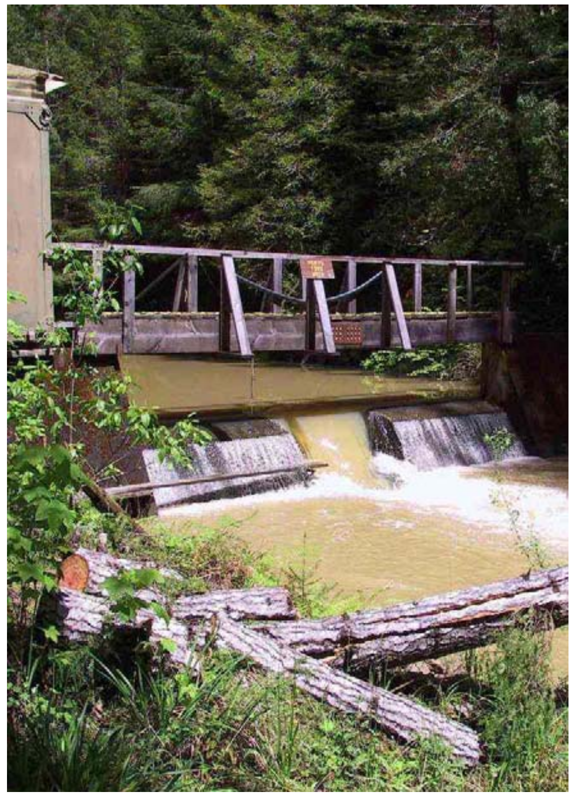
Five Counties Salmonid Conservation Program
Coastal Conservancy Grant Agreement No. 03-051

FINAL REPORT

Christine Jordan
Assistant Program Manager
Five Counties Salmonid Conservation Program

Trinity County Planning Department
Natural Resources Division
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Acknowledgements:

This project represents thousands of hours of effort and dedication by people throughout Northern California, many of whom cannot be individually recognized for their assistance and support. Janet Clements began this project for the Five Counties Program (5C) and in 2004 left to pursue other goals. Christine Jordan began managing the 5C Migration Barrier Removal program in 2005 and made a smooth transition into managing the many projects under this grant

The counties' engineering staffs undertook projects and provided valuable insight. Thank you: Howard Dashiell and Alex Straessle - Mendocino County; Chris Whitworth - Humboldt County; Art Reeve, Juris Mergups and Bill Lewis - Del Norte County; and, Carl Bonomini, Andrew Pence, Randy Cessna, Steve Roberts and Steve Judson - Trinity County

Many organizations and individuals have quietly or publicly shown support of the projects, including: Tom Weseloh - Cal Trout, Zack Larson - Smith River Advisory Council; John Schwabe - Fish and Game; and others

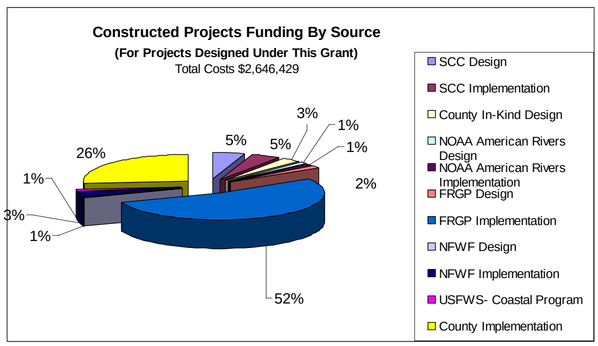
The project would not have been successful without the advice, direction and help of Michael Bowen of the Coastal Conservancy staff. Most importantly, we thank the Five Counties Policy Board and the Trinity County staff that have supported the 5C Program since its inception

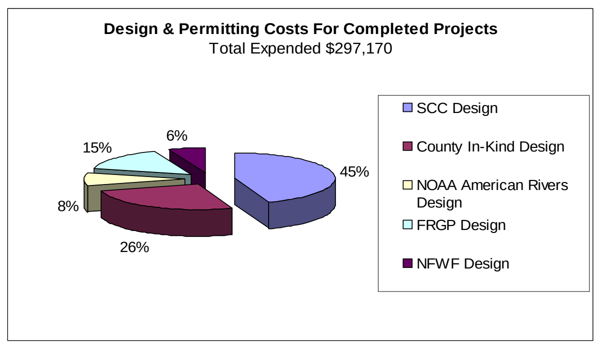
Respectfully,

Mark Lancaster, Director
Five Counties Salmonid Conservation Program

5C dedicates the completion of this project to the memory of Tim McKay

Project Summary
This grant contributed to the design, permitting and cost estimates for improving 26 migration barriers on private, county, State and federal lands within Mendocino, Humboldt, Del Norte and Trinity counties. Of these 26 projects, eight were constructed between 2005 and 2007; four are to be completed in 2007; and, three are planned for construction in 2008. The remaining eleven projects are undergoing design revisions or not scheduled for a specific construction year at this time. The projects, at completion, will restore access to 49 miles of spawning and rearing habitat for salmonids, will prevent 42,932 cubic yards of sediment delivery from failed culvert crossings and will reduce transportation maintenance activities, and associated costs, during high storm flows. Funds from this grant contributed to leveraging an additional $2.5 million in engineering, permitting and construction of the eight projects that were constructed between 2005 and 2007 (refer to graphs below). The remaining Conservancy funding has leveraged $164,713 in engineering and permitting, funded by the Counties, State and Federal agencies.





Introduction
For decades, culverts on established county roads and state highways have disrupted the spawning and rearing behavior of all four species of anadromous salmonids in California: Chinook and coho salmon, coastal rainbow trout, and coastal cutthroat trout. The problem was recognized more than 70 years ago, when the Forest Service and the California Division of Highways (Caltrans) were constructing roads in the Klamath River watershed:

> *"In a number of instances both State and Forest Service crews have in the process of road construction cut off spawning tributaries…. They have done this especially by directing streams through culverts whose low ends terminate in vertical drops of fifteen to thirty feet, barring the way to spawning steelhead and salmon… It cannot be too strongly emphasized that when possible, small bridges rather than culverts, should be installed in spawning streams, even through the cost of construction be greater. It is certainly "robbing Peter to pay Paul" to put in low-cost, impassible culverts on the one hand and to expend money for stream improvement on the other."*
>
> -A.G. Taft & Leo Shapovalov (Dept. of Commerce, Bureau of Fisheries) February, 1935

In the rush to reopen road systems in Northwestern California following the 1955 and 1964 floods, many stream crossings were reinstalled with little to no consideration for fluvial or biological processes. Culverts were installed high in the road prism and set at steep grades, resulting in 2-3 foot, if not more, jumps at their outlets. By the time salmonid populations were listed under the State or federal Endangered Species Act, many of these culvert crossings were impassable due to the outlet jumps, velocities within the culverts exceeding swim speeds of juveniles and adult salmonids, or other problems.

This grant contributed immensely to the ongoing restoration efforts in Northwestern California by addressing a combination of aged infrastructure and passage design criteria for migrating juvenile and adult salmonids.

Within Del Norte, Humboldt, Mendocino, Siskiyou and Trinity Counties there are 245 inventoried migration barriers on County roads. There are approximately 967 recorded barriers on public and private roads within this area (California Passage Assessment Database, 2007), 810 of which are road-crossings. The barriers, mostly culverts, are either undersized, set at too steep a grade, or retrofitted with failing or ineffective baffle structures. These conditions have prevented adult and juvenile fish passage due to excessive jump heights between culvert outlets and plunge pools below, impassably high-flow velocities within the culverts during migration flows and/or too shallow of flows in low flow conditions.

This grant was unique in that it provided for projects to be completely designed in advance of securing construction funding, allowing the Counties and other entities to responsibly apply for implementation funds. It has also resulted in “shelf ready” projects that can wait to be constructed based upon prioritization, and under more favorable market conditions (such as lower materials and fuel costs). Despite the available grant sources for implementation of barrier removal projects, sufficient funding to complete engineering and permitting has been limited. The original grant, awarded in 2003, aimed to complete the design and permitting of sixteen high-priority projects located on County roads and other Federal/State properties. An amendment to the grant agreement in 2005 allowed for the design of an additional nine projects, located on County, State and private roads. The completion of the design and permitting phases for these twenty-six projects (Table 1) has facilitated implementation, continuing the recovery of anadromous fish and other aquatic species habitats found in coastal and inland watersheds. Projects funded under this grant were limited to anadromous fish-bearing streams within Del Norte, Humboldt, Mendocino, and Trinity counties. An additional benefit of these projects includes the replacement of degraded culverts that are nearing the end of their functionality. Doing so improves local infrastructure and reduces future maintenance costs, particularly those associated with storm events and emergency repair needs.

Project	Implementing Entities	Status
Griffin Creek Fish Passage Improvement Project	Del Norte County CDD	Design Completed Construction in 2008 or 2009
Yonkers Creek Migration Barrier Removal Project	Del Norte County CDD City of Crescent City	Design Completed Constructed in 2006
Graham Gulch Migration Barrier Removal Project	Humboldt County DPW	Design Completed Constructed in 2005
Indian Creek Migration Barrier Removal Project	Humboldt County DPW	Design Completed Construction in 2007
Painter Creek Migration Barrier Removal Project	Humboldt County DPW	Design Partially Completed No Construction Date Planned
Rocky Gulch Migration Barrier Removal Project	Humboldt County DPW	Design Completed Construction in 2007
Albion River & Marsh Creek Migration Barrier Removal Projects	Mendocino County DOT	Design Completed Constructed in 2006
Ancestor Creek Migration Barrier Removal Project	Mendocino County DOT	Design Completed Construction in 2009
Dark Gulch Migration Barrier Removal Project	Mendocino County DOT	Design Partially Completed No Construction Date Planned
Ryan Creek Migration Barrier Removal Project	Mendocino County DOT	Design Completed Construction in 2007 or 2008
Conner Creek #1 & #2 Fish Passage Improvement Projects	Five Counties Salmonid Conservation Program	Design Completed Construction Planned for 2008
Deadwood Creek Fish Passage Improvement Project	Trinity County DOT Five Counties Salmonid Conservation Program	Design Completed Constructed in 2005
Little Browns Creek Migration Barrier Removal Project	Trinity County DOT	Design Completed Construction in 2007
Soldier Creek #1 & #2 Migration Barrier Removal Projects	Trinity County DOT	Design Completed Constructed in 2005
North & South Fork Caspar Creek Fish Passage Improvement Projects	California Department of Forestry United States Forest Service	Design Completed Construction in 2007 & 2008
North & South Fork Ryan Creek Fish Passage Improvement Projects South Fork Ryan Creek – Hamman Driveway Crossing	Caltrans – NF Five Counties Salmonid Conservation Program – Others	NF – Design Completed No Construction Date Planned SF & Hamman Driveway– Designs Complete Construction in 2008 & 2009
North Fork Schooner Gulch Migration Barrier Removal Project	Mendocino County RCD	Design Completed No Construction Date
Salmon Creek Tidegates Fish Passage & Habitat Improvement Project	Pacific Coast Fish, Wildlife & Wetlands Restoration Association	Design Completed Constructed in 2007
Yontocket Slough Fish Passage & Habitat Enhancement Project	California State Parks California Department of Fish & Game	Partial Design Completed No Construction Date Planned
Fish Creek Migration Barrier Removal Project	Caltrans California State Parks	Partially Designed Project Dropped

Table 1 - Projects included in for design under Grant Agreement 03051 with the State Coastal Conservancy

The Five Counties Salmonid Conservation Program (5C) administered this grant through Trinity County. The 5C is a large-scale watershed and salmonid conservation effort formed by the Boards of Supervisors of Del Norte, Humboldt, Mendocino, Siskiyou and Trinity counties in response to the 1997 listing of the coho salmon as a Threatened species under the Federal Endangered Species Act. Since the program's inception, 5C has been committed to the development and implementation of land use conservation standards and practices that reduce erosion, improve water quality and quantity, and restore anadromous salmonid habitat within the Southern Oregon-Northern California Coast Evolutionarily Significant Unit for coho salmon (SONCC ESU). Defining the Program area boundaries, the SONCC ESU for coho is not the only ESU in which 5C activities have had a beneficial impact. 5C-related barrier and sediment reduction work also affects the the CCC (Central California Coast) coho ESU, the California Coastal chinook ESU, the Northern California steelhead ESU. The Migration Barrier Inventory and Removal Program comprises just one element of the 5C and to date, 48 projects have been completed under this program, restoring access to 119 miles of anadromous salmonid habitat. Refer to the Five Counties website (www.5counties.org) for more information on the program and its work products.

Benefits of the 5C's migration barrier removal program include not only improved access to historic salmonid habitat, but also reduced maintenance and emergency repair costs for County transportaion departments. The Counties realize a substantial financial benefit in reduced maintenance costs with the new crossing structures, as well as an overall social benefit. The projected, maintenance-free lifespan of new structures that can pass fish, 100-year flows and associated bedload and debris is longer than that of traditional culvert repairs or replacements that tend to plug annually during high flows, cause flodding of nearby properties, or simply wash out. Another benefit of replacing undersized culverts with properly sized sructures is the reduction of potential sediment delivery in the event of culvert failure. With the 48 projects that have been constructed under the 5C Program, approximately 67,305 cubic yards of sediment were removed from road crossings that had a high likelihood of failure, and had in past high flow years, failed. The initial design and implementation costs for full stream simulation and hydraulic design option crossings are high, but over time, are offset by the reduced annual repair and maintenance costs, and flood event replacement costs, of failed crossings.

One of the key benefits of this type of grant and having projects properly designed and permitted prior to implementation, is the ablity to accurately predict what the cost of implementation will be for a given project. A construction estimate is included in each final design for the projects not yet completed which will be utilized to apply for implementation funds. Historically, the lack of funding for engineering and permitting resulted in the Counties, and other entities, applying for construction funding prior to completing all portions of design. In some instances, the actual costs of constructing a project far exceeded the amount applied for and received under construction grants. Cost overruns and changes in economics between the time that a grant is written and a project is constructed have been well documented for 5C projects. This grant agreement leveraged County engineering department funds and state/federal dollars as well as facilitated cooperation among federal, state and local agenices for completing design and permitting of high priority fish passage projects.

Migration Barrier Inventories within the 5C Program Area

The projects selected by 5C staff for inclusion in this grant agreement were based on the following inventories and their project prioritizations. Other factors, including discussions with California Department of Fish and Game (CDFG) , NOAA's National Marine Fisheries Service (NMFS), and Conservancy staff, as well as biological considerations of anadromous salmonids, were taken into account during project selection.

County Road Barrier Inventory

The 5C Migration Barrier Inventory was completed from 1998 through 2004 and resulted in the identification of 245 barriers on county maintained stream crossings within anadromous reaches. These inventories were conducted by Ross Taylor & Associates with funding from the CDFG. County-maintained stream crossings (typically culverts) within present and historic anadromous reaches were analyzed with FishXing software to determine fish passage capability. Culvert statistics were also recorded (diameter, length, slope, etc.) and the barrier status (complete, partial, temporal) was described for adults and juveniles. As barriers were identified, they were ranked in an order from high to low priority for treatment. Each barrier was assigned a score based on anadromous species diversity at the crossing (both historic and present); the extent of the barrier, or percent passable; habitat quality and quantity upstream of the barrier; and, the current condition of the crossing (i.e. the risk of culvert failure as related to sizing and flow capacity). On a site-specific basis, varying factors influenced the ranking; including fish observations at crossings, roadfill that may potentially deliver to a stream should the culvert fail, presence of other barriers upstream and/or downstream, perceived project cost, schedule of other road maintenance and repair projects, and local agency biologist recommendations. The County projects selected under this grant agreement were based on the 5C Program-wide prioritization ranking matrix.

