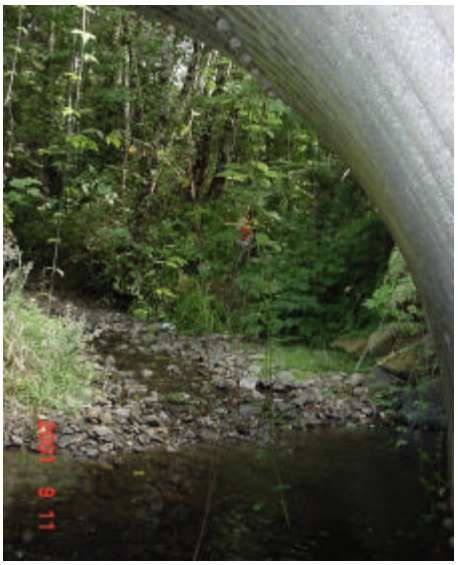
The Peacock Creek culvert provides good passage for adult anadromous salmonids and the culvert barrel is predicted to provide some passage for resident trout and juvenile salmonids. However, the outlet weir is perched almost 0.5 ft above the natural tailwater control creating a leap that impedes upstream migration of resident trout and juvenile salmonids. The leap at the outlet weir should be addressed to enhance passage for resident trout and juvenile salmonids. The wood-block weir performance and condition should be monitored as the blocks are in fair-to-poor condition

Site Photos

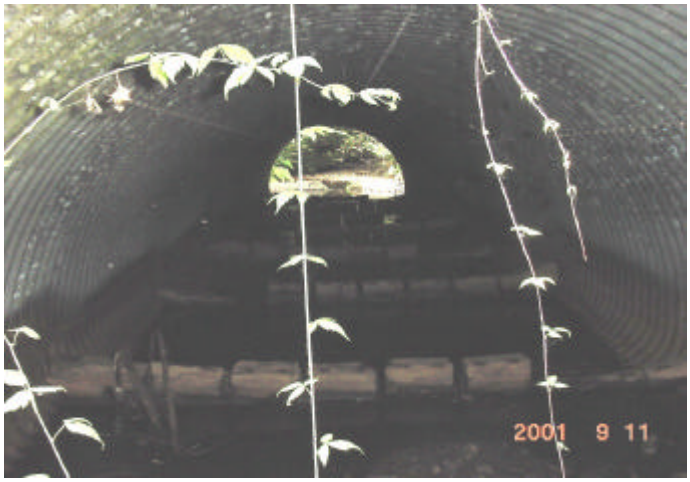
Culvert outlet

Culvert inlet

Upstream channel



Wooden baffles in culvert



Site Photos

Peacock Creek outlet weir at winter base flow.

FISH PASSAGE EVALUATION SUMMARY SHEET

County: Mendocino **Route: 1** **Post Mile: 4.64 (Kilopost: 7.47)**

Survey Date: 29-Jan-03 **Survey Crew: HSU (T.Grey,A.Kelly)**

Stream Name:	**Fish Rock Gulch**		**Latitude**	**Longitude**	**GPS Unit**
Tributary to:	**Pacific Ocean**	**Site Coordinates**	38.80572 N	123.57907 W	Trimble Pathfinder
Basin:	**Fish Rock Gulch**	**(NAD 1983)**			
Quad name (1:24K):	**Gualala**	**GPS point location:**	Above inlet on road		

USGS Hydrologic Unit	18010108 BIG-NAVARRO-GARCIA	**CalWater Unit HA**	7 (Garcia River)
CalWater Unit HU	13 (Mendocino Coast)	**CalWater Unit HSA**	0 (Garcia River)

Culvert Description

Culvert number: 1 of 1
Segment 1 of 1

Culvert or segment shape:	Circular	Culvert/Segment Slope:	4.4%
Culvert or segment material:	CSP (68mmx13mm)	Culvert/Segment Roughness (n):	0.024
Culvert bottom material:	CSP (68mmx13mm)	Rustline Height	0.8 ft
Inlet Type:	Headwall	Outlet Type:	Projecting
Height/Diameter	6 ft	Length (incl. aprons):	80 ft
Width	--- ft	Length (w/o aprons):	80 ft
Inlet Apron Length:	N/A ft	Outlet Apron Length:	N/A ft
US Inlet Apron Width	N/A ft	Outlet Apron Slope:	N/A
DS Inlet Apron Width	N/A ft	DS Outlet Apron Width	N/A ft
Inlet Apron Slope:	N/A	US Outlet Apron Width	N/A ft
Alignment of culvert inlet to channel	0-30 degrees	Alignment of culvert outlet to channel:	Straight
		Outlet configuration	Freefall into pool

Trash rack: Yes

Trash rack description: Debris rack of vertical beams spaced approximately 2.5 ft apart exists just upstream of the inlet.

Culvert Retrofits: None

Culvert retrofit descriptions

Height of road prism above the inlet invert: 13.8 ft

Road fill volume: 1,220 yd^3

Comments:

Channel Characteristics

Inlet channel gradient:	13.5%	Natural tailwater control (TWC):	Pool tailout
Channel gradient at TWC:	3.4%	Channel substrate at tailwater:	Boulder (>10 inches)

Hydrology

Drainage Area:[1]	1.12 mi^2	Estimated 100-yr Flow:[3]	391 cfs
Mean annual precipitation:[2]	43 in/yr	Estimated 50-yr Flow:[3]	350 cfs
Potential Evapotranspiration:	37 in/yr	Estimated 25-yr Flow:[3]	289 cfs
Mean elevation:[1]	600 ft	Estimated 10-yr Flow:[3]	227 cfs
		Estimated 5-yr Flow:[3]	171 cfs
		Estimated 2-yr Flow:[3]	111 cfs

Culvert Flood Capacity Calculations (based on FHWA Charts)

ENTRANCE TYPE: Headwall

Headwater = Top of Inlet

Face Control ($HW_{face}/D = 1.0$) = 213 cfs

Hydrology Explanation/Comments:

[1]Drainage area and mean elevation from USGS 1:24K topo maps

[2]Mean annual precip (PRISM 2002) and PET from Rantz (1964)

[3]Return period flows determined using regional regression equations (Waananen and Crippen, 1977). These are also in Caltrans Highway Design Manual (May 2001), Chap. 810, p. 810-19.

CDFG Matrix Site Ranking

Active Channel Width	13.9 ft	**Residual Inlet Depth**	-5.1 ft
Maximum slope	4.4%	**Residual Outlet Depth**	-1.3 ft
Baffles/Weirs (Yes or No)	No	**Substrate Throughout (YorN)**	No

Filter Result **RED** **Reason for filter result:** Slope >3%

Filter result adjusted? **No** **Describe adjustment:** No adjustments were made.

Fish Passage Analysis

	Q_{LP} (cfs)	Q_{HP} (cfs)	Leap Barrier Range (cfs)	Depth Barrier Range (cfs)	Velocity Barrier Range (cfs)	Range of passable flows	% of passable flows
Adult Anadromous	3.0	19.5	**Hydraulic Analysis not conducted, Red-ranked sites do not meet fish passage criteria.**				0%
Adult Resident	2.0	6.6					0%
Juvenile salmonids	1.0	3.4					0%

Summaries

Culvert Condition

Pipe is poor condition with rust and debris damage.

Fish Evidence

Fish Rock Gulch is a historic coho stream (Brown & Moyle 1991). A 2000 CDFG survey found steelhead above the culvert. Highway 1 culvert is considered a barrier (Jones 2000). No fish observed during surveys.

Stream Condition

Good fish habitat. Cobble & boulder substrate with some fines present. Fish Rock Gulch is a perennial stream.

Barrier Status

No additional barriers are known.

Habitat Information

Approximately 2900 ft of suitably sloped habitat above the Highway 1 culvert was identified using 1:24K topographic maps.

Recommendations

Site mitigation requires reducing the culvert barrel velocities and increasing the water depths over the range of fish passage flows. Deposition above the inlet debris rack has created a locally, steep channel slope (13.4%) just upstream of the culvert inlet that also hinders fish passage. Debris should be removed and regular maintenance scheduled to minimize debris buildup.

Site Photos

Downstream channel

Culvert outlet

Culvert Inlet

Upstream channel

FISH PASSAGE EVALUATION SUMMARY SHEET

County: Del Norte **Route: 101** **Post Mile: 2.22 (Kilopost: 3.57)**

Survey Date: 12-Jun-02 **Survey Crew: HSU (F. Maisch, R. Gonzalez)**

			Latitude	Longitude	GPS Unit
Stream Name:	**Waukell Creek**				
Tributary to:	**Klamath River**	**Site Coordinates**	41.49260	124.04542	Trimble Pathfinder
Basin:	**Klamath River**	**(NAD 1983)**			
Quad name (1:24K):	**Fern Canyon**	**GPS point location:**	Inlet milepost marker		

USGS Hydrologic Unit 18010209 (Lower Klamath - CA, OR) **CalWater Unit HA** 1 (Lower Klamath River)
CalWater Unit HU 5 (Klamath River) **CalWater Unit HSA** 1 (Klamath Glen)

Culvert Description

Culvert number: **1** **of** **1**
Segment: **1** **of** **1**

Culvert or segment shape:	Circular	Culvert/Segment Slope:	3.9%
Culvert or segment material:	SSP (152mm X 51mm)	Culvert/Segment Roughness (n):	0.028
Culvert bottom material:	SSP (152mm X 51mm)	Rustline Height:	1 ft
Inlet Type:	Wingwall at 45º	Outlet Type:	Headwall
Height/Diameter:	8 ft	Length (incl. aprons):	570 ft
Width:	N/A ft	Length (w/o aprons):	570 ft
Inlet Apron Length:	N/A ft	Outlet Apron Length:	N/A ft
US Inlet Apron Width:	N/A ft	Outlet Apron Slope:	N/A
DS Inlet Apron Width:	N/A ft	DS Outlet Apron Width:	N/A ft
Inlet Apron Slope:	N/A	US Outlet Apron Width:	N/A ft
Alignment of culvert inlet to channel:	Approximately 0º	Alignment of culvert outlet to channel:	Approximately 30º
		Outlet configuration:	At stream grade

Trash rack None
Trash rack description
Culvert Retrofits None
Culvert retrofit descriptions

Height of road prism above the inlet invert: 59.8 ft Road fill volume: 96,670 yd^3

Comments: There is a portion of the culvert with holes rusted through the bottom. The culvert outlet is slightly backwatered. The culvert is partially embedded near the outlet with a sediment depth of 1.5 ft.