CalTrans District 1 Barrier Inventory

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. The study identified 411 potential stream crossings for fish passage improvement. As of December 1, 2004, 312 of those sites had been analyzed to identify the potential impediments to fish passage. Impediments to juvenile and adult passage during migration flows included high-water velocities and low-water depths through crossings and excessive outlet jumps. FishXing analysis of the 312 sites showed that 60% did not meet the current fish passage guidelines for existing culverts. The data from this analysis is located within the *Caltrans District 1 Pilot Fish Passage Assessment Study: Volume 1* (Margaret Lang et al, 2005) and was utilized in the selection of an additional nine projects in 2005. Among the projects selected for design under this grant were the first and second highest ranked priority sites in District 1, Fish Creek and North Fork Ryan Creek. The barrier improvement for South Fork Ryan Creek, and a private crossing upstream, were also desgined under this grant agreement due to the proximity of the project sites and the cost effectiveness of treating those sites at the same time.

Inventory Of Barriers To Fish Passage In California's Coastal Watersheds
This inventory report was completed by the California Coastal Conservancy in 2004. This report was also utilized to determine priority projects. Projects specifically identified in this inventory that were not located on county roads or State Highways included Caspar Creek and North Fork Schooner Gulch. These were considered high priority projects due to the habiat that they could provide for the Central California Coast (CCC) coho and the Northern California steelhead Evolutionary Significant Units. These ESUs are listed as endangered and threatened, respectively. The existing fish ladders on Caspar Creek, located in the Jackson Demonstration State Forest in Mendocino County, are barriers to all age classes of coho and steelhead. The proposed project will replace the deteriorating wooden ladders on both North and South Fork Caspar Creek with new structures that provide for improved passage. The Schooner Gulch project was described in this inventory as a high priority crossing for sediment reduction as well as fish passage improvement. It is also referenced in the 2001 *CDFG Stream Inventory Report*. The crossing, located on a private road between the Gualala and Garcia River watersheds in Mendocino County, is a complete barrier to adults and juveniles due to the length of the culvert, the flow velocities during migration flows, and the perched outlet.

The Salmon Creek Tidegates and Yontocket Slough Projects were not selected from specific inventories, but were recommended by resource agency staff as high priorities for coho salmon rearing habitat, as well as improved fish passage. The Salmon Creek Tidegates and Fish Passage Imrpovement Project is located within the Humboldt Bay National Wildlife Refuge. The tidegates at the mouth of the Salmon Creek Estuary had partially blocked fish access, caused poor tidal circulation and water quality conditions, and led to sedimentation of important estuarine habitat. New tidegates would eliminate the potential for adult and juvenile stranding and assist in restoring degraded rearing habitat to a usable condition. The project was a priority action item for the Salmon Creek Unit of the Humboldt Bay National Wildlife Refuge, the *Recovery Strategy for California Coho Salmon* and the Humboldt Bay Watershed Advisory Committee. Research has also demonstrated the importance of tidal estuaries and low gradient freshwater wetlands in the life history of anadromous salmonids. The Yontocket Slough Fish Passage and Habitat Enhancement project is located in Del Norte County, near the Smith River. It was identified in *The Yontocket Slough and Tryon Creek Assessment for Improvement of Anadromy*, *The Smith River Anadromous Fish Action Plan*, and the *Recovery Strategy for California Coho Salmon* as a limiting factor for anadromous salmonids due to poor access and habitat conditions. The project will restore over 100 acres of salmonid habitat by removing the non-native, invasive reed canary grass within the slough and improving passage conditions.

Detailed work plan descriptions for all projects funded under this grant agreement are included below in Task 4 – Migration Barrier Removal Project Planning.

Grant Agreement Objectives and Work ProgramTasks

The objectives of this grant included:

- Design, obtain permits, and prepare for the implementation of twenty-six fish passage improvement projects in anadromous streams within the counties of Del Norte, Humboldt, Mendocino and Trinity in which the initial design and placement of instream structures have created complete and partial fish passage barriers;
- Facilitate local and state governments and agencies, as well as private firms, with the development of designs and preparation for implementation of high priority fish passage improvement projects;
- Seek funding for implementation of the projects.

To achieve these objectives, the following tasks were developed and implemented:

Task 1 – Grant Administration
Conduct grant administration, conduct site assessments, coordinate meetings, prepare requests for proposals and develop contracts (subject to Coastal Conservancy review) for design components, manage invoicing, prepare progress and final reports, and transfer funds to contractors and the county departments.

Task 2 – Technical Advisory Team
Establish technical advisory teams with representatives from the resource agencies, and other qualified personnel, as needed, for various projects.

Task 3 – Fish Passage Design and Engineering Workshop
Provide a workshop for biologists and engineers on the most fish passage design and engineering, including innovative designs. A training video will also be produced from this workshop.

Task 4 – Migration Barrier Removal Project Planning
Complete engineering design, environmental documentation, geotechnical analysis hydraulic analysis, and other activities necessary for the development of twenty-six fish passage improvement projects (Table 1). A general map of the project locations is included as Attachment 2.

Task 1 – Grant Administration

The following work was performed under this task, with more detail included in Progress Reports 1-11 (January 20, 2004 through April 25, 2007). 5C staff prepared and reviewed responses to requests for proposals for design of the Caspar Creek, North and South Fork Ryan Creek, Fish Creek, and Conner Creek projects. Design contracts were prepared and approved (with Coastal Conservancy preapproval) by the Trinity County Board of Supervisors with six consulting firms for the above mentioned projects as well as Yontocket Slough and Salmon Creek Tidegates projects and the fish passage design workshop. Memorandums of Understanding with Humboldt, Mendocino, and Del Norte Counties were developed and approved as was an MOU with the Mendocino County Resource Conservation District for various county projects and the North Fork Schooner Gulch project. The aforementioned agreements were required for assuring completion of the work stipulated under each project and the transfer of funds to each entity.

IMPLEMENTING ENTITY	PROJECT
Del Norte County Community Development Department	Yonkers Creek Migration Barrier Removal Project and Griffin Creek Fish Passage Improvement Project
Humboldt County Department of Public Works	Painter Creek, Graham Gulch, Indian Creek, and Rocky Gulch Migration Barrier Removal Projects
Mendocino County Department of Transportation	Ancestor Creek, Ryan Creek, Dark Gulch, Marsh Creek and Albion River Migration Barrier Removal Projects
Mendocino County Resource Conservation District	North Fork Schooner Gulch Migration Barrier Removal Project
Pacific Coast Fish, Wildlife and Wetlands Restoration Association	Salmon Creek Tidegates Project
Winzler & Kelly Consulting Engineers	Caspar Creek Fish Passage Improvement Project
Michael Love & Associates	Yontocket Slough Fish Passage & Habitat Enhancement Project and Fish Passage Design & Engineering Workshop
Thomas B. Dunklin	Fish Passage Design & Engineering Workshop videography/training video
SHN Consulting Engineers & Geologists	Conner Creek Migration Barrier Removal Project
Gray Sky Engineering	Griffin Creek Fish Passage Improvement Project
Prunuske Chatham, Inc.	North and South Fork Ryan Creek and James L. Hamman Driveway Crossing

Table 2 - MOUs and contracts developed between Trinity County and various Counties and private consulting firms for design of projects

Task 2 – Technical Advisory Team

The Technical Advisory Team (TAT) component was established in order to evaluate the design of projects, track and assist with permitting, and coordinate agency criteria for design. Specific TAT's were developed for the Deadwood and Soldier Creek projects, the Caspar Creek project, the Conner Creek project, and the NF/SF Ryan Creek projects. More detail on each TAT is included in Progress Reports 1,3,5,6, and 7. TAT members participated in site visits and conference calls to establish design criteria for projects. They also reviewed and ranked responses to requests for proposals from consultants and provided 5C staff with engineering, biological and hydrological information. TAT's were composed of engineers, biologists, hydrologists and other personnel from the United States Forest Service (USFS), CDFG, NMFS, California Department of Forestry (CDF), and Caltrans. Similar agency personnel also assisted the individual County engineering departments with design and permitting of their projects, as jurisdictions allowed.

Task 3 – Fish Passage Design and Engineering Workshop

This task was developed to provide for a regional workshop on fish passage engineering to train biologists and engineers on the most up-to-date fish passage issues and innovative designs. The workshop included a mix of county, state and federal agency engineers, biologists, hydrologists, and private consulting firm personnel (refer to Progress Report #7 and the submitted Final Report CD for more detail on the workshop and its participants). The classroom portion of the workshop was at the Ukiah Valley Conference Center on March 7 and 8, 2006 with a field tour of completed and designed barrier sites on March 9. The classroom portion of the workshop included lectures by: Ken Bates (consulting professional engineer), George Heise (hydraulic engineer, CDFG), Michael Love (consulting hydraulic engineer) and Ross Taylor (consulting fisheries biologist). Guest speakers included Howard Dashiell (Mendocino County Director of Transportation and engineer), Chris Whitworth (Humboldt County Public Works Deputy Director and engineer) and Jon Mann (consulting professional engineer). Primary topics included: 1) design guidelines for state and federal agencies; 2) stream simulation techniques; 3) culvert retrofits; 4) project monitoring; and, 5) case studies. Group exercises on both days allowed participants to work cooperatively in assessing sample barrier sites and to propose solutions using information that they had learned. One critique of the workshop was the request for more calculations and in-depth review of the engineering required for project design. Because of this request, the next workshop (to be held by FishNet 4C in March 2007) would include a session on engineering calculations.

Due to the overwhelming response of interested participants during the 5C workshop registration period, and the expressed need for this type of training, Thomas Dunklin was contracted to record the workshop proceedings and produce a training video. The footage from the March 2006 workshop, and the Engineering Practicum in March 2007, were produced into a 4-disk training DVD that will be distributed to: University engineering departments; 5C, Fishnet 4C, and Tri-County FISH Team engineering staff; State and Federal agency personnel; and, watershed groups. The lectures are also available to the general public through a link on the FishXing website (www.fishxing.org). The CDFG Adaptive Management Program and the NOAA Restoration Center funded recording and production of the March 2006 workshop DVDs. The March 2007 filming and production of the engineering practicum DVD was funded under this grant agreement. The training DVD is included as a deliverable with this report.

Task 4 – Migration Barrier Removal Project Planning

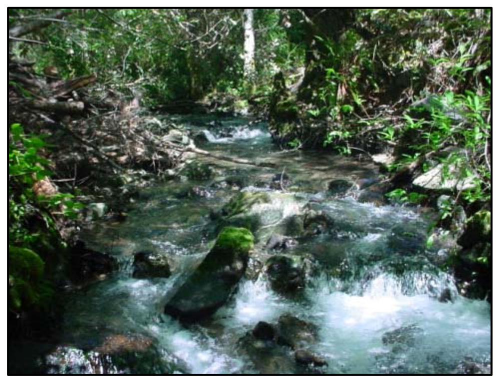
This task represents the majority of the work completed under this grant agreement and was developed to track completion of the engineering design, environmental documentation and necessary permitting, geotechnical analysis, hydraulic analysis, and other activities necessary to fully design the following fish passage improvement projects. The following constitutes the work plans and completed tasks for each project and final reports for construction and/or design are included where applicable.

COUNTY ROAD PROJECTS

Del Norte

Griffin Creek Fish Passage Improvement Project

This project is located within the Smith River watershed, approximately 35 miles northeast of Crescent City in Del Norte County on Oregon Mountain Road (County Road #324). Griffin Creek currently hosts populations of resident Coastal cutthroat trout in the upstream reaches and is an important spawning and rearing tributary for coho and steelhead with approximately 3.7 miles of high quality habitat. It is the second highest priority in Del Norte County (assessed during the second round of County Road migration barrier inventory in coastal watersheds - Ross Taylor & Associates, 2003-2004). The existing 36" diameter, 120-foot long culvert was not assessed with FishXing software due to safety issues, but was identified as a complete barrier to all age classes during all migration flows because of the buried inlet and perched, degraded outlet.



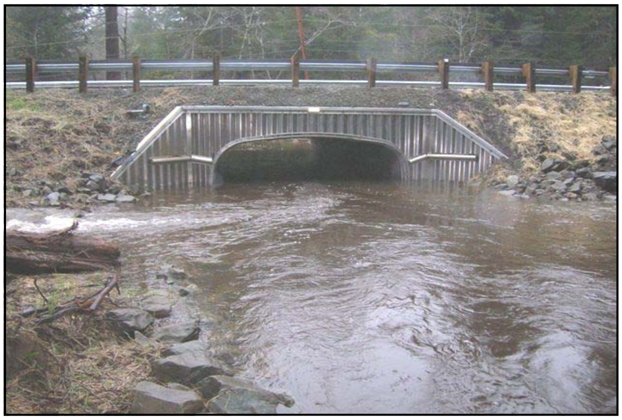
Griffin Creek #2

Outlet of 36" Culvert Upstream Habitat

Oregon Mountain Road—Del Norte County

The new culvert design meets with NOAA Fisheries Guidelines for Salmonid Passage at Stream Crossings for the 100-year flow (calculated at 224 cfs) and is a 7-foot diameter, 130 feet long steel culvert. It will be bored through the existing roadfill and 36" culvert at a 1-2% slope and embedded utilizing the "Active Channel Design" option. This is a simplified design option that sizes a crossing sufficiently large and embedded deep enough into the channel to allow for the natural movement of bedload and formation of a stable streambed inside the culvert. A properly sized, embedded culvert was deemed the most appropriate design for this site's specific characteristics in order to reduce future sediment accumulation at the inlet, reduce the risk of catastrophic roadfill failure, and provide fish passage to upstream habitat. Tasks funded under this grant agreement included the surveying, hydraulic analysis, and civil/structural engineering. The topographical and thalweg survey of the crossing was conducted by 5C staff member Carolyn Rourke and Ron Borth of the Del Norte County Road Department (in–kind). Juris Mergups of the Del Norte County Community Development Department completed the hydraulic analysis, including modeling of 100-year flows, and portions of the civil engineering. This project incorporates a fairly new construction technique of boring through the fill as excavation of the existing 6,500 cubic yard fill would be cost prohibitive. Gray Sky Engineering was contracted to complete design for the boring platform required to implement this project. This project has construction funding under the 2006/2007 DFG Fisheries Restoration Grant Program (FRGP) and the CEQA and permitting will be conducted and funded by CDFG. This project will allow passage through the crossing and prevent the catastrophic delivery of approximately 6,500 cubic yards of sediment to the downstream reaches of Griffin Creek. Construction is planned for 2008 and 50% design plans for the new crossing were included with Progress Report #11. The plans are also included on the submitted Final Report CD.

Yonkers Creek Migration Barrier Removal Project
This project is located on Wonderstump Road in Del Norte County and crosses a small coastal tributary to Lake Earl, just north of Crescent City. This project was designed in 2004 and constructed in 2006 within the timeframe of this grant. It now provides unimpeded access for coho, steelhead and Coastal cutthroat trout to 1.7 miles of upstream spawning and rearing habitat. FishXing analysis determined the 6-foot diameter, 61-foot long culvert (with perched outlet and steep slope) as a complete barrier to adult Coastal cutthroat and all juvenile species due to the excessive velocities within the culvert and outlet barrier. It was replaced with a 15-foot wide by 8-foot high natural bottom aluminum arch structure, designed under the “stream simulation” design method (sizing the structure at 1.45 times the active channel width). This crossing was the last high priority barrier identified in the first run of the Del Norte County barrier inventory (Taylor & Associates, 2000).