Channel Characteristics

Inlet channel gradient: 3.4% Natural tailwater control (TWC): Pool Tailout
Channel gradient at TWC: 1.2% Channel substrate at tailwater: Cobble (2.5 - 10")

Hydrology

Drainage Area:[1]	1.39 mi^2	Estimated 100-yr Flow:[3]	831 cfs
Mean annual precipitation:[2]	77 in/yr	Estimated 50-yr Flow:[3]	739 cfs
Potential Evapotranspiration:	29 in/yr	Estimated 25-yr Flow:[3]	604 cfs
Mean elevation:[1]	<1000 ft	Estimated 10-yr Flow:[3]	471 cfs
		Estimated 5-yr Flow:[3]	352 cfs
		Estimated 2-yr Flow:[3]	226 cfs

Culvert Flood Capacity Calculations (based on FHWA Charts)
ENTRANCE TYPE: Wingwall at 45º

Headwater = Top of Inlet
Face Control ($HW_{face}/D = 1.0$) = 437 cfs

Hydrology Explanation/Comments:
[1]Drainage area and mean elevation from USGS 1:24K topo maps
[2]Mean annual precip (PRISM 2002) and PET from Rantz (1964)
[3]Return period flows determined using regional regression equations (Waananen and Crippen, 1977). These are also in Caltrans Highway Design Manual (May 2001), Chap. 810, p. 810-19.

CDFG Matrix Site Ranking

Active Channel Width	13.2 ft	**Residual Inlet Depth**	-20.2 ft
Maximum slope	3.9%	**Residual Outlet Depth**	0.4 ft
Baffles/Weirs (Yes or No)	No	**Substrate Throughout (YorN)**	No

Filter Result RED **Reason for filter result:** Slope > 3%

Filter result adjusted? **No** **Describe adjustment:** No adjustments were made.

Fish Passage Analysis

	Q_{LP} (cfs)	Q_{HP} (cfs)	Leap Barrier Range (cfs)	Depth Barrier Range (cfs)	Velocity Barrier Range (cfs)	Range of passable flows	% of passable flows
Adult Anadromous	3.0	53.5	Fish Passage Analysis unnecessary, Red-ranked site does not meet fish passage criteria.			None	0%
Adult Resident	2.0	25.0				None	0%
Juvenile salmonids	1.0	15.5				None	0%

Summaries

Culvert Condition

The culvert is in fair condition; there is a portion of the culvert with holes rusted through the bottom. The culvert outlet is slightly backwatered. The culvert is partially embedded near outlet with a sediment depth of 1.5 ft The wingwalls, headwall, inlet and outlet are in good condition.

Fish Evidence

Waukell Creek is known to support coho, steelhead trout and coastal cutthroat trout. Small, unidentified fish (< 3 inches) were observed during surveys.

Stream Condition

There is a defined channel both upstream and downstream of culvert. Waukell Creek is a perennial stream.

Barrier Status

A segment of Waukell Creek just downstream of this culvert has been channelized. This channel is a concrete channel with trapezoidal cross-section that is a complete barrier to fish (slope > 25%). See attached photos.

Habitat Information

Approximately 5000 ft of habitat suitable to resident or anadromous salmonids is available above this culvert (CDFG and topographic maps).

Recommendations

The highest priority barrier on Waukell Ck is the concrete channel (a > 25% slope) just downstream of the stream crossing at PM 2.22. The stream crossing should only be addressed before the concrete channel is passable if the Waukell Creek headwaters is determined to be unique habitat with a genetically significant coastal cutthroat trout population. In culvert retrofits would mitigate the low water depths and excessive velocities caused by the culvert's 3.9% slope. The culvert needs maintenance to address the rust holes.

Site Photos

Downstream channel

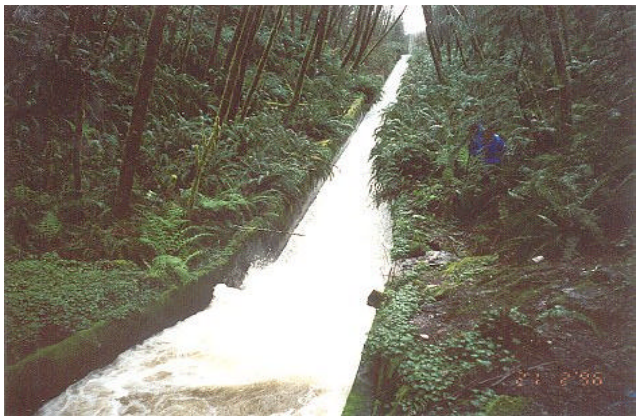
Culvert outlet

Culvert Inlet

Upstream channel

Top of concrete channel - summer flow

Complete Channel - winter flow



FISH PASSAGE EVALUATION SUMMARY SHEET

County: Humboldt **Route: 101** **Post Mile: 95.60(Kilopost: 153.9)**

Survey Date: 9-Jul-02 **Survey Crew: HSU (J. Walker, A. Lubard, F. Maisch)**

			Latitude	Longitude	GPS Unit
Stream Name:	**Strawberry Creek**				
Tributary to:	**Pacific Ocean**	**Site Coordinates**	40.99344	124.11316	Trimble Pathfinder
Basin:	**Pacific Ocean**	**(NAD 1983)**			
Quad name (1:24K):	**Arcata - North**	**GPS point location:**	Inlet milepost marker		

USGS Hydrologic Unit 18010102 (Mad-Redwood) **CalWater Unit HA** 1 (Blue Lake)
CalWater Unit HU 9 (Mad River) **CalWater Unit HSA** 0 (Blue Lake)

Culvert Description

Culvert number: **1** **of** **1**
Segment: **1** **of** **1**

Culvert or segment shape:	Circular		Culvert/Segment Slope:	0.3%
Culvert or segment material:	concrete		Culvert/Segment Roughness (n):	0.013
Culvert bottom material:	concrete		Rustline Height	N/A ft
Inlet Type:	Headwall		Outlet Type:	Wingwall at 60º
Height/Diameter	8.5 ft		Length (incl. aprons):	273 ft
Width	N/A ft		Length (w/o aprons):	273 ft
Inlet Apron Length:	N/A ft		Outlet Apron Length:	N/A ft
US Inlet Apron Width	N/A ft		Outlet Apron Slope:	N/A
DS Inlet Apron Width	N/A ft		DS Outlet Apron Width	N/A ft
Inlet Apron Slope:	N/A		US Outlet Apron Width	N/A ft
Alignment of culvert inlet to channel:	Approximately 70º		Alignment of culvert outlet to channel:	Approximately 65º
			Outlet configuration	At stream grade

Trash rack Yes
Trash rack description Debris blocker located downstream of culvert (see photo)
Culvert Retrofits None
Culvert retrofit descriptions

Height of road prism above the inlet invert: 25.3 ft Road fill volume: 33,010 yd^3

Comments: Culvert is partially embedded starting 42 ft in from the inlet. The depth of embedding is 5 ft at outlet.

Channel Characteristics

Inlet channel gradient: 2.2% Natural tailwater control (TWC): No Control Point
Channel gradient at TWC: 8.6% Channel substrate at tailwater: Sand (<0.08")

Hydrology

Drainage Area:[1]	3.01 mi^2	Estimated 100-yr Flow:[3]	966 cfs
Mean annual precipitation:[2]	45 in/yr	Estimated 50-yr Flow:[3]	864 cfs
Potential Evapotranspiration:	30 in/yr	Estimated 25-yr Flow:[3]	714 cfs
Mean elevation:[1]	<1000 ft	Estimated 10-yr Flow:[3]	565 cfs
		Estimated 5-yr Flow:[3]	429 cfs
		Estimated 2-yr Flow:[2]	281 cfs

Culvert Flood Capacity Calculations (based on FHWA Charts)
ENTRANCE TYPE: Headwall

Headwater = Top of Inlet
Face Control ($HW_{face}/D = 1.0$) = 509 cfs

Hydrology Explanation/Comments:

[1]Drainage area and mean elevation from USGS 1:24K topo maps

[2]Mean annual precip (PRISM 2002) and PET from Rantz (1964)

[3]Return period flows determined using regional regression equations (Waananen and Crippen, 1977). These are also in Caltrans Highway Design Manual (May 2001), Chap. 810, p. 810-19.

CDFG Matrix Site Ranking

Active Channel Width	10 ft		**Residual Inlet Depth**	-1.0 ft
Maximum slope[A]	2.2%	0.30%	**Residual Outlet Depth**	-0.2 ft
Baffles/Weirs (Yes or No)	No		**Substrate Throughout (YorN)**	No

Filter Result **GRAY** **Reason for filter result:** Residual inlet depth < 0.5 ft

Filter result adjusted? **No** **Describe adjustment:** No adjustments were made.

Notes: A) The culvert is placed on a 2.2 % slope but the partial embedding has created an overall slope of 0.3%.

Fish Passage Analysis

	Q_{LP} (cfs)	Q_{HP} (cfs)	Leap Barrier Range (cfs)	Depth Barrier Range (cfs)	Velocity Barrier Range (cfs)	Range of passable flows	% of passable flows
Adult Anadromous	3.0	49.0	None	< 27	> 84	27 - 49	48%
Adult Resident	2.0	20.9	None	< 19	> 17	None	0%
Juvenile salmonids	1.0	12.7	None	< 7	> 2.5	None	0%

Summaries

Culvert Condition

Culvert is in good condition. The culvert is partially embedded with sandy substrate (<0.08") from a depth of 0 ft, starting 42 ft in from the inlet, to 5 ft at the outlet. The headwalls, inlet and outlet are in good condition.