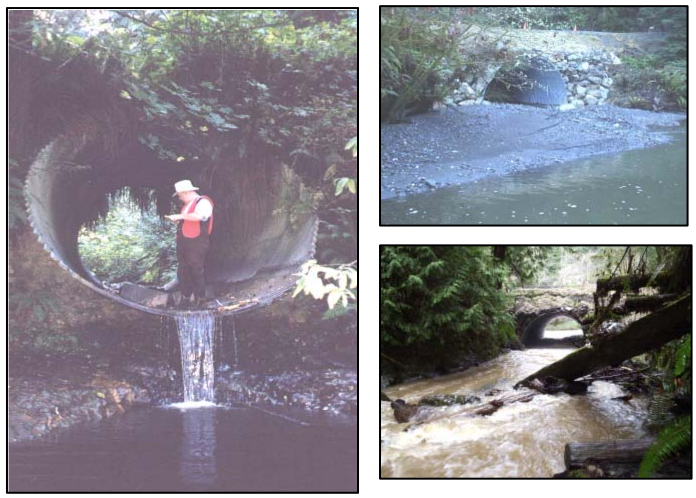
Yonkers Creek
Wonderstump Road—Del Norte County

Due to the higher costs of relocating a 12-inch and 24-inch waterline beneath the road if a bridge had been constructed, the design option of an arched culvert was selected. The waterlines were re-installed in the culvert roadfill after project construction. This project was partially funded for construction under the 2004/2005 CDFG FRGP and was included in the 2005 CDFG Mitigated Negative Declaration. All other permits (1602, 404, 401 and a Del Norte County grading permit) were secured prior to implementation. The design elements funded under this grant agreement included the geo-technical investigation, hydraulic analysis for the 100-year flow (317 cfs), development of a suitable channel shape and substrate/rock sizing to provide adequate fish passage conditions (roughened channel and portions of the structural engineering. A final report on project construction is included on the submitted Final Report CD.

Humboldt

Graham Gulch Migration Barrier Removal Project

Graham Gulch is a tributary to Freshwater Creek in Humboldt County. The project was constructed in 2005 and provides unimpeded access to 2.5 miles of habitat for coho, steelhead and Coastal cutthroat trout. The 13.25-foot diameter, 60.5-foot long metal culvert was replaced with a 18-foot wide, 9-foot high corrugated metal arch culvert set on concrete footings, allowing for complete passage of all species and life stages and the 100-year flows. The perched outlet, with ineffective steel-ramp baffles, was the primary migration barrier for adults and juveniles. Observations were made on numerous occasions, prior to replacement, of both age classes making failed attempts at the culvert outlet. This project received funding from 2003/2004 CDFG FRGP and was included in the 2004 Mitigated Negative Declaration. This grant agreement funded the site surveying, hydraulic analysis, and portions of the civil engineering. A final report on project construction is included on the submitted Final Report CD.



Graham Gulch
Before & After
Palco Camp Road, Humboldt County
Tributary to Freshwater Creek

Indian Creek Migration Barrier Removal Project

Indian Creek is a tributary to the Mattole River in southern Humboldt County with approximately 1.2 miles of high quality coho and steelhead spawning and rearing habitat located upstream. It is a high priority stream due to its cool-water refugia, boulder/cobble-dominant channel, dense riparian zone of conifers, and good flows in late summer for over-summering juveniles. The existing crossing is a 10-foot wide, 48-foot long concrete box culvert in a shallow fill, perched 2-3 feet at its outlet. Shallow flow through the culvert at low flows, excessive velocities at migration flows, and the outlet jump all contribute to barrier status. The project has construction funding from the 2003/2004 CDFG FRGP and the National Association of Counties (NACO) National Fish and Wildlife Foundation (NFWF) grant program. It was included in the 2004 CDFG FRGP Mitigated Negative Declaration and all other construction permits have been secured by Humboldt County. This grant agreement funded the geotechnical analysis, site surveying, hydraulic analysis and a portion of the structural design. The proposed design was to replace the existing culvert with a 55-foot long concrete bridge. The project was ready for construction in 2006 but no bids were received. The project has since been redesigned and is planned for construction in 2007, pending receipt of bids within the construction budget. Humboldt County engineering and Morrison Structures have designed a pile-less bridge structure with shallower abutments using a box girder design instead of a concrete slab. Design plans are included in Attachment 3 and on the submitted Final Report CD.

Indian Creek
Tributary to
Mattole River

Humboldt County

Mattole Road

Painter Creek Migration Barrier Removal Project
The Shelter Cover Road crossing of Painter Creek has approximately one mile of habitat upstream for coho, Chinook and steelhead. This project is also in the Mattole River watershed and would replace the existing 8-foot, 53-foot long concrete box culvert which is perched 3-5 feet at the outlet with a bottomless metal arch culvert set on concrete grade beams. The upstream habitat is considered good with cool-water flows during the summer. Coho and steelhead juveniles have been observed in the outlet pool on numerous occasions. The Painter Creek crossing is similar to several other County culverts in the Whitethorne area, which were built on siltstone bedrock. The result is that the culverts have become perched at their outlets and bedload has built up at the inlets, covering the base flow pools that harbor young of the year. This grant agreement funded the hydraulic analysis, surveying and a portion of the civil and structural engineering. This project is partially designed and had funding from the 2003/2004 CDFG FRGP and was included in the 2004 CDFG FRGP Mitigated Negative Declaration. Final design could not be completed in the timeframe of this grant agreement and additional funding for completing design and engineering will be sought under other federal and state grant sources, or funded by Humboldt County.

Rocky Gulch Migration Barrier Removal Project

Rocky Gulch
Outlet at High Flows
Humboldt County

Rocky Gulch is a 1.5 square mile watershed that drains into North Humboldt Bay, approximately six miles north of Eureka. It historically supported coho salmon and steelhead populations, but past timber and agricultural land-uses caused extirpation of these populations by the early 1960's. The County maintained crossing (part of the "*Rocky Gulch Salmonid Access and Habitat Restoration Project*") is located on Old Arcata Road approximately 5,000 feet upstream of the confluence with the Bay. The crossing consists of two 36-inch diameter, 48-foot long culverts. They are undersized, with a capacity for less than a 2-year storm event and the high –flows through the culverts during migration flows result in a velocity barrier for all age classes and species. The current design options are to replace the culverts with either a countersunk metal box or pipe-arch culvert with a low, broad cross-section that allows for native bedload accumulation. Either design will create a natural stream bottom within the new structure, allowing for full passage of all life stages. There is approximately 2.7 miles of habitat upstream of the county crossing with several private barrier crossings that are also being addressed. Project construction is scheduled for 2007. Design elements funded under this grant agreement included the site surveying, hydraulic analysis, digital terrain modeling, conceptual designs for the crossing, a site restoration plan, and a portion of the structural engineering. This project has construction funding from the 2004/2005 CDFG FRGP and was included in the 2005 CDFG FRGP Mitigated Negative Declaration. A Final Report on the "*Rocky Gulch Salmonid Access and Habitat Restoration Project*" was completed (includes the County culvert) and was submitted with Progress Report #9. The report is also included on the submitted Final Report CD.

Mendocino

Ancestor Creek Migration Barrier Removal Project

This project is located on Briceland Road in the Mattole River watershed. It will provide unimpeded access to two miles of good quality upstream anadromous spawning and rearing habitat for coho salmon and steelhead by replacing the existing culvert with a properly sized, embedded culvert. The crossing is located approximately 500 feet upstream of the confluence with the Mattole and for the range of migration flows, FishXing predicted it to be a complete barrier for adults and juveniles of all species and age classes. The existing 7-foot diameter, 40-foot long culvert set at a 3.8% grade will be replaced with a 16-foot wide, 40-foot long multi-plate pipe-arch structure. This culvert will be embedded, utilizing the "Active Channel" design method. The upstream habitat consists of a dense riparian zone of conifers and hardwoods, numerous pools, ample areas of spawning-sized gravels, and cool-water temperatures during the late summer flows. Access to this type of habitat, especially for over-summering juveniles, is critical for juvenile survival. Numerous juveniles have been observed in outlet pool and Ancestor Creek is a known coho-bearing tributary in the upper Mattole. The geotechnical analysis for this project was completed with funding from an existing 5C Program grant and this grant agreement funded the following design elements: hydraulic analysis, right of way negotiations, and structural design. The project received 85% funding for construction from the California Regional Water Quality Control Board in 2002 (Proposition 13 funds) but the Mendocino DOT was unable to construct the project due in part to landowner issues with a proposed road closure and lack of grade control in the first conceptual design (concrete arch). The project has been re-designed and includes a construction period detour plan. This is the highest priority project in the 5C Program area and a NFWF Keystone grant for 2008 construction was submitted in April 2007 (not funded) and a re-application to the CDFG FRGP for 2008 construction has been submitted.

Albion River & Marsh Creek Migration Barrier Removal Projects

These projects are located on Flynn Creek Road within the Albion River Watershed. The existing circular culverts on the Albion River and Marsh Creek were complete barriers to all age classes of coho salmon and steelhead. Barrier status was

Albion River	Marsh Creek

Both constructed in 2006

Flynn Creek Road—Mendocino County

primarily due to the excessive velocities over the concrete culvert linings, the lack of depth at lower migration flows, and the leap required to enter the culverts. The culverts were replaced in 2006 with open-bottom, pre-manufactured concrete arch structures, providing for full passage of all species and life stages and the 100-year flows. This project has allowed access to approximately five miles of historic spawning and rearing habitat upstream of the crossings, approximately one mile on Marsh Creek and four miles on the Albion River. Both projects were constructed at the same time due to their proximity in location as well as their high priority rankings (#3 and #5 in Mendocino County). Conducting the environmental review and permitting for both projects at once was cost effective and sequential implementation reduced the overall environmental impact and construction costs. This grant agreement funded the following design elements: site surveying, geotechnical analysis, and the civil and strucutral engineering. The project was funded for construction under the 2001/2002 CDFG FRGP and the NOAA American Rivers grant program. Design plans were submitted with Progress Report #6 and are included on the submitted Final Report CD, along with a draft final report on project construction.

Ryan Creek Migration Barrier Removal Project

Ryan Creek is located in the Outlet Creek sub-watershed of the North Fork Eel River. Outlet Creek one of the highest priority coho watersheds identified in the *Recovery Strategy for California Coho Salmon*. The existing culvert is a 10-foot wide, 6-foot high, 82-foot long concrete box and is proposed for full replacement with a 19-foot wide, 82-foot long concrete arch structure set on concrete footings. The existing culvert was assessed as 20% passable for adults coho, Chinook, and steelhead and as a complete barrier for all age classes of juveniles due to the excessive velocities and outlet jump. The broken concrete apron at the outlet is also a major impediment to fish migration. Approximately 500 feet of good quality habitat exists between the county Ryan Creek crossing and the two Caltrans crossings (North and South Fork) located upstream (all of these crossings were designed under this grant agreement and are described below). CDFG surveyed the SF in 1995 (NF was denied entry) and estimated 6,000 feet of upstream habitat. During the Caltrans District 1 Inventory there was estimated to be 9,000 feet of upstream habitat. When all of the barriers in this portion of the watershed (including a private crossing on the SF that was also designed under this grant agreement) are treated, approximately 15,500 feet or 3 miles will be made accessible to Chinook and coho salmon and steelhead.

Ryan Creek
Ryan Creek Road—
Tributary to Outlet
Creek
Mendocino County

Design elements funded under this grant agreement for the county project included the hydraulic analysis, site surveying, and a portion of the structural engineering. Mendocino County conducted CEQA for this project and a Mitigated Negative Declaration was filed in March 2003. All construction permits have been secured by the County and CDFG and the project is scheduled for constructed in 2007. It has funding from the 2001/2002 CDFG FRGP and potentially the Coastal Conservancy and Steelhead Restoration Card Program. Design plans are included as Attachment 4 and on the submitted Final Report CD.

Dark Gulch Migration Barrier Removal Project

This project is located at the Orr Springs Road crossing of Dark Gulch, a tributary to South Fork Big River. The existing culvert is a 7-foot diameter, 90-foot long corrugated steel pipe set at 3.29% slope. The culvert is in poor condition, rusted through the bottom in several places and is a complete barrier for all species and age classes of salmonids, due mostly to the excessive velocities within the culvert, lack of depth at the lower migration flows, and the leap required to enter the culvert. The culvert is retrofit with a concrete lining and boulder weir placement at the outlet. However, the modification has failed to raise the elevation of the outlet pool and still results in a 1.8 foot dro Implementation of this project will restore access to approximately 1 mile of habitat for coho salmon and steelhead. Dark Gulch flows into the South Fork Big River just below the crossing. The upstream habitat consists of a dense riparian canopy of conifers and hardwoods and small bedrock-formed pools. Replacement of the culvert with a bridge that provides for passage of adults and juveniles is the current conceptual design. The project is 60% designed and not scheduled for construction until at least 2009. Final design could not be completed in the timeframe under this Grant Agreement and additional funding for completing design and construction will be sought under other federal and state grant sources. The geotechnical analysis was funded under a CDFG FRGP grant through the 5C Program and this grant agreement funded the following design elements: site surveying, hydraulic analysis and modeling of the proposed crossing for the 100-year flows.

Dark Gulch
Orr Springs Road—Tributary to Big River

Trinity

Conner Creek Fish Passage Improvement Project

This project is located in the Trinity River Watershed near Junction City and consists of improving passage at two crossings, located on Conner Creek Road (#1) and Red Hill Road (#2). Crossing #1 currently consists of a 14-foot wide, 17-foot long concrete box culvert with three, 1-foot high offset baffles spanning the lower half of the culvert bottom. The baffles plug with woody debris and are non-functional for providing resting places and slowing water velocities to allow for passage. The culvert is a complete barrier to juveniles and adults due to the outlet jump and the velocities during migration flows. Crossing #2 is located approximately 1,100 feet upstream of Crossing #1 and is a 10-foot, 66-foot long corrrugated steel culvert set at 3.17% slope with ten steel-ramp offset baffles. It fails to meet passage criteria for adult salmonids on ~45% of migration flows and is a complete barrier for all age classes of juveniles at all flows. These projects were proposed for simultaneous design due to their proximity. The ability to conduct environmental review and permitting for both projects at once will better address the cumulative effects and will be more cost effective, as will construction. Given the time constraints and workload on the Trinity County Department of Transportation (TCDOT) engineering staff, the project's design was contracted to SHN Consulting Engineers and Geologists. Design elements funded under this grant agreement included:

1) The formation of and meetings with the Technical Advisory Team (TAT) members to establish design criteria (TCDOT staff, CDFG and NMFS personnel, Mike Love and 5C staff);
2) Preparation of the RFP for design consultants and review/selection of a design firm based on responses to the RFP;
3) Site visits with the TAT;
4) Topographical and thalweg surveying at both crossings;
5) Hydraulic analysis and modeling (HEC-RAS and FishXing) for replacement and retrofit options of both crossings;
6) A conceptual design report for all four options and cost estimates for construction; and,
7) The design plans for the selected retrofit options.

A construction proposal under the CDFG FRGP will be submitted in 2007 for 2008 construction. If the project is funded, it will be included in the CDFG Mitigated Negative Declaration along with other permitting. The retrofit design options for both crossings will allow passage of adult and juvenile coho and steelhead during all migration flows. Each crossing's current flow capacity will also be increased to convey the 100-year flow and 50-year flow, respectively. The conceptual design report is included as Attachment 5 and is on the submitted Final Report CD. It includes design plans for both project sites, the hydraulic analyses, cost estimates for construction, and permitting requirements.

Conner Creek #1

Conner Creek #2

Upstream Habitat

Tributary to Trinity River—Trinity County

Deadwood Creek Migration Barrier Removal Project

The purpose of this project was to provide for passage of all life stages of coho and Chinook salmon and steelhead to the natural limit of anadromy (waterfall) of Deadwood Creek and to increase the flood-flow capacity through the road crossing at Deadwood Road in Lewiston. The existing culvert is an 8-foot diameter, 120-foot long corrugated metal pipe. It was identified as meeting passage criteria for all species of adult salmonids during approximately 12% of adult migration flows and on less than 5% of migration flows for all age classes of juveniles. The design was completed using an informal TAT of the following federal, state, local and county staff: NOAA Fisheries Branch, CDFG, Trinity County Resource Conservation District, Trinity County Department of Transportation, Trinity County Building and Development Services, Mendocino County Department of Transportation and 5C staff. The installation of baffles was determined to be the most cost-effective design for improving adult and juvenile passage during 100% of migration flows. 48-inch diameter overflow culverts were also designed to compensate for the reduced capacity of the culvert with the baffles installed. This project was ranked as the 3rd highest priority in Trinity County due to the quantity and quality of habitat available upstream, approximately 2 miles, and the consistent presence of coho, steelhead and Chinook in the stream system. The 2004 *Recovery Strategy for California Coho Salmon* also identifies Deadwood Creek a high priority watershed for coho based on population, habitat condition and at-risk factors. The engineering and permitting elements funded under this grant agreement were completed in 2003/2004 and included completing and securing the CDFG 1602 and ACOE 404 permits as well as the preparation and submittal of the CEQA Mitigated Negative Declaration (Trinity County). Topographical/thalweg surveying and portions of the civil engineering for the baffle design were also included under this agreement. A final report on project construction was submitted with Progress Report #6 and it is also included on the submitted Final Report CD.

Little Browns Creek Migration Barrier Removal Project

This project is located on Roundy Road, approximately 6 miles north of Weaverville. It is the second highest priority in the 5C Program area and the highest in Trinity County. It was included in the 2004 *Inventory of Barriers to Fish Passage in California's Coastal Watersheds* (Coastal Conservancy) as a high priority and identified during the environmental analysis completed by USFS for their planned 'Browns Project' as the highest priority treatment in the watershed. The project site is surrounded by private property, but the majority of the upper watershed is managed by the USFS. The crossing is a complete barrier to adult and juvenile coho and steelhead and their inadequate size and placement has resulted in upstream sediment aggradation. There is an estimated 1,400 cubic yards of upstream stored sediment, a direct result of the improperly placed culverts, that could deliver to the downstream reaches of Little Browns Creek if not treated. This sediment will be mobilized over time as the removal of the culverts will result in upstream headcutting and erosion. The final design includes plans for upstream grade control to reduce the impacts of upstream headcutting and sediment intrusion. Coho presence surveys have consistently found coho in Weaver Creek and young-of-the-year (y-o-y) steelhead were observed in 2001. In 2000 and

2001, y-o-y coho were sampled in the creek downstream of the project site. From 1986 to 1992, the Creek had in-stream habitat structures installed in its lower reaches, which have provided more complex rearing habitat for juveniles. Habitat surveys condcuted upstream of the project site rated it as good quality due to the presence of stones, logs, brush and aquatic macrpohytes. The stream is currently desginated as 'Critical Habitat' for the SONCC coho ESU up to the county barrier.

Little Browns Creek
Roundy Road
Tributary to Weaver Creek
Trinity County

The existing crossing consists of three, 4-foot diameter, 50-foot long metal culverts all of which are undersized with ~8-foot jumps at their outlets. The proposed design consists of a 30-foot long concrete bridge (developed by TCDOT engineering staff). Consulting hydrologist, Mike Love, was contracted (under a matching grant source) to assist with the upstream grade control design. A roughened channel consisting of ten rock weir structures and engineered streambed material was developed. The permitting for this project is currently in progress. A categorical exemption under Section 15333 was prepared and filed in December 2006 and the ACOE 404 notification and 401 water quality certification were filed in March 2007. Site visits were held on April 13, 2007 with David Ammerman (ACOE) and Jan Smith (DOT) to discuss the 404 permit and on April 23, 2007 with Mike Harris (CDFG) to discuss the stream alteration agreement. Dean Prat of the North Coast Regional Water Quality Control Board (NCRWQCB) has been assigned to completing the 401 permit process. 5C staff worked continuously with Margaret Tauzer and Rick Rogers of NMFS on development and approval of the design and NOAA Biological Opinion. The project is "approved" by all of the resource agencies at this time and construction bids came in at or near the engineers estimated cost. The project is scheduled for construction in 2007. Design elements funded under this grant agreement included site surveying, hydraulic analysis, civil/structural engineering, and permitting. The geotechnical analysis and roughened channel design were funded by 5C Program grants (CDFG). The design plans are included as Attachment 6 and on the submitted Final Report CD, along with other design deliverables.

Soldier Creek Migration Barrier Removal Project

This project is located in the Trinity River Watershed near Junction City. Both crossings are located on Soldier Creek on Evans Bar (#1) and Dutch Creek Roads (#2). Crossing #1 is located approximately 800 feet from the Trinity River with Crossing#2 located approximately 2,400 feet upstream. The culverts at both crossings were replaced in 2005 with 23-foot wide metal-arch, natural bottom structures. The new structures were designed to convey 100-year flows for the watershed and provide full passage for all age classes and species of salmonids. The old culverts were approximately 30-feet long, 8-foot diameter metal pipes with ineffective baffles and outlet jumps. They would often plug with woody debris during large storms, resulting in flooding of nearby private properties, diversion and sediment delvery down the roads, and repeated maintenance issues/costs for the TCDOT. The removal of the two barriers has provided access to approximately 2 miles of good quality rearing habitat for coho and steelhead. These projects were simultaneously designed and implemented because of their proximity as well as their high priority rankings (#7 and #8 in Trinity County). A single CEQA/NEPA document addressing both projects was completed and permitting fees for one construction application were substantially less than the fees for separate projects. The sequential implementation of these projects also reduced the environmental impacts and constrution costs were reduced due to: one-time mobilization of equipment and crews, simpler contract management, and lower engineering and construction costs. Geotechnical analysis for both sites was completed in January 2004 under a 5C Program grant (CDFG). The Trinity County Building and Development Services staff completed the civil and structural engineering and hydraulic analysis with assistance from the TCDOT engineering staff.

Solider Creek in February 2004
Dutch Creek Road

Solider Creek in December 2005
Dutch Creek Road

Specific design elements funded under this grant agreement included:

1) Topographical/thalweg surveying;
2) Hydraulic analysis;
3) Environmental Permitting and Documentation;
    a. CEQA Initial Study and Negative Declaration
    b. CDFG Streambed Alteration Agreement (1602 permit)
    c. NEPA- Initial Study and Categorical Exclusion
    d. ACOE RGP #1 (Regional General Permit For Fish Passage/Sediment Reduction Projects At Water Crossings Notification package)
    e. NOAA RGP #1 Tiering Letter
4) Structural Engineering and Design;
5) Preparation of construction bid package and advertisement.

A final report was submitted with Progress Report #11 and is also included on the submitted Final Report CD.

For each of the following projects, 5C Program staff administered the funding through Trinity County and developed/assisted in the formulation and facilitation of design tasks with the various government agencies, consulting firms and project proponents. The staff time expended on these projects was proportionately higher than on the County road projects listed above. This expenditure was due to greater project design oversight requirements, including: development of design criteria with multiple stakeholders, information gathering, private landowner contacts, travel to site visits, overall facilitation of design tasks, and conference calls/sit-down meetings on various projects.

Private Road Projects

<u>North Fork Schooner Gulch Migration Barrier Removal Project</u>
This project is located between the Gualala and Garcia River watersheds, approximately three miles southeast of Point Arena in Mendocino County. It is within both the Central California Coast coho and Northern California Steelhead ESU. The existing crossing consists of a 4-foot diameter, 100-foot long corrugated steel pipe with perched outlet. The culvert is rusted through the bottom, has a failing center structure and a high plug potential all within a large roadfill (estimated at 2,700 cubic yards). It was referenced in the 2001 DFG *Stream Inventory Report*, which recommends “the active and potential sediment delivery from roads and other sources in the Schooner Gulch watershed be treated”. It was also referenced in the 2004 *Inventory of barriers to fish passage in California’s Coastal Watersheds* as a high priority for sediment reduction and fish passage improvement. For this reason, the project was selected as a Task 4 “Work Program” element for design when this grant agreement was augmented with additional funding in 2005. The crossing is a complete barrier to juveniles and adults due to length of the culvert, velocities at migration flows and the perched outlet. The 5C and Trinity County contracted with the Mendocino County Resource Conservation District (RCD), notably Janet Olave (Director), on design. Design work began with a July 2005 site visit that included Olave, Teri Barber (project hydrologist), Alan Grass and Doug Albin (CDFG), Danny Hagans of Pacific Watershed Associates (PWA), Ron Dickerson of Trout Unlimited, and 5C staff. The two design options, a bridge or an embedded culvert, were discussed and due to the switchback configuration of the road (and a landslide near the proposed southern bridge abutment), replacement with an embedded culvert was determined as the most cost-effective treatment. 5C staff member, Carolyn Rourke, conducted the topographical surveying for the project site with in-kind assistance from the RCD and USDA-NRCS and Teri Barber assembled watershed and flow data. This information, along with the topographical survey data, was provided to Erin O'Farrell (agricultural engineer, NRCS) for use in the hydraulic analysis (HEC-RAS) modeling of the proposed design. Joe Scriven (fisheries biologist) conducted a habitat assessment up and downstream of the project site in January 2007. The RCD also contracted with Westcoast Watershed to develop the revegetation plan for the project (see Attachment 7). Olave proceeded with structural design of the embedded culvert by contracting Rau & Associates out of Ukiah. Rau developed

design plans for the culvert (sized at 12-foot diameter) to be embedded approximately half way into the streambed, utilizing the "Active Channel Design" method. The design also incorporates up and downstream grade control and several road surface treatments not related to the stream crossing. These elements, along with the shoring required for the construction of the new culvert, resulted in a construction estimate of ~$441,000. A construction proposal for the 2006/2007 CDFG FRGP was submitted but not funded because of the high costs. Various re-design options are currently in consideration, including utilizing an arch shaped culvert from Mendocino Redwood Company (MRC) and/or removal of the road treatments proposed in the barrier replacement design. As designed, the embedded 12-foot culvert is the best option for the site characteristics. When the project is constructed it will provide access to 2 miles of upstream spawning and rearing habitat for steelhead and coho (see *Fisheries Report* included in Attachment 7). It will also reduce the potential sediment delivery of ~2,700 cubic yards by removing the large roadfill and potential for culvert failure. The existing design plans developed by Rau & Associates were submitted with Progress Report #8 and are included on the submitted Final Report CD.

<u>South Fork Ryan Creek Fish Passage Improvement Project - James L. Hamman Driveway Crossing</u>

The design portion of this project was completed by Prunuske Chatham, Inc. in conjunction with the North Fork and South Fork Ryan Creek Fish Passage Improvement Project designs. The crossing is located approximately six miles north of Willits in Mendocino County and is a private driveway over the South Fork of Ryan Creek (~300 feet upstream of the SF Caltrans crossing). Refer to the *South Fork Ryan Creek James L. Hamman Driveway Crossing Scoping Report for Fish Passage Improvement* included on the submitted Final Report CD and the discussion below for the <u>North Fork and South Fork Ryan Creek Fish Passage Improvement Projects</u> for more detail. Design plans are included as Attachment 8 and on the submitted Final Report CD.


South Fork Ryan Creek—Hamman Driveway Culverts
Southerly Culvert　　　　Northerly Culvert
Tributary to Outlet Creek

Federal and State Ownership Projects

<u>Caspar Creek Fish Passage Improvement Project</u>
The goal of this project was to facilitate USFS Redwood Sciences Lab (RSL) and CDF Jackson Demonstration State Forest staff in designing replacement structures for the North and South Fork Caspar Creek fish ladders. The watershed hosts populations of Central California Coast coho salmon and Northern California steelhead which are listed as endangered and threatened, respectively. A design of replacement ladders, other "fishways" that would improve passage for both adults and juveniles without disturbing the integrity of current data collection, specifically not backwatering the V-notch weirs used to measure watershed flows, was the primary design criteria. The Caspar Creek watershed is located within the Jackson Demonstration State Forest, approximately five miles south of Fort Bragg in Mendocino County. For the last forty years, stream flow and suspended sediment have been monitored continuously as part of a paired-watershed study. The project sites consist of concrete V-notch flow-gauging weir dams, redwood dams that regulate the water surface beneath the weirs, and wooden fish ladders. The existing wooden dams and fish ladders are in poor condition with 90% of the stream flow leaking through the structures during low summer flows, trapping fish upstream until the fall rains. In May 2001, Robert Floerke (Regional Manager, CDFG Central Coast Region) submitted a Memorandum to CDF that the existing ladders were a partial barrier to fish passage and recommended their replacement. Jeffrey Jahn, NMFS biologist, issued a biological opinion in 2003 that covered the weir pond cleanouts (conducted bi-annually by CDF/RSL as part of the study) and the replacement of the ladders (when designed). From 2001 to 2004, no progress was made in developing a design for the new ladders. In order to expedite development of this project, the Coastal Conservancy recommended the project for inclusion in this grant's work program. The Conservancy also authorized disbursement of $600,000 to CDF in May 18, 2005 for the purpose of implementing the project following successful completion of the design. From March 2005 to February 2007, 5C staff administered the preparation of the existing final design (concrete ladder with low flow sluice gates & labyrinth weir, roughened channel, and monitoring capability) for full replacement of both redwood fish ladders. The design was prepared by: Winzler & Kelly Consulting Engineers (W/K), Michael Love & Associates, and Taber Consultants. Unfortunately, this process was hampered by extensive and often late-to-arrive project recommendations from both NOAA staff and RSL.

Design elements funded under this grant program included:

1) Assemblage of a Technical Advisory Team (TAT) including Marcin Whitman & Brad Valentine (CDFG), Jeffrey Jahn, Rick Wantuck & Margaret Tauzer (NMFS), Marc Jameson & Fay Yee (CDF), Tom Lisle, Rod Nakamoto, Jack Lewis & Elizabeth Keppeler (USFS RSL), and later Steven Allen (W/K) & Michael Love (MLove);
2) Development & release of the RFP for engineering and rating criteria to select a consultant including a legal notice in the Ukiah Daily Journal;

3) Formulation (March/April 2005) & revision (January 2006) of the design criteria for the V-notch weirs and juvenile/adult fish passage;
4) Information gathering & data transfer between TAT members, including research on 1) alternative flow measurement devices (consultation with USGS staff & consulting hydrologist Greg Kamman), and 2) video monitoring & viewport structural design information;
5) Four sit-down meetings & numerous conference calls:

   MEETINGS

   -March 11, 2005 Initial Site Visit;
   -April 21, 2005 Design Criteria Meeting for adult/juvenile passage (Whitman, Jahn, Jordan, Taylor, Lancaster);
   -August 18, 2005 Site Visit with Consultant & CDF/USFS staff;
   -January 10, 2006 Introduction of Rick Wantuck to TAT & modified design criteria: 1) improved passage for adults/juveniles and, 2) integration of video monitoring & viewport windows into ladder structures.

   KEY CONFERENCE CALLS

   -July 28, 2005 Review of consultant responses to engineering RFP & ranking/selection of Winzler & Kelly team;
   -October 20 & 27, 2005 Discussion of *Preliminary Design Clarification* letter from W/K, specifically the flow measurement at which the V-notch could not be backwatered - set at 400 cfs (RSL staff).
6) Geotechnical investigation (Taber); Site surveying (W/K); Complete civil and structural engineering; Development of draft *Operations & Maintenance Manual*; and, draft/final designs, plans & specifications (W/K & MLove);
7) Coordination with permitting agencies (CDFG – Brad Valentine; NMFS & ACOE – Jeffrey Jahn);
8) Posting of all pertinent information on the CDF website;
9) Circulation of draft and final design plans and reports to TAT members.


North Fork Caspar Creek
Wood dams & fish ladder   Low flow between ladders & weir dams
Jackson Demonstration State Forest—Mendocino County

The final design (plans/specifications, draft O& M Manual & construction estimate) was circulated to various TAT members and per the NOAA Biological Opinion, RSL staff reviewed the design and submitted it to NMFS for review and approval. Wantuck and Whitman approved the design in December 2006. CDF is responsible for administering the implementation funding, preparing the construction bid package, and overseeing construction. At this time, at least one ladder is planned for construction in 2007 and the other in 2008. CDF has contacted W/K regarding a construction oversight and inspection contract, critical to ensure that the ladder structures are constructed as-designed. 5C staff has continuously sought, notified CDF of, and written construction grant applications to supplement the existing $600,000 in construction funding from the Conservancy, effectively serving as CDF's project proponent for this undertaking. A NOAA Community Based Habitat Restoration Project Grant Program proposal and a NFWF Keystone Grant pre-proposal were submitted in 2006 and 2007 (preparation funded under subsequent grant source). When implemented, this project will improve access to 3.5 miles of rearing and spawning habitat for threatened steelhead and endangered coho salmon in the Caspar Creek watershed. Design plans were submitted with Progress Report #10 as a CD of plans, specifications, and the O&M Manual, and are also included on the submitted Final Report CD.