Fish Evidence

Strawberry Creek currently supports or has supported coho, steelhead and coastal cutthroat trout (Taylor, 2000 and CDFG surveys). No fish were observed at the time of survey (9-July-02).

Stream Condition

Strawberry Creek is a perennial stream.

Barrier Status

The state highway culvert is located right at Strawberry Creek's outlet to the ocean so is the first potential barrier encountered by migrating fish. Just upstream of the state highway culvert is a concrete channel paralleling Central Avenue that presents the second possible barrier. Beyond these potential barriers are county road crossings at Central Avenue (800 ft upstream) and Dows Prairie

Habitat Information

Approximately 18,000 feet of suitable habitat exists upstream of the state highway culvert (Taylor, 2000).

Recommendations

Just upstream of this culvert, the stream is channelized in a steep trapezoidal, concrete channel along Central Avenue through McKinleyville (see attached photo). Fish access into the Strawberry Creek watershed requires remediation of both the state highway culvert and the concrete channel. If the state highway culvert remains embedded during high flows, adult passage is possible.

Site Photos

Downstream channel

Culvert outlet

Culvert Inlet

Upstream channel

FISH PASSAGE EVALUATION SUMMARY SHEET

County: Humboldt **Route: 36** **Post Mile: 9.92 (Kilopost: 15.97)**

Survey Date: 15-Jan-03 **Survey Crew: HSU (T.Grey,F.Maisch)**

			Latitude	Longitude	GPS Unit
Stream Name:	**Flannigan Creek**				
Tributary to:	**Van Duzen River**	**Site Coordinates**	40.50930 N	123.98846 W	Trimble Pathfinder
Basin:	**Van Duzen River**	**(NAD 1983)**			
Quad name (1:24K):	**Owl Creek**	**GPS point location:**	Inlet milepost marker		

USGS Hydrologic Unit	18010105 (Lower Eel River)	**CalWater Unit HA**	2 (Van Duzen River)
CalWater Unit HU	11 (Eel River)	**CalWater Unit HSA**	1 (Hydesville)

Culvert Description

Culvert number: 1 of 1
Segment 1 of 1

Culvert or segment shape:	Circular	Culvert/Segment Slope:	1.4%
Culvert or segment material:	SSP (68mmx13mm)	Culvert/Segment Roughness (n):	0.024
Culvert bottom material:	SSP (68mmx13mm)	Rustline Height	1.8 ft
Inlet Type:	Headwall	Outlet Type:	Projecting
Height/Diameter	6 ft	Length (incl. aprons):	104 ft
Width	ft	Length (w/o aprons):	104 ft
Inlet Apron Length:	N/A ft	Outlet Apron Length:	N/A ft
US Inlet Apron Width	N/A ft	Outlet Apron Slope:	N/A
DS Inlet Apron Width	N/A ft	DS Outlet Apron Width	N/A ft
Inlet Apron Slope:	N/A	US Outlet Apron Width	N/A ft
Alignment of culvert inlet to channel	0-30 degrees	Alignment of culvert outlet to channel:	Straight
		Outlet configuration	At stream grade

Trash rack	None
Trash rack description	
Culvert Retrofits	None
Culvert retrofit descriptions	

Elevation of the road prism 22 ft
(assumes culvert inlet invert at 0.0 ft)

Road fill volume: 3,740 yd^3

Comments: Pipe appears undersized due to the deposition at the inlet and the scouring around the inlet.

Channel Characteristics

Inlet channel gradient:	6.5%	Natural tailwater control (TWC):	Pool tailout
Channel gradient at TWC:	3.9%	Channel substrate at tailwater:	Gravel (0.08-2.5") with some cobbles

Hydrology

Drainage Area:[1]	1.88 mi^2	Estimated 100-yr Flow:[3]	725 cfs
Mean annual precipitation:[2]	51 in/yr	Estimated 50-yr Flow:[3]	647 cfs
Potential Evapotranspiration:	35 in/yr	Estimated 25-yr Flow:[3]	533 cfs
Mean elevation:[1]	450 ft	Estimated 10-yr Flow:[3]	419 cfs
		Estimated 5-yr Flow:[3]	317 cfs
		Estimated 2-yr Flow:[3]	206 cfs

Culvert Flood Capacity Calculations (based on FHWA Charts)

ENTRANCE TYPE: Headwall

Headwater = Top of Inlet

Face Control ($HW_{face}/D = 1.0$) = 213 cfs

Hydrology Explanation/Comments:

[1]Drainage area and mean elevation from USGS 1:24K topo maps

[2]Mean annual precip (PRISM 2002) and PET (Rantz 1964)

[3]Return period flows determined using regional regression equations (Waananen and Crippen, 1977). These are also in Caltrans Highway Design Manual (May 2001), Chap. 810, p. 810-19.

CDFG Matrix Site Ranking

Active Channel Width	10.8 ft	**Residual Inlet Depth**	-1.5 ft
Maximum slope	1.4%	**Residual Outlet Depth**	-0.1 ft
Baffles/Weirs (Yes or No)	No	**Substrate Throughout (YorN)**	No

Filter Result **GRAY** **Reason for filter result:** Residual inlet depth > 0.5 ft

Filter result adjusted? **No** **Describe adjustment:** No adjustments were made.