<u>Salmon Creek Tidegates Fish Passage Improvement Project</u>

<u>Salmon Creek Tidegates</u>
Installed 5' x 8' Tidegate, January 2007
Humboldt Bay National Wildlife Refuge

This project is located within the Salmon Creek Unit of the Humboldt Bay National Wildlife Refuge. The project consists of replacing two existing sets of tidegates and installing an additional tidegate where one had previously existed within the Salmon Creek Estuary. The tidegates had partially blocked fish access, caused poor tidal circulation and water quality conditions, and led to sedimentation of important juvenile rearing estuarine habitat. Analysis of environmental impacts associated with this project included hydrologic modeling to evaluate the potential impacts that various tidegate configurations would have on the following: tidal circulation, fish passage, flooding, and sediment routing. The final design included pre-manufactured tidegate structures from Nehalem Marine, located in Oregon, that provide for unimpeded access of migrating adults and juveniles at all ebbing tides using a vertical hinged gate. Two of the structures include adjustable sluice gates that allow for a muted tide cycle, improving water quality and increasing the quantity and quality of estuarine habitat. The third structure eliminates the potential for adult and juvenile stranding during flooding and low tides. Salmonid species known to utilize Salmon Creek and the estuary include steelhead, Coastal cutthroat, coho and Chinook salmon. Preparation of the environmental documents and permit applications required for construction, assisting the USFWS with the NEPA process, and obtaining permits were the primary design elements funded under this grant agreement. The lead agency (USFWS) completed the necessary NEPA review through the Humboldt Bay National Wildlife Refuge (HBNWR) Management Plan and obtained the following permits:

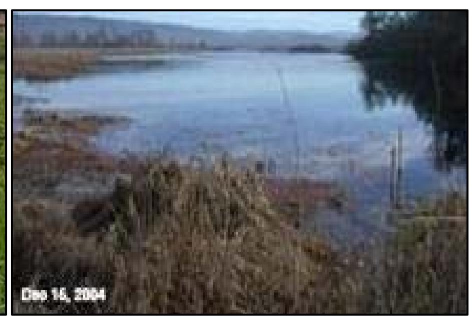
DFG 1602; RWQCB Sec. 401; ACOE 404; Coastal Development; Humboldt County Grading Permit; Humboldt Bay Harbor, Recreation and Conservation District CEQA Categorical Exemption under Section 15333; and, a Cooperative Agreement with HBNWR. Consultation with NMFS biologists was also conducted as part of the 404 permit process. Other design elements funded under this agreement included: topographical surveys of the proposed tidegate locations, collection of site data, construction phase environmental impacts analysis, and final engineered designs. From January 2004 – January 2005 the following were completed:

1) Design level topographic mapping of 4 project locations, including bathymetry of portions of Hookton Slough (includes detailed site specific topographic maps & improved/expanded overall project area topography & DTM);
2) Detailed hydrologic analysis of the Salmon Creek watershed (includes a HEC-HMS model, and hydrographs of project design storms);
3) Assessment of existing tidegate performance using a spreadsheet hydrologic routing model (includes a spreadsheet model created specifically for this project & a preliminary performance assessment of the existing tidegate structures for fish passage & flood routing);
4) Preliminary analysis of various tidegate alternatives. The various alternatives were analyzed for improving fish access and flood routing through the tidegate structures;
5) Detailed hydraulic modeling of the proposed tidegate structures. A detailed 1-dimensional hydraulic model was developed of the project area, used to conduct unsteady analysis. This model was/will be used to conduct detailed hydraulic analysis of pre-project and post-project conditions, providing information on the improved fish passage, tidal wetland/estuary flow conditions and flood routing.

The “Subgrade Soil Bearing Capacity at Tide Gate Sites” report (prepared by Laco Associates) and the “Draft Environmental Assessment for the Humboldt Bay National Wildlife Refuge (HBNWR) Salmon Creek Restoration” (prepared by Eric Nelson of HBNWR) were submitted with Progress Report #5. Portions of the project were constructed in January 2007, including the installation of a 5-foot x 8-foot tidegate and a new 4-foot diameter tidegate. The Environmental Assessment for the Salmon Creek Restoration project was also submitted with Progress Report #5. A report on a portion of the constructed project is included on the submitted Final Report CD.

<u>Yontocket Slough Fish Passage and Habitat Enhancement Project</u>

This project is located in Del Norte County and is part of the Smith River estuary, located north of Crescent City. The existing fish access and habitat conditions within Yontocket Slough were identified by CDFG and other entities as a limiting factor for anadromous salmonids. Historically, the slough was a large open expanse of deep water, supporting thriving populations of trout and coho salmon. During the 1964 flood, and other events, the slough filled with fine sediments, making it much shallower. The introduction of the semi-aquatic canary grass (*Phalaris arundinacea*) to the area in the 1960’s has lead to colonization of the slough by this invasive species. It prohibits growth of native riparian vegetation and results in decreased channel capacity, making the slough impassable for various fish species, while additionally limiting the availability of quality rearing habitat. Two culverts on Pala Road, managed by California State Parks, have also limited access of anadromous salmonids to this important habitat for over 20 years. The culverts have created a large depositional reach of fine sediments and have disconnected the slough from the Smith River estuarine tidal influence. The design element funded under this grant agreement was completion of the sediment coring and analysis of deposited sediments within Yontocket Slough. The drilling/coring identified the level of sediment aggradation from flood events, along with the strata associated with pre-1880's tribal cultural deposits (Yontocket was the site of a large Native American village). This information has given the agencies involved in the project (CDFG & State Parks) a starting point for completing final design and permitting for construction. 5C staff developed a contract with Michael Love & Associates, the prime consultant responsible for completing and submitting required permit applications and obtaining archeological clearance as required, for the project. Love contracted with Pacific Watershed Associates (PWA) to perform the coring fieldwork in October 2005 and coordinated with the Smith River Rancheria to provide tribal cultural monitors during the coring. The stratigraphic investigation report findings were incorporated into three alternatives for improving aquatic habitat and fish passage in the slough. Currently, State Parks and CDFG are negotiating a potential land swap for this project. State Parks is also interested in a fourth alternative that involves large-scale excavation, with excavation depths based on the sediment coring results from PWA. The coring report, funded under this grant agreement, is included on the submitted Final Report CD, as is a Final Report on the design of the project (funded by matching grant sources).



Yontocket Slough

Reed canary grass in the Slough   Smith River inundation

North Fork and South Fork Ryan Creek Migration Barrier Removal Projects

These crossings are located on State Highway 101, approximately 6 miles north of Willits in Mendocino County. Ryan Creek supports steelhead, Chinook and coho salmon and is a tributary to Outlet Creek, a high priority watershed listed in the *Recovery Strategy for California Coho Salmon* (2004) as it has one of the longest migrating populations of coho salmon within California. These projects are within the Northern California Steelhead, California Coastal Chinook, and Southern

Oregon-Northern California coho ESUs. These two projects, along with the private driveway crossing on South Fork Ryan, were designed together due to their proximity and realized cost savings of completing design, securing permits, and potential construction under one contract. In an effort to effectively and efficiently restore habitat in this important sub-watershed, 5C staff has continuously worked with Caltrans staff and the selected design consultant, Prunuske Chatham, Inc. on design and permitting issues for these three crossings simultaneously. The North Fork (NF) crossing was identified in the Caltrans District 1 fish passage inventory as the second highest priority to treat and was included in the *Inventory of barriers to fish passage in California's Coastal Watersheds*. The existing crossing at the NF site is a concrete lined 5-foot diameter, 83-foot long corrugated metal pipe with a 3-foot outlet jump, the primary barrier. The final design consists of full replacement with a 21-foot diameter embedded arch culvert to create a natural bottom. This design utilizes the "Stream Simulation" approach, which sizes the replacement structure at 1.5 times the active channel width. The new culvert will also convey the 100-year flows, estimated at 665 cfs. The South Fork (SF) Ryan Creek crossing is located approximately ¼ mile south of the NF site and was identified as the 6th highest priority in District 1. The existing structure is a 5-foot diameter, 125-foot long corrugated metal pipe with a concrete apron invert. The design plan at this crossing is to install angled metal baffles and an emergency overflow culvert on the right inlet hinge to compensate for the lost hydraulic capacity of the main culvert. Installation of baffles will eliminate the velocity barrier and provide adequate resting pools for adults and juveniles.

The private driveway crossing was identified as a barrier during the September 2006 site visit (see below) and SCC staff authorized the Consultant to work on design plans for improving passage at this site. Jon Mann (Prunuske Chatham, Inc.) initiated design by contacting the private landowner to discuss the barrier and the landowner is agreeable to a replacement option. The two driveway culverts were installed in late 1970 and are both barriers. The crossing consists of two 5-foot diameter corrugated metal pipes under a 25-foot embankment. One culvert is 40% crushed in the middle and the other is starting to rust through on the bottom. The northern pipe is 102-feet long, set slightly lower in elevation than the southern pipe so that it c the first streamflows and is perched approximately 1.5 feet. The driveway slope is approximately 20%. The proposed design is to replace the existing corrugated metal pipes with another crossing structure, the most appropriate being a much larger culvert (replacement with a bridge may be difficult due to the steep driveway grade). A standard structural metal plate pipe arch similar to the proposed design for the NF site can be considered. This conceptual design will require a geotechnical investigation to determine depths to bedrock within the replacement culverts.

There are eight landowners within the limits of these three projects, including Caltrans right-of-way and all existing landowners support the projects. Design elements funded under this grant program included the following with in-kind from Caltrans where noted:

1) Assemblage of a Technical Advisory Team (TAT) including Marcin Whitman & Scott Harris (CDFG), Tom Daugherty & Rick Wantuck (NMFS biologist &

engineer), Lucy Kostrzewa & Tim Ash (Caltrans hydrology & environmental), and later Jon Mann (P Chatham);
2) Formulation of the design criteria for all three crossings (TAT);
3) Three site visits & numerous conference calls:

SITE VISITS

- July 2005 Initial Site Visit with Kostrzewa & Ash, Harris, Jordan & Lancaster;
- July 2006 Fisheries Assessment with Jordan & Ross Taylor (5C fisheries biologist);
- September 2006 Site Visit with Consultant: Kostrzewa, Ash, & Susan Leroy (Caltrans), Mann, Dennis Ruttenberg & Jennifer Michaud (P Chatham), Michael Bowen (SCC), Alex Straessle (Mendocino County DOT), Harris, Daugherty & Jordan.

4) Initial site surveying (Caltrans in-kind);
5) Hydraulic analysis of the watershed for 100-year flood flows (Caltrans in kind: Lisa Hockaday & Kostrzewa);
6) Geotechnical Analysis (Caltrans in-kind: Drill Crew, Charlie Narwold);
7) FishXing analysis of the SF culverts, Final Surveying (including the private driveway crossing); Environmental Resources & Permitting Information Review; Civil & Structural engineering; draft & final design plans & specifications (Prunuske Chatham, Inc.);
8) 5C staff conducted formulation of design criteria with various resource agency personnel & Caltrans staff; RFP preparation & ranking criteria/selection of design team; Contract development & management; Encroachment permit applications for design of both sites (Caltrans waived application fees); Landowner contacts & right-of-entry agreements; Information gathering & data transfer between the TAT.

CDFG staff and the District 1 inventory estimated approximately 15,000 feet or miles of good quality habitat upstream of the SF and NF highway crossings with no other known barriers upstream. Once all of the barriers in this portion of the watershed are treated (including the County road crossing of Ryan Creek, 3 miles of habitat will be made accessible to coho and Chinook salmon and steelhead. Pacific lamprey have also been sighted in the outlet pool of the County crossing. The final design plans/technical specifications (Caltrans format), the biological resource data for permitting of all three projects, and cost estimates are included on the submitted Final Report CD. Caltrans will be required to review the designs for the two highway projects prior to completing the permitting process. It is anticipated that the 5C Program will work with a consultant to secure funding and finalize permitting for both the South Fork highway and private driveway crossing projects. Caltrans will be responsible, either until completed or until another agency/entity assumes responsibility, for finalizing the permitting and completing construction of the North Fork crossing, although they have no immediate plans to do so. Design plans are included in Attachment 9 and also on the submitted Final Report CD.

Fish Creek Migration Barrier Removal Project

This project is located on State Highway 254 in Humboldt County, within Humboldt Redwoods Sate Park. There is 1.63 miles of good quality upstream habitat above the existing 6-foot wide, 184-foot long concrete, single-bay, box culvert. It was identified as the highest priority crossing to treat for fish passage as a result of the Caltrans District 1 Assessment. The outlet has a 9-foot wide, 45-foot long concrete apron and the culvert is retrofit with eight concrete ramp-style baffles. Fish Creek is a major tributary to the South Fork Eel River (confluence ~320 feet downstream of the crossing) and the culvert is the only barrier in the system. Steelhead, Chinook, and coho salmon have been located in the outlet pool during past CDFG spawning surveys. In 2000, the Caltrans' Office of Design South compiled a list of ten projects on State Highway 254 that included: replacement of damaged culverts, down drains, and drainage inlets. A quick treatment for resurfacing the Fish Creek culvert's invert (presently consisting of broken concrete and exposed rebar) was developed. Environmental evaluations and preliminary drainage reports were compiled for this and the other nine projects, but they were never implemented due to a Caltrans budget constraint. The preliminary report recommended replacing the existing box culvert with a "two bay" nine-foot wide by eight-foot high concrete box culvert. This replacement option would likely require baffles to address fish passage at this site, unless installed at a less steep grade than the existing structure. The project was added to this grant agreement's Work Program in June 2005 but was removed in June 2006 due to time constraints and lack of in-kind sources from Caltrans. Portions of the project's design that were completed include a draft MOU/Cooperative (COOP) Agreement between Caltrans and Trinity County for the design services and a draft bridge design. The COOP agreement was not finalized, but a draft agreement is on file with the 5C Program. A site visit with Kostrzewa, Ash, Lancaster, Jordan, Gary Flosi and Paul Divine (CDFG) was held in July 2005 to discuss the potential design options. Caltrans engineer Darron Hill also developed a conceptual design for constructing a 25-foot long bridge but the removal of two 6-foot diameter redwood trees would be required. The crossing is located within Humboldt Redwoods State Park and full collaboration between Caltrans and State Parks has not been addressed to date, with the exception of several conference calls between Ash, Kostrzewa, Hill, Jordan and Keith Witte (Park environmental staff). Since the bridge design would result in the removal of the two redwood trees, Witte expressed interest in investigating all potential designs that would not impact the trees or their root systems. Jordan developed a Request for Proposal for design of an alternative crossing structure in and one response was received. The cost of designing alternatives to the bridge design (including topographical surveying, geotechnical work, hydrology, civil and structural design, and final plans and specifications) far exceeded the available funds remaining in the grant agreement and in-kind for these services from Caltrans was not feasible in May 2006. Discussion with Caltrans staff and the Coastal Conservancy grant manager resulted in the removal of this project from the Work Program, but it is still a high priority project. Every effort should be made to ensure that this project is designed, and constructed, within the next ten years.