Fish Passage Analysis

	Q_{LP} (cfs)	Q_{HP} (cfs)	Leap Barrier Range (cfs)	Depth Barrier Range (cfs)	Velocity Barrier Range (cfs)	Range of passable flows	% of passable flows
Adult Anadromous	3.0	46.1	None	< 10.4	> 12.3	10.4-12.3	11%
Adult Resident	2.0	17.0	None	< 3.9	> 4.8	3.9-4.8	12%
Juvenile salmonids	1.0	10.0	None	< 1.5	> 0.5	None	0%

Summaries

Culvert Condition

Culvert barrel is in good condition but there is some scour around the inlet headwall.

Fish Evidence

Chinook, coho, and steelhead presence assumed given stream size, suitable habitat and connectivity to the Van Duzen River. No CDFG surveys found from the spawning season but a June 1988 habitat survey concluded: “Potential for chinook salmon habitat was rated good to excellent throughout the survey.” No fish observed during survey (1/15/03).

Stream Condition

Good fish habitat, the HUM36 crossing is ~200 ft from mainstem Van Duzen River.

Barrier Status

1989 CDFG survey identified two potential barriers: a log jam approximately 240 ft downstream and erosion 1060 feet upstream of the HUM36 crossing.

Habitat Information

Approximately 3,800 ft of suitable fish habitat above the HUM36 culvert was identified in a 1989 CDFG survey.

Recommendations

The existing culvert is too small for this stream. Fish passage and drainage hydraulics would be significantly improved by replacing the existing culvert with a larger culvert designed to meet current fish passage design guidelines. Impacts of culvert backwatering are evident at the culvert inlet (see deposits in photo) and the inlet channel gradient is 6.5% compared to the culvert and downstream channel gradients of 1.4% and 3.5%, respectively. Recommend complete replacement.

Site Photos

Downstream channel

Culvert outlet

Culvert Inlet

Upstream channel

FISH PASSAGE EVALUATION SUMMARY SHEET

County: Mendocino **Route: 20** **Post Mile: 30.87(Kilopost: 49.68)**

Survey Date: 6-Aug-02 **Survey Crew: HSU (A. Lubard, J. Wolf, F. Maisch)**

Stream Name:	**unnamed tributary**		**Lattitude**	**Longitude**	**GPS Unit**
Tributary to:	**Broaddus Creek**	**Site Coordinates**	39.40234	123.38993	Trimble Pathfinder
Basin:	**Eel River**	**(NAD 1983)**			
Quad name (1:24K):	**Burbeck**	**GPS point location:**	Inlet milepost marker		

USGS Hydrologic Unit	18010103 (Upper Eel River)	**CalWater Unit HA**	6 (Upper Main Eel River)
CalWater Unit HU	11 (Eel River)	**CalWater Unit HSA**	1 (Outlet Creek)

Culvert Description

Culvert number: 1 of 1
Segment: 1 of 1

Culvert or segment shape:	Box	Culvert/Segment Slope:	3.1%
Culvert or segment material:	Concrete	Culvert/Segment Roughness (n):	0.013
Culvert bottom material:	Concrete	Rustline Height:	N/A ft
Inlet Type:	Wingwall (angle varies, see photo)	Outlet Type:	Wingwall (angle varies, see photo)
Height/Diameter:	6 ft	Length (incl. aprons):	83 ft
Width:	9 ft	Length (w/o aprons):	59 ft
Inlet Apron Length:	N/A ft	Outlet Apron Length:	24.1 ft
US Inlet Apron Width:	N/A ft	Outlet Apron Slope:	9.2%
DS Inlet Apron Width:	N/A ft	DS Outlet Apron Width:	12.0 ft
Inlet Apron Slope:	N/A	US Outlet Apron Width:	9.0 ft
Alignment of culvert inlet to channel:	Approximately 10º	Alignment of culvert outlet to channel:	Approximately 0º
		Outlet configuration:	Cascade over riprap

Trash rack	None
Trash rack description	
Culvert Retrofits	None
Cuvlert retrofit descriptions	

Height of road prism above the inlet invert: 9.3 ft

Road fill volume: 560 yd^3

Comments: Inlet and outlet are angled with respect to the channel but aligned with the road. The wingwalls are therefore at different angles (see photos).