BUDGET

This grant agreement was for $670,178 to be utilized in the design and permitting of twenty-six fish passage improvement projects. The funding for each task outlined above was as follows:

Task 1 – Grant Administration – $71,000

Task 2 – Technical Advisory Team – $9,418

Task 3 – Fish Passage Design and Engineering Workshop – $22,710

Task 4 – Migration Barrier Removal Project Planning – $567,050
(In-kind funding for projects is highlighted in Attachment 1)

LIST OF ATTACHMENTS

Attachment 1 – Project List with Breakdown of Matching & SCC Funding

Attachment 2 – Map of Project Location Sites

Attachment 3 – Indian Creek Migration Barrier Removal Project plans

Attachment 4 – Ryan Creek Migration Barrier Removal Project plans

Attachment 5 – Conner Creek Fish Passage Improvement Project design report

Attachment 6 – Little Browns Creek Migration Barrier Removal Project plans

Attachment 7 - North Fork Schooner Gulch Migration Barrier Removal Project design report

Attachment 8 – South Fork Ryan Creek Fish Passage Improvement Project - James L. Hamman Driveway Crossing plans

Attachment 9 - North Fork and South Fork Ryan Creek Migration Barrier Removal Project Plans

FINAL REPORT CD

Includes this Final Report, electronic format of all attached Plans and those submitted with previous Progress Reports, final reports of projects already constructed, and design information for select projects:

- Griffin Creek Fish Passage Improvement Project Plans
- Yonkers Creek Migration Barrier Removal Project Final Report

- Graham Gulch Migration Barrier Removal Project Final Report
- Indian Creek Migration Barrier Removal Project Plans
- Rocky Gulch Migration Barrier Removal Project Design Report
- Albion River & Marsh Creek Migration Barrier Removal Project Plans & Final Report
- Ryan Creek Migration Barrier Removal Project Plans
- Conner Creek Fish Passage Improvement Project Conceptual Design Report
- Deadwood Creek Migration Barrier Removal Project Final Report
- Little Browns Creek Migration Barrier Removal Project Plans & Other Documents
- Soldier Creek Migration Barrier Removal Project Final Report
- North Fork Schooner Gulch Migration Barrier Removal Project Plans
- South Fork Ryan Creek Fish Passage Improvement Project - James L. Hamman Driveway Crossing Plans & Design Reports
- Caspar Creek Fish Passage Improvement Project Plans & Other Documents
- Salmon Creek Tidegates Fish Passage Improvement Project Final Report
- Yontocket Slough Fish Passage and Habitat Enhancement Project Reports
- North Fork and South Fork Ryan Creek Fish Passage Improvement Project Plans & Design Reports
- Fish Creek Migration Barrier Removal Project - Caltrans Preliminary Bridge Design Plans

Also included on the CD is the 2006 Fish Passage Design & Engineering Workshop Final Report for videography (taping and production funded by the NOAA Restoration Center, California Department of Fish and Game, Pacific State Marine Fisheries Commission, and the Coastal Conservancy).

A copy of the 2006 Fish Passage Design & Engineering Workshop Training DVD Set is also included as this was completed with funding under Task 3.

Attachment One

Project List with Breakdown of Matching & Coastal Conservancy Funding

Project	Design Element Entity	County Matching Funds	Other Matching Funds Source	Other Matching Funds	03-051 Design	Total Design Cost	03-051 Percentage
COUNTY PROJECTS							
Griffin Creek Fish Passage Improvement	Del Norte County Road Department	$5,000		$0	$15,476	$20,476	76%
Yonkers Creek Migration Barrier Removal	Del Norte County Road Department City of Crescent City	$16,154		$0	$17,000	$33,154	51%
Graham Gulch Migration Barrier Removal	Humboldt County DPW	$12,446	CDFG FRGP	$34,083	$5,447	$51,976	10%
Indian Creek Migration Barrier Removal	Humboldt County DPW	$10,000		$0	$27,000	$37,000	73%
Painter Creek Migration Barrier Removal	Humboldt County DPW	$5,000		$0	$12,000	$17,000	71%
Rocky Gulch Migration Barrier Removal	Humboldt County DPW	$10,000	CDFG FRGP	$11,000	$25,122	$46,122	54%
Albion River & Marsh Creek Migration Barrier Removal	Mendocino County DOT	$25,493		$0	$55,362	$80,855	68%
Ancestor Creek Migration Barrier Removal	Mendocino County DOT	$7,000	CDFG FRGP	$5,000	$14,443	$26,443	55%
Dark Gulch Migration Barrier Removal	Mendocino County DOT	$3,703	CDFG FRGP	$13,773	$5,127	$22,603	23%
Ryan Creek Migration Barrier Removal	Mendocino County DOT	$30,099	CDFG FRGP	$2,346	$13,242	$45,687	29%
Conner Creek #1 & #2 Fish Passage Improvement	Five Counties Salmonid Conservation Program		CDFG FRGP	$3,900	$27,950	$31,850	88%
Deadwood Creek Fish Passage Improvement	Trinity County DOT Trinity County RCD	$1,504	CDFG FRGP NFWF	$2,202 $7,010	$8,084	$18,800	43%
Little Browns Creek Migration Barrier Removal	Trinity County DOT	$5,970	CDFG FRGP	$15,822	$35,732	$57,525	62%
Soldier Creek #1 & #2 Migration Barrier Removal	Trinity County DOT	$22,557	*CDFG FRGP *NOAA American Rivers *NFWF	$8,264 $25,000 $10,000	$16,740	$82,561	20%

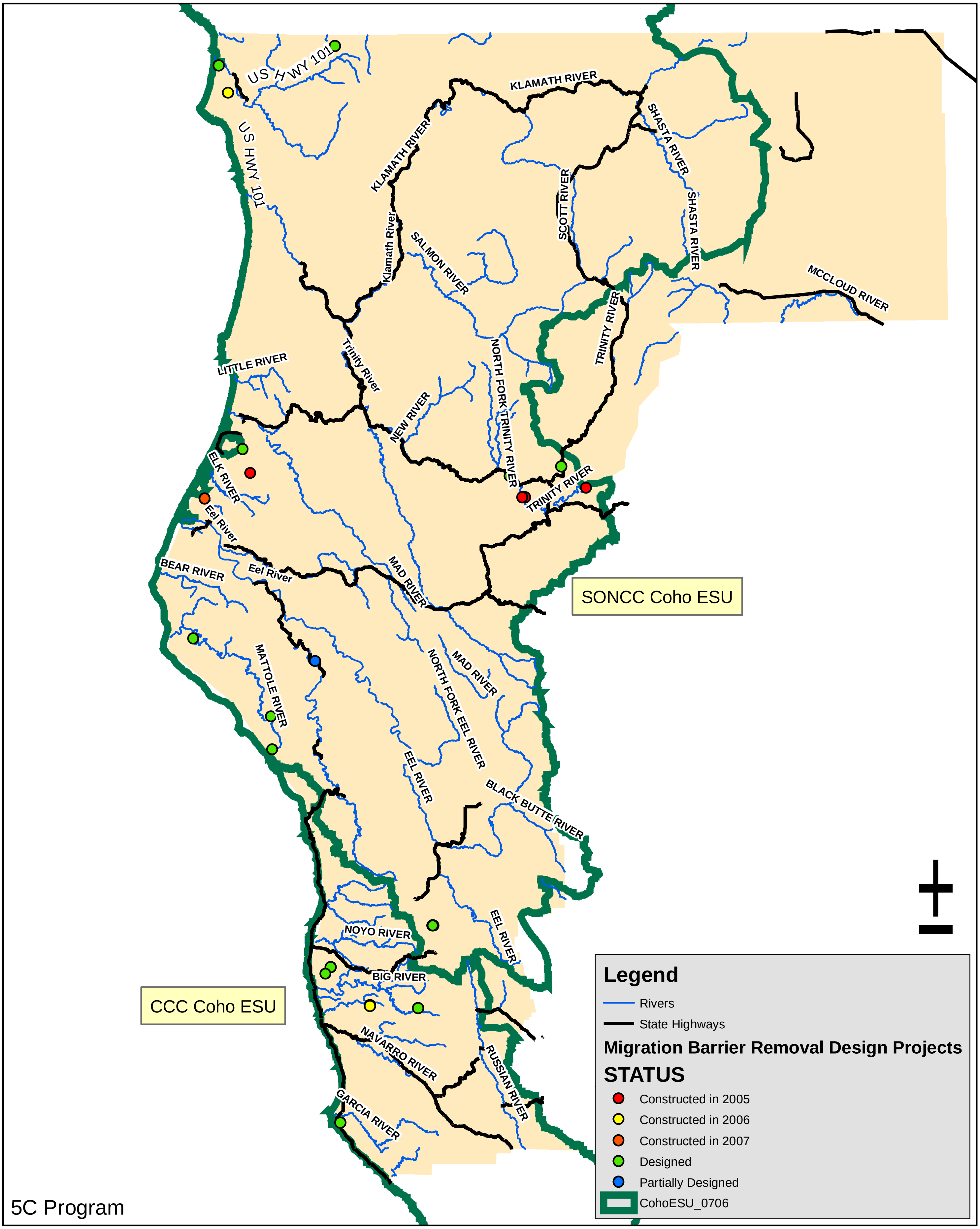
Project	Design Element Entity	County Matching Funds	Other Matching Funds Source	Other Matching Funds	03-051 Design	Total Design Cost	03-051 Percentage
PRIVATE ROAD PROJECTS							
North Fork Schooner Gulch Migration Barrier Removal	Mendocino County RCD		Natural Resources Conservation Service	$5,650	$24,710	$30,360	81%
South Fork Ryan Creek – Hamman Driveway Crossing	State Coastal Conservancy				$22,246	$22,246	100%
FEDERAL and STATE OWNERSHIP PROJECTS							
North & South Fork Caspar Creek Fish Passage Improvement	CDF USFS Redwood Sciences Lab		NOAA's NMFS CDF	$2,800 $1,800	$124,539	$129,139	96%
Fish Creek Migration Barrier Removal	Caltrans & Five Counties Salmonid Conservation Program		Caltrans	$2,580	$978	$3,558	27%
North Fork Ryan Creek Fish Passage Improvement	Caltrans & Five Counties Salmonid Conservation Program		Caltrans	$35,011	$44,493	$79,504	56%
South Fork Ryan Creek Fish Passage Improvement	Caltrans & Five Counties Salmonid Conservation Program		Caltrans	$1,500	$22,246	$23,746	94%
Salmon Creek Tidegates Fish Passage & Habitat Improvement	Pacific Coast Fish, Wildlife & Wetlands Restoration Association		USFWS Coastal Program	$30,000	$29,991	$59,991	50%
Yontocket Slough Fish Passage & Habitat Enhancement	Michael Love & Associates		CDFG FRGP Smith River Alliance	$34,899 $11,383	$17,102	$63,384	27%
		$154,926		**$264,023**	**$565,028**	**$983,977**	**57%**

CDF - California Department of Forestry and Fire Protection
CDFG FRGP - California Department of Fish and Game Fisheries Restoration Grant Program
NFWF - National Fish and Wildlife Foundation
NOAA's NMFS - NOAA's National Marine Fisheries Service
USFS - United States Forest Service
USFWS - United States Fish and Wildlife Service

Attachment Two

Map of Project Location Sites

Five Counties Salmonid Conservation Program
Coastal Conservancy Grant No. 03051
Fish Passage Improvement Project Locations
within Coho Salmon ESUs



Attachment 3

Indian Creek Migration Barrier Removal Project Plans

BAR IS ONE INCH ON ORIGINAL DRAWING IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY	ROAD NAME: MATTOLE ROAD ROAD NO: F3C010 — MILE POST: 10.0 AGREEMENT No. P0310511 CONTRACT NO.: 204301 DRAWING FILE NAME: L:\PROJECTS\204301\DWG\CDSN01.DWG PLOT DATE: 07/25/2005	DESIGN SECTION R. L. BURNETT DESIGNED BY: LLH/RLM DRAWN BY: JAB/LLH REVIEWED BY: RLB APPROVED BY: CJW	COUNTY OF HUMBOLDT DEPARTMENT OF PUBLIC WORKS INDIAN CREEK BRIDGE – MATTOLE ROAD COVER SHEET AND SHEET INDEX	SHEET 1 OF 12

COUNTY OF HUMBOLDT
DEPARTMENT OF PUBLIC WORKS

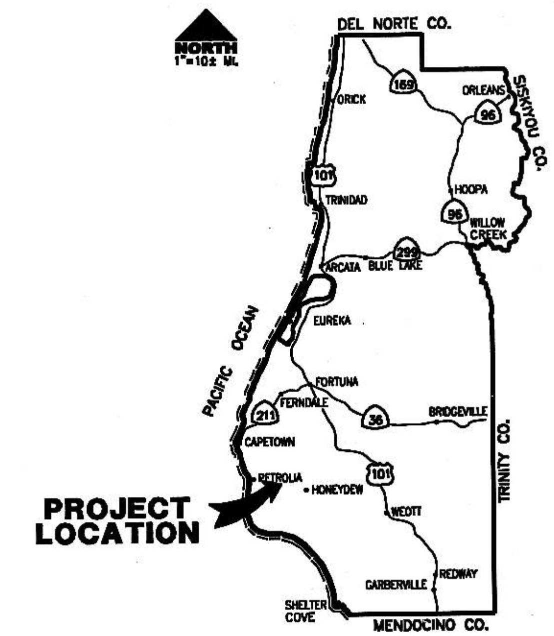
PROJECT PLANS FOR CONSTRUCTION OF

BRIDGE OVER INDIAN CREEK ON MATTOLE ROAD [F3C010] AT PM 10.0
AGREEMENT NO. P0310511
CONTRACT NO. 204301

INDEX OF SHEETS

APPLICABLE STANDARD PLANS

A10A ABBREVIATIONS
A10B SYMBOLS
A62A EXCAVATION AND BACKFILL MISCELLANEOUS DETAILS
A74 SURVEY MONUMENTS
A77A–C METAL BEAM GUARD RAILING
A77D–F GUARD RAIL FLARES
A77H1–3 METAL BEAM GUARD RAILING END TREATMENT TERMINAL ANCHOR ASSEMBLY (TYPE SFT)
A77L1 METAL BEAM GUARD RAILING AND SINGLE FACED BARRIER RAILING TERMINAL SYSTEM END TREATMENT
B0–1 BRIDGE DETAILS
B0–3 BRIDGE DETAILS



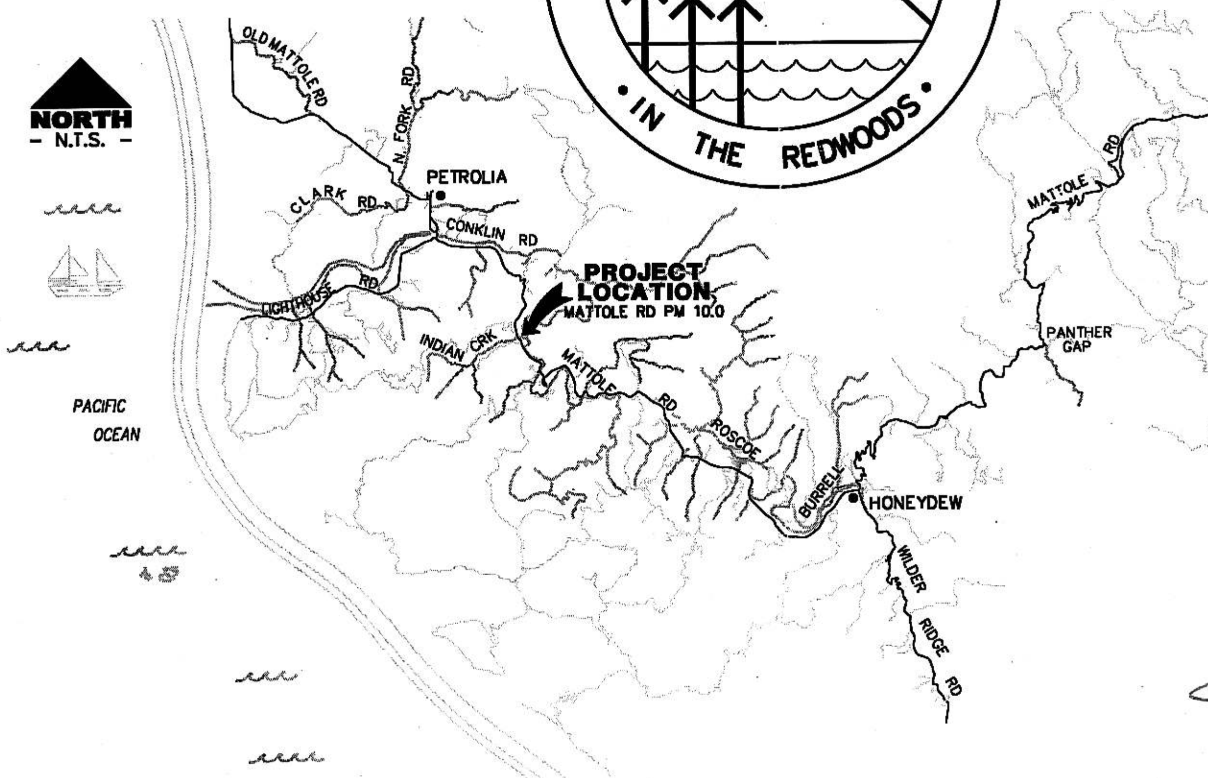
LOCATION MAP
SCALE: 1"=10± MILE

FUNDING SOURCE

THIS PROJECT IS FUNDED BY DEPARTMENT OF FISH AND GAME, COASTAL SALMON RECOVERY PROJECT FUNDS.