Channel Characteristics

Inlet channel gradient:	2.3%	Natural tailwater control (TWC):	Pool Tailout
Channel gradient at TWC:	8.0%	Channel substrate at tailwater:	Cobble (2.5 - 10")

Hydrology

Drainage Area:[1]	1.068 mi^2	Estimated 100-yr Flow:[3]	443 cfs
Mean annual precipitation:[2]	51 in/yr	Estimated 50-yr Flow:[3]	381 cfs
Potential Evapotranspiration:	42 in/yr	Estimated 25-yr Flow:[3]	301 cfs
Mean elevation:[1]	1600 ft	Estimated 10-yr Flow:[3]	224 cfs
		Estimated 5-yr Flow:[3]	162 cfs
		Estimated 2-yr Flow:[3]	99 cfs

Culvert Flood Capacity Calculations (based on FHWA Charts)

ENTRANCE TYPE: Wingwall (angle varies, see photo)

Headwater = Top of Inlet

Face Control ($HW_{face}/D = 1.0$) = 396 cfs

Hydrology Explanation/Comments:

[1]Drainage area and mean elevation from USGS 1:24K topo maps

[2]Mean annual precip (PRISM 2002) and PET from Rantz (1964)

[3]Return period flows determined using regional regression equations (Waananen and Crippen, 1977). These are also in Caltrans Highway Design Manual (May 2001), Chap. 810, p. 810-19.

CDFG Matrix Site Ranking

Active Channel Width	11.1 ft	**Residual Inlet Depth**	-3.3 ft
Maximum slope	3.1%[A] 9.2%[B]	**Residual Outlet Depth**	-1.5 ft
Baffles/Weirs (Yes or No)	No	**Substrate Throughout (YorN)**	No

Filter Result RED **Reason for filter result:** Slope > 3%

Filter result adjusted? **No** **Describe adjustment:** No adjustments were made.

Notes: A) Cuvlert barrel slope
B) Outlet apron slope

Fish Passage Analysis

	Q_{LP} (cfs)	Q_{HP} (cfs)	Leap Barrier Range (cfs)	Depth Barrier Range (cfs)	Velocity Barrier Range (cfs)	Range of passable flows	% of passable flows
Adult Anadromous	3.0	24.4	**Hydraulic Analysis not conducted, Red-ranked sites do not meet fish passage criteria.**				0%
Adult Resident	2.0	8.3					0%
Juvenile salmonids	1.0	4.2					0%

Summaries

Culvert Condition

The inlet, outlet and wingwalls are in good condition. However, the culvert is in fair condition because streamflow has worn a path through the bottom of the culvert exposing the rebar.

Fish Evidence

No CDFG surveys exist for this Broaddus Creek tributary. Chinook, coho and steelhead were assumed given easy access and known presence in Broaddus Creek. Stream is dry in summer so is not rearing habitat. No fish were observed at the time of survey (6-Aug-02).

Stream Condition

There is a well-defined channel both upstream and downstream of culvert. Stream flow was discontinuous at the time of survey.

Barrier Status

No additional barriers are known.

Habitat Information

Approximately 3,700 ft of suitably sloped habitat above the Highway 1 culvert was identified using 1:24K topographic maps.

Recommendations

Confirm potential for fish use of this tributary by consistent presence in Broaddus Creek at this river mile and sufficient, sustained winter flows for spawning. If fish can and should use this tributary, the outlet apron slope is too steep to allow fish passage and must be significantly reduced, backwatered or a ladder-type structure provided. The culvert barrel should have internal baffles or weirs added to

Site Photos

Downstream channel

Culvert outlet

Culvert Inlet

Upstream channel

FISH PASSAGE EVALUATION SUMMARY SHEET

County: Humboldt **Route: 101** **Post Mile: 99.03(Kilopost: 159.4)**

Survey Date: 25-Jul-02 **Survey Crew: HSU (J. Wolf, F. Maisch, A. Lubard)**

Stream Name:	**Luffenholtz Creek**		**Latitude**	**Longitude**	**GPS Unit**
Tributary to:	**Luffenholtz Creek**	**Site Coordinates**	41.04475	124.11697	Trimble Pathfinder
Basin:	**Pacific Ocean/Luffenholtz Creek**	**(NAD 1983)**			
Quad name (1:24K):	**Crannell**	**GPS point location:**	Inlet milepost marker		

USGS Hydrologic Unit 18010102 (Mad-Redwood) **CalWater Unit HA** 1 (Big Lagoon)
CalWater Unit HU 8 (Trinidad) **CalWater Unit HSA** 0 (Big Lagoon)

Culvert Description

Culvert number: 1 of 1
Segment: 1 of 2

Culvert or segment shape:	Arch - concrete floor	Culvert/Segment Slope:	0.2%
Culvert or segment material:	concrete	Culvert/Segment Roughness (n):	0.013
Culvert bottom material:	concrete	Rustline Height	N/A ft
Inlet Type:	segment connection	Outlet Type:	Wingwall at 45º
Height/Diameter	14 ft	Length (incl. aprons):	130 ft
Width	14 ft	Length (w/o aprons):	99 ft
Inlet Apron Length:	N/A ft	Outlet Apron Length:	30.9 ft
US Inlet Apron Width	N/A ft	Outlet Apron Slope:	-0.6%
DS Inlet Apron Width	N/A ft	DS Outlet Apron Width	35.2 ft
Inlet Apron Slope:	N/A	US Outlet Apron Width	14.0 ft
Alignment of culvert inlet to channel:	N/A	Alignment of culvert outlet to channel:	> 45 degrees (~90º)
		Outlet configuration	Freefall into pool

Culvert number: 1 of 1
Segment: 2 of 2

Culvert or segment shape:	Arch - concrete floor	Culvert/Segment Slope:	4.7%
Culvert or segment material:	concrete	Culvert/Segment Roughness (n):	0.013
Culvert bottom material:	concrete	Rustline Height	N/A ft
Inlet Type:	Wingwall at 45º	Outlet Type:	segment connection
Height/Diameter	14 ft	Length (incl. aprons):	298 ft
Width	14 ft	Length (w/o aprons):	298 ft
Inlet Apron Length:	N/A ft	Outlet Apron Length:	N/A ft
US Inlet Apron Width	N/A ft	Outlet Apron Slope:	N/A
DS Inlet Apron Width	N/A ft	DS Outlet Apron Width	N/A ft
Inlet Apron Slope:	N/A	US Outlet Apron Width	N/A ft
Alignment of culvert inlet to channel:	0 - 30 degrees	Alignment of culvert outlet to channel:	N/A
		Outlet configuration	segment connection

Trash rack None
Trash rack description
Culvert Retrofits None
Culvert retrofit descriptions

Height of road prism above the inlet invert: 82.9 ft Road fill volume: 48,100 yd^3

Comments: Both segments are identical except for slope and length. There is curved weir just downstream of the outlet.

Channel Characteristics

Inlet channel gradient:	0.9%	Natural tailwater control (TWC):	Pool Tailout
Channel gradient at TWC:	0.0%	Channel substrate at tailwater:	Cobble (2.5 - 10")

Hydrology

Drainage Area:[1]	4.42 mi^2	Estimated 100-yr Flow:[3]	1,466 cfs
Mean annual precipitation:[2]	49 in/yr	Estimated 50-yr Flow:[3]	1,309 cfs
Potential Evapotranspiration:	30 in/yr	Estimated 25-yr Flow:[3]	1,080 cfs
Mean elevation:[1]	<1000 ft	Estimated 10-yr Flow:[3]	857 cfs
		Estimated 5-yr Flow:[3]	653 cfs
		Estimated 2-yr Flow:[2]	428 cfs

Culvert Flood Capacity Calculations (based on FHWA Charts)

ENTRANCE TYPE: Wingwall at 45º

Headwater = Top of Inlet

Face Control (HW_{face}/D = 1.0) = Not determined for this shape.

Hydrology Explanation/Comments:

[1]Drainage area and mean elevation from USGS 1:24K topo maps

[2]Mean annual precip (PRISM 2002) and PET from Rantz (1964)

[3]Return period flows determined using regional regression equations (Waananen and Crippen, 1977). These are also in Caltrans Highway Design Manual (May 2001), Chap. 810, p. 810-19.

CDFG Matrix Site Ranking

Active Channel Width	39 ft	**Residual Inlet Depth**	-15.1 ft
Maximum slope	4.7%	**Residual Outlet Depth**	-2.0 ft
Baffles/Weirs (Yes or No)	No	**Substrate Throughout (YorN)**	No

Filter Result RED **Reason for filter result:** Slope > 3%

Filter result adjusted? **No** **Describe adjustment:** No adjustments were made.

Fish Passage Analysis

	Q_{LP} (cfs)	Q_{HP} (cfs)	Leap Barrier Range (cfs)	Depth Barrier Range (cfs)	Velocity Barrier Range (cfs)	Range of passable flows	% of passable flows
Adult Anadromous	3.0	84.0	**Fish Passage Analysis unnecessary, Red-ranked site does not meet fish passage criteria.**				0%
Adult Resident	2.0	35.8					0%
Juvenile salmonids	1.0	21.7					0%

Summaries

Culvert Condition

The culvert, wingwalls, and weir are all in good condition.

Fish Evidence

CDFG surveys confirm the presence of steelhead and coastal cutthroat trout. No evidence was found that Luffenholtz Creek had or has coho. They are most likely excluded by natural barriers. No fish were observed at the time of survey (25-July-02).

Stream Condition

Luffenholtz Creek is a large perennial stream that outlets directly to the ocean. Stream channel contains lots of wood and good habitat.

Barrier Status

There are two county culverts. The culvert on Scenic Drive is 500 ft downstream of the HUM101 culvert and is a complete barrier to fish due to a perched outlet. There are also very steep natural chutes and falls just downstream of the Scenic Dr where Luffenholtz Ck drops ~25 ft in 200 ft to the beach. The second county culvert is 1200 ft upstream of the HUM101 culvert. This culvert is a barrier to resident fish.

Habitat Information

Approximately 37,000 feet of habitat exists upstream of the HUM101 crossing (Taylor, 2000).

Recommendations

The Luffenholtz Creek crossing is a complete barrier due to the 4.7% slope. There is also a perch at the downstream weir that is a barrier to resident and juvenile fish. Decreasing the perch below the weir and modifying the culvert barrel with baffles or weirs would great improve passage. However, remediation of the Luffenholtz Creek crossing may not benefit adult anadromous salmonids as natural and man-made barriers exist downstream. Luffenholtz Creek does support a healthy resident salmonid population.

Site Photos

Downstream channel

Culvert outlet

Culvert Inlet

Upstream channel

Site Photos

Downstream debris

Outlet weir