RESOURCES AGENCY
CALIFORNIA
DEPARTMENT
FISH & GAME

COUNTY OF HUMBOLDT • IN THE REDWOODS •



VICINITY MAP
SCALE 1"=10000'
TOWNSHIP 5 SOUTH, RANGE 2 EAST, H.B.M.

PREPARED BY

STRUCTURAL PLANS ON SHEETS 4 THRU 8 ARE PREPARED BY:

MORRISON STRUCTURES, INC.
1050 WEST STREET
REDDING, CA 96001
TEL (530) 246-8628
FAX (530) 246-8625

RECOMMENDED

R Burnett — 3-27-06
ROBERT L. BURNETT
RCE 36210, EXP. 06/30/2006
DATE

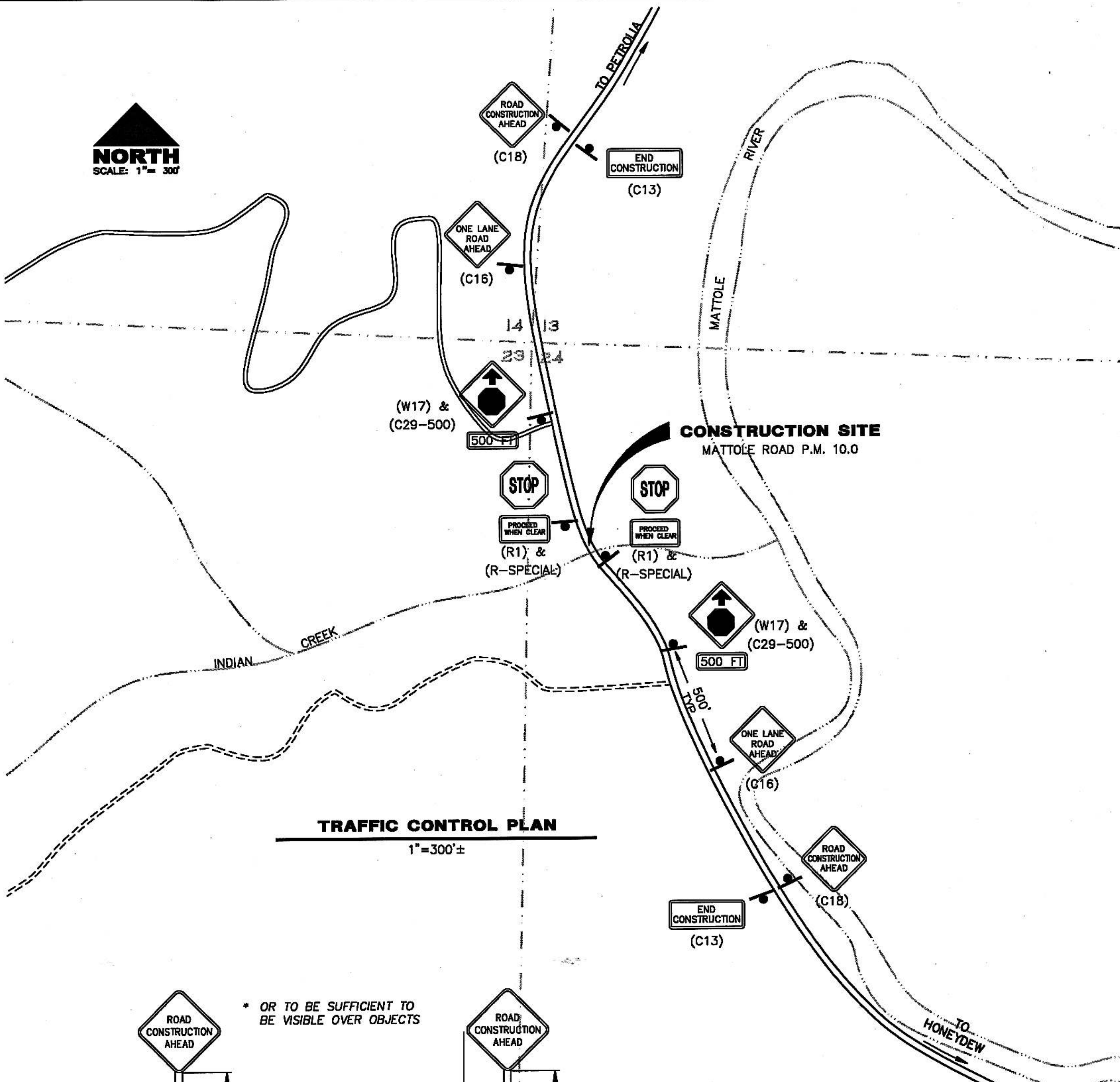
REGISTERED PROFESSIONAL ENGINEER ROBERT L. BURNETT NO. 36210 EXP. 06/30/06 CIVIL STATE OF CALIFORNIA

APPROVED

Christopher J. Whitworth — 3/27/06
CHRISTOPHER J. WHITWORTH
RCE 51931, EXP. 6/30/2006
DATE

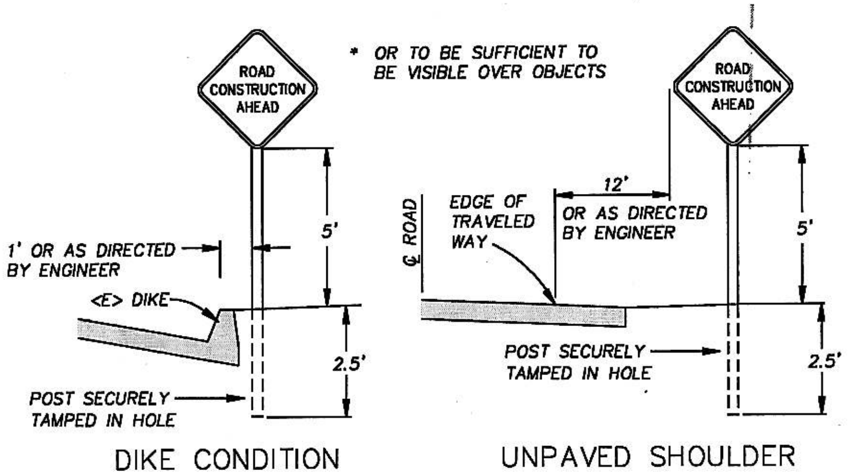
REGISTERED PROFESSIONAL ENGINEER CHRISTOPHER J. WHITWORTH NO. 51931 EXP. 06/30/06 CIVIL STATE OF CALIFORNIA

ORIGINAL LOW BID PRICE	CONSTRUCTED BY	RESIDENT ENGINEER
	PROJECT COMPLETED / /	CONSTRUCTION COST $



TRAFFIC CONTROL PLAN

1"=300'±



RURAL CONSTRUCTION AREA SIGN

– NOT TO SCALE –

NOTES

1) SIGNS SHALL BE PLACED AS SHOWN ON PLAN OR AS DIRECTED BY THE RESIDENT ENGINEER.
2) FINAL PLACEMENT OF SIGNS SHALL BE APPROVED BY RESIDENT ENGINEER.
3) ADDITIONAL PORTABLE SIGNS SHALL BE USED AS REQUIRED FOR OTHER ROADSIDE WORK.
4) SEE STANDARD PLAN T13 FOR TRAFFIC CONTROL SYSTEM.
5) IN ADDITION TO CONSTRUCTION AREA SIGNS AND WHEN DIRECTED BY THE RESIDENT ENGINEER, THE CONTRACTOR SHALL UTILIZE FLAGMEN AS NECESSARY TO DIRECT TRAFFIC.
6) DISTANCE TO C18/C23 AND C13/C14 MAY BE EXTENDED TO ENCOMPASS SITES WITHIN ONE MILE OF EACH OTHER.

BAR IS ONE INCH ON ORIGINAL DRAWING. IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY	ROAD NAME: MATTOLE ROAD; ROAD NO: F3C010; MILE POST: 10.0; AGREEMENT No. P0310511; CONTRACT NO.: 204301; DRAWING FILE NAME: L:\PROJECTS\204301\DWG\CDSN02.DWG; PLOT DATE: 07/25/2005	DESIGN SECTION R. L. BURNETT; DESIGNED BY: LLH/RLM; DRAWN BY: JAB/LLH; REVIEWED BY: RLB; APPROVED BY: CJW	COUNTY OF HUMBOLDT DEPARTMENT OF PUBLIC WORKS; INDIAN CREEK BRIDGE – MATTOLE ROAD; CONSTRUCTION AREA SIGNS, QUANTITIES, SURVEY CONTROL AND DETAILS; SHEET 2 OF 12

QUANTITIES

ITEM NO.	ITEM CODE		ITEM DESCRIPTION	UNIT	BID QUANTITY
1	120050X		Construct Detour- Mattole Rd	LS	1
2	120090		Construction Area Signs	EA	10
3	120120		Type III Barricade	EA	6
4	150805		Remove Culvert	LS	1
5	160101		Clearing and Grubbing	LS	1
6	190101		Roadway Excavation	CY	1,525
7	192003	F	Structure Excavation (Bridge)	CY	245
8	193003	F	Structure Backfill (Bridge)	CY	285
9	203016	S	Erosion Control (Type D)	LS	1
10	260301		Class 3 Aggregate Base	CY	245
11	390102		Asphalt Concrete (Type A)	Ton	205
12	490508	S	Furnish Steel Piling (HP 10 x 57)	LF	354
13	490509	S	Drive Steel Piling	EA	18
14	510051		Structural Concrete, Bridge Footing	CY	31
15	510053	F	Structural Concrete, Bridge	CY	225
16	520102	S-F	Bar Reinforcing Steel	Lbs	45,000
17	721007		Rock Slope Protection (1/2 ton, Method B)	CY	240
18	832003	S	Metal Beam Guard Railing	LF	113
19	833092	S	Metal Tube Bridge Railing (Type 117)	LF	160
20	839552	S	Terminal Section (Type C)	EA	2
21	839553	S	End Section	EA	4
22	839565	S	Terminal System (Type SRT)	EA	2
23	839569	S	Terminal Anchor Assembly (Type SFT)	EA	2
24	999990		Mobilization	LS	1

'L-LINE' SURVEY COORDINATES

PNT.#	NORTHING	EASTING	ELEV.	DESCRIPTION
5004	1,995,083.117	5,933,703.357	115.21	"L"10+75 Begin
5063	1,994,793.210	5,933,195.245	0.00	RP
5079	1,995,178.463	5,933,635.477	117.25	"L"11+92.24 BB
5080	1,995,211.942	5,933,603.764	119.22	"L"12+38.36 EB
5014	1,995,265.824	5,933,540.007	124.80	"L"13+21.91 EC
5016	1,995,282.378	5,933,517.313	127.21	"L"13+50 End

'D-LINE' SURVEY COORDINATES

PNT.#	NORTHING	EASTING	ELEV.	DESCRIPTION
5017	1,995,064.252	5,933,713.667	115.25	"D"0+00
5064	1,995,017.920	5,933,625.048	0.00	RP
5020	1,995,102.357	5,933,678.623	115.80	"D"0+52.37 PT
5023	1,995,126.218	5,933,641.018	117.26	"D"0+96.90 PC
5065	1,995,210.655	5,933,694.593	0.00	RP
5026	1,995,150.357	5,933,614.817	118.43	"D"1+32.72 PT
5036	1,995,286.088	5,933,512.227	127.60	"D"3+02.86 End

BRIDGE LAYOUT COORDINATES

PNT.#	NORTHING	EASTING	ELEV.	DESCRIPTION
5037	1,995,204.215	5,933,684.277	99.94	"C"1+00
5062	1,995,192.223	5,933,560.499	104.24	"C"2+24.36 End
5066	1,995,161.129	5,933,621.394	0.00	End WW LT
5067	1,995,159.752	5,933,596.432	0.00	WW Rod Pt
5068	1,995,177.247	5,933,614.290	0.00	EB@CL Abut 1
5069	1,995,168.171	5,933,667.871	0.00	End WW RT
5070	1,995,181.239	5,933,655.493	0.00	EB@CL Abut 1
5071	1,995,213.185	5,933,625.236	0.00	EB@CL Abut2
5072	1,995,226.254	5,933,612.858	0.00	End WW RT
5073	1,995,209.101	5,933,583.084	0.00	EB(PI)@CLAbut2
5074	1,995,221.165	5,933,569.725	0.00	End WW LT
5075	1,995,208.962	5,933,581.650	100.19	CL End FT LT
5076	1,995,213.398	5,933,627.436	100.19	CL End FT RT
5077	1,995,181.452	5,933,657.694	98.27	CL End FT RT
5078	1,995,177.016	5,933,611.908	98.27	CL End FT LT

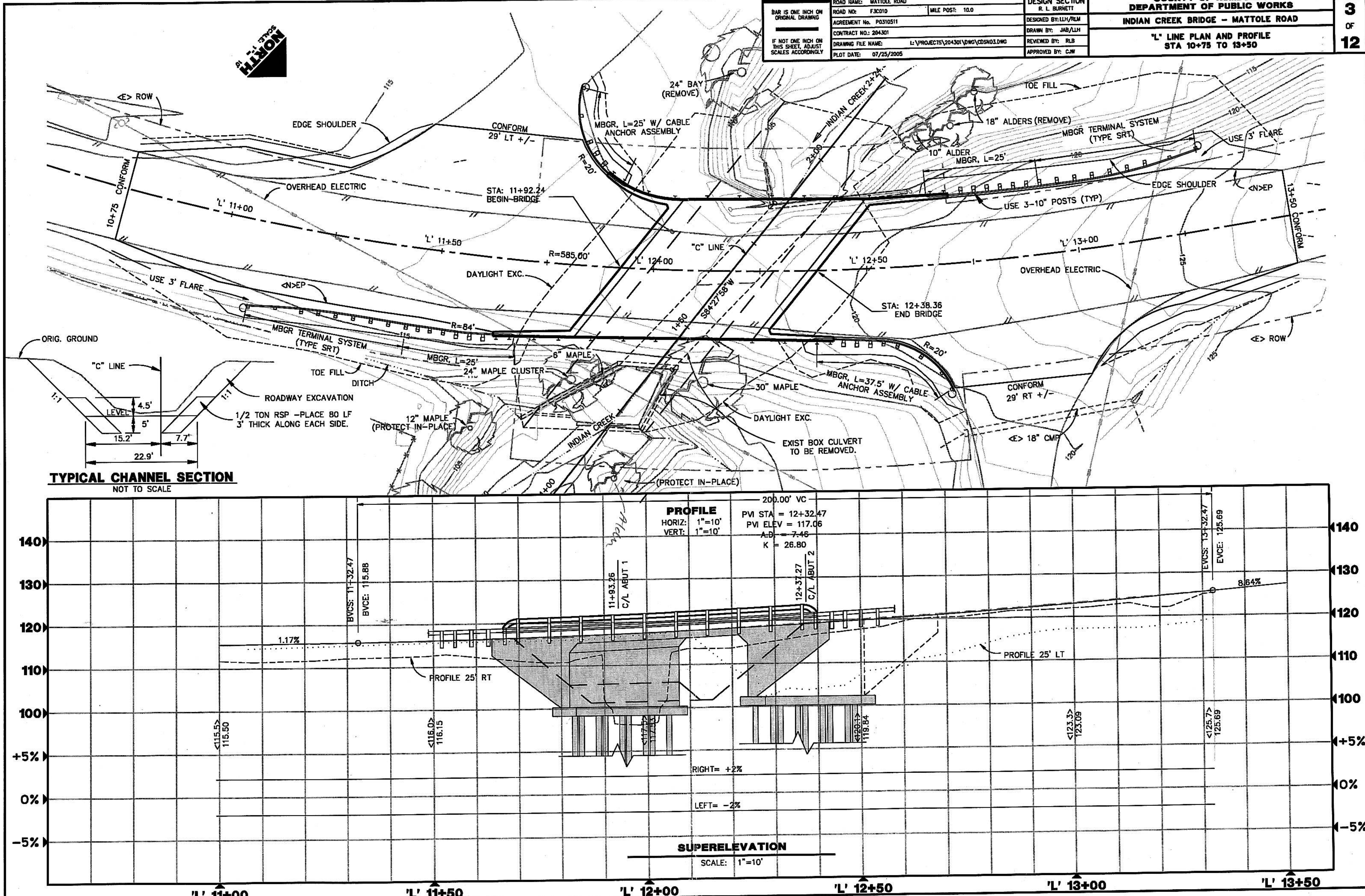
SURVEY CONTROL COORDINATES

PNT.#	NORTHING	EASTING	ELEV.	DESCRIPTION
100	1994792.763	5933776.217	-99999.00	CPREBAR
101	1995429.208	5933382.921	147.27	CPREBAR
200	1995093.547	5933716.109	114.98	CPSPK
201	1994792.763	5933776.217	116.85	CPRBR
305	1995429.238	5933382.905	147.27	GPS101
310	1995214.395	5933575.717	115.39	TOP2.5INPIPE
311	1995187.696	5933607.488	115.09	TOP2.5INPIPE
381	1995216.250	5933583.692	119.50	CP60D
382	1995189.670	5933648.862	116.08	CP60D
438	1995196.120	5933526.234	107.54	CP60D
495	1995247.601	5933430.947	115.91	CP60D
558	1995216.238	5933583.676	119.50	CK381
560	1995200.510	5933688.588	101.53	CPX
561	1995236.416	5933808.184	97.45	CP60D
672	1995200.516	5933688.587	101.54	CK560

SURVEY BY OSCAR LARSON & ASSOCIATES – AUGUST 2004.
VERTICAL DATUM: ASSUMED EL=100FT AT TOP CONC APRON, CL CULVERT OUTLET.
HORIZONTAL DATUM: NORTH AMERICAN DATUM OF 1983 (NAD83) BASED ON GPS TIES TO REFERENCE STATION CME1, PID AJ7894.
DISTANCE SHOWN ARE GRID DISTANCES WITH A COMBINED SCALE FACTOR OF 0.99993765.

CONSTRUCTION AREA SIGN SUMMARY

SIGN TYPE	QTY	DESCRIPTION	SIZE	REMARKS	POST SIZE	NUMBER
C18	2	ROAD CONSTRUCTION AHEAD	48" x 48"	VISIBLE AT ALL TIMES	4" x 4"	1
C16	2	ONE LANE ROAD AHEAD	48" x 48"	VISIBLE AT ALL TIMES	4" x 4"	1
W17 & C29-500	2	STOP AHEAD 500 FT	48" x 48" 29" x 9"	VISIBLE AT ALL TIMES	4" x 4"	1
R1 & R-SPECIAL	2	STOP PROCEED WHEN CLEAR	48" x 48" 29" x 9"	VISIBLE AT ALL TIMES	4" x 4"	1
C13	2	END CONSTRUCTION	60" x 24"	VISIBLE AT ALL TIMES	4" x 4"	2



BAR IS ONE INCH ON ORIGINAL DRAWING	
IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY	

ROAD NAME: MATTOLE ROAD		DESIGN SECTION R. L. BURNETT
ROAD NO: F3C010	MILE POST: 10.0	DESIGNED BY: LLH/RLM
AGREEMENT No. P0310511		DRAWN BY: JAB/LLH
CONTRACT NO.: 204301		REVIEWED BY: RLB
DRAWING FILE NAME: L:\PROJECTS\204301\DWG\CDSN03.DWG		APPROVED BY: CJW
PLOT DATE: 07/25/2005		

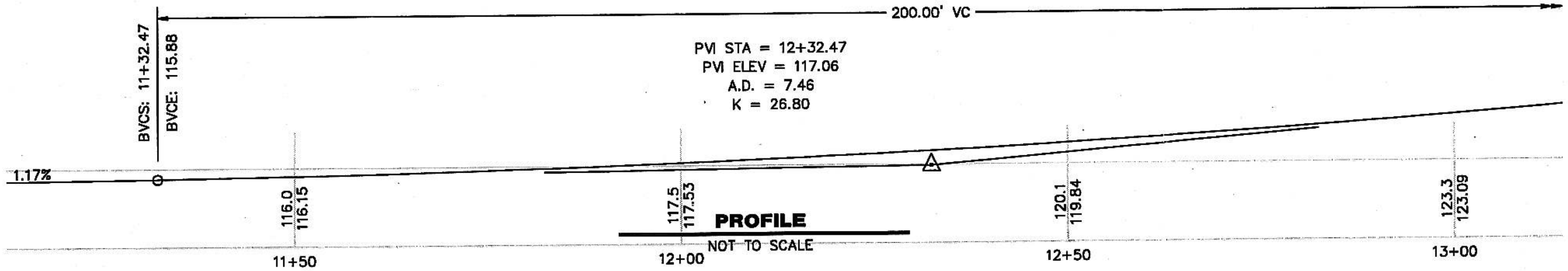
COUNTY OF HUMBOLDT
DEPARTMENT OF PUBLIC WORKS

INDIAN CREEK BRIDGE - MATTOLE ROAD

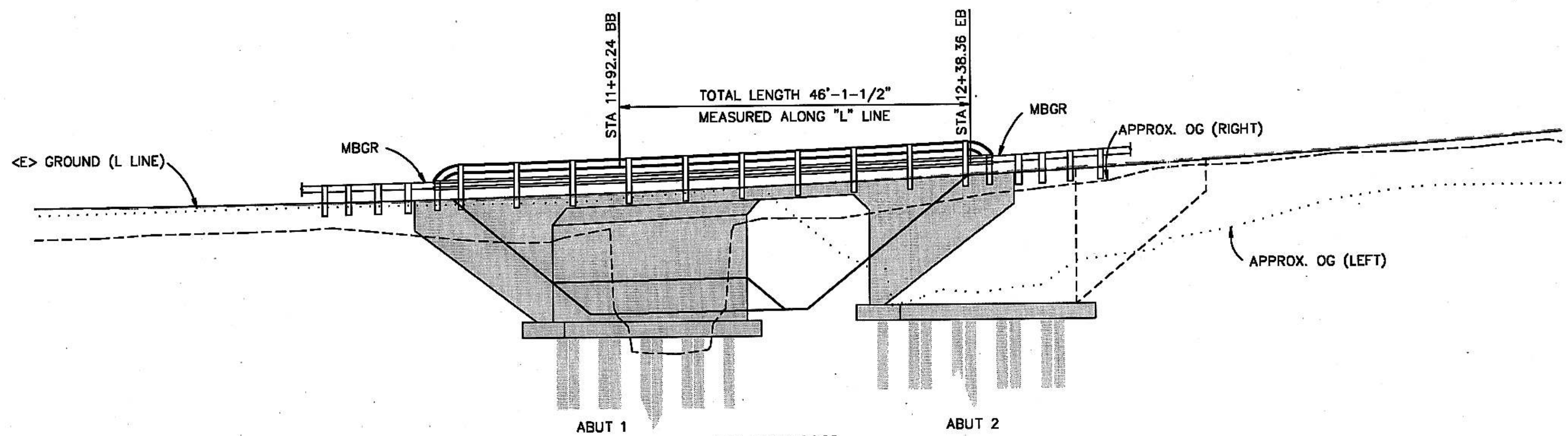
"L" LINE PLAN AND PROFILE
STA 10+75 TO 13+50

SHEET 3 OF 12

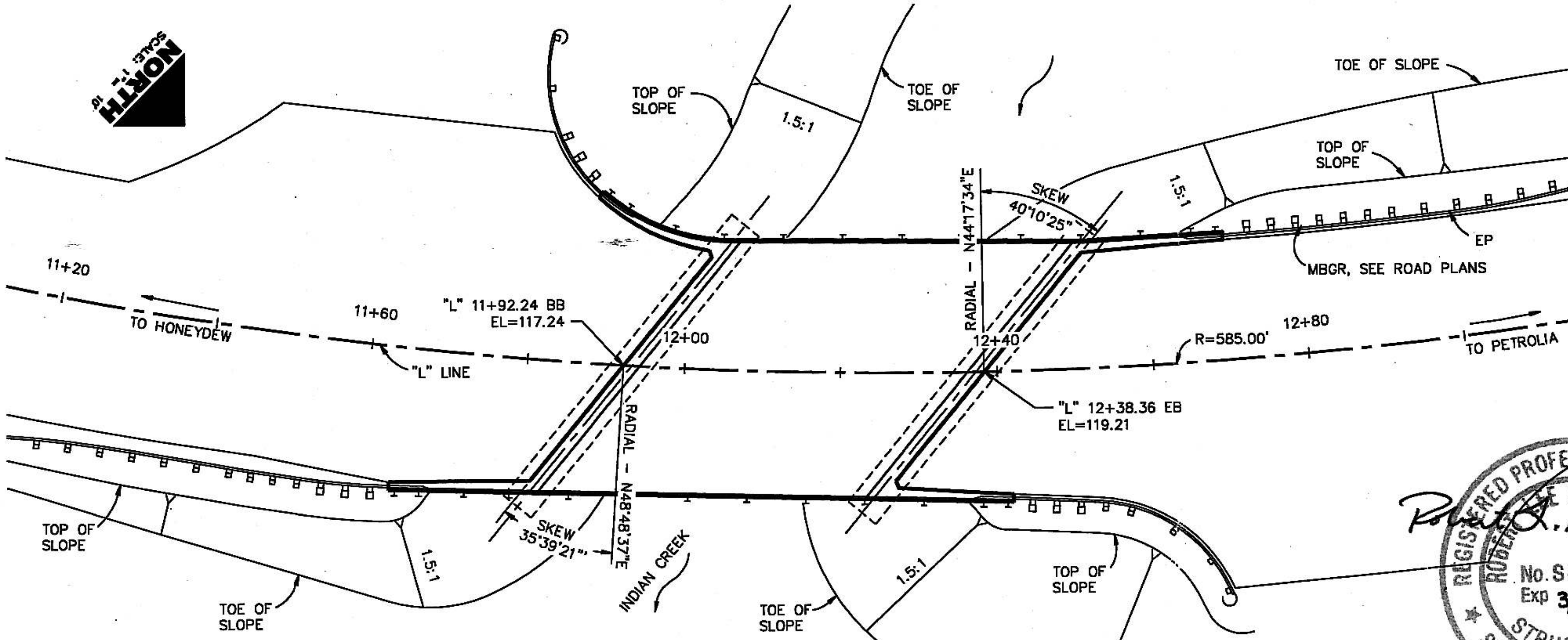
BAR IS ONE INCH ON ORIGINAL DRAWING IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY	ROAD NAME: MATTOLE ROAD ROAD NO: F3C010 MILE POST: 10.0 AGREEMENT No. P0310511 CONTRACT NO.: 204301 DRAWING FILE NAME: L:\PROJECTS\204301\DWG\CDSN04.DWG PLOT DATE: 07/25/2005	DESIGN SECTION R. L. BURNETT DESIGNED BY: LLH/RLM DRAWN BY: JAB/LLH REVIEWED BY: RLB APPROVED BY: CJW	COUNTY OF HUMBOLDT DEPARTMENT OF PUBLIC WORKS INDIAN CREEK BRIDGE – MATTOLE ROAD BRIDGE – GENERAL PLAN SHEET 4 OF 12



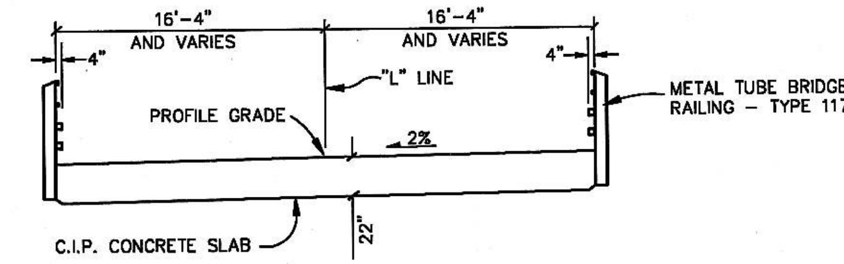
PROFILE
NOT TO SCALE



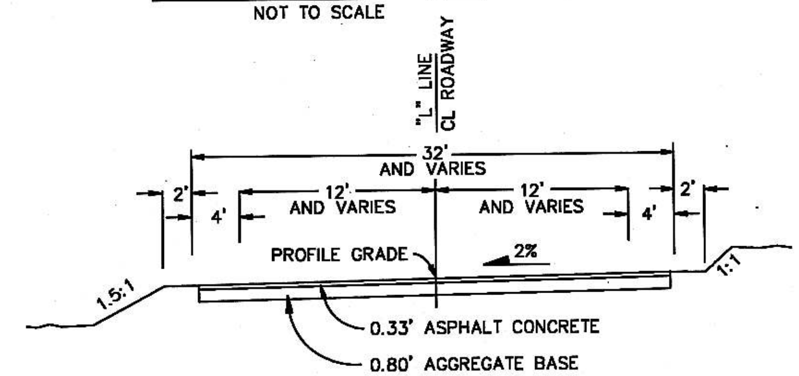
ELEVATION
SCALE 1"=10'



PLAN VIEW
SCALE 1"=10'



TYPICAL SECTION
NOT TO SCALE



TYPICAL ROAD SECTION
NOT TO SCALE

DESIGN NOTES, LOAD FACTOR DESIGN

DESIGN: BRIDGE DESIGN SPECIFICATIONS – 1996 AASHTO WITH INTERIMS AND REVISIONS BY CALTRANS SUPPLEMENTS

DEAD LOAD: INCLUDES 35 P.S.F. FOR FUTURE WEARING SURFACE

LIVE LOAD: HS20-44 AND ALTERNATIVE AND PERMIT DESIGN LOAD
REINFORCEMENT: fy = 60,000 P.S.I. (REINFORCING STEEL)
CONCRETE: fc = 3,250 P.S.I., n=9
PILES: DESIGN LOADING = 45 TON

CONSTRUCTION: STATE OF CALIFORNIA STANDARD SPECS., DATED JULY, 2002 AND THE PROJECT SPECIAL PROVISIONS.

SEISMIC LOADING: PEAK ROCK ACCELERATION 0.7g
SOIL PROFILE – TYPE D

PILE DATA - STEEL PILES

LOCATION	DESIGN LOADING	TYPE	SPECIFIED TIP ELEV.	PROBABLE TIP ELEV.
WEST ABUT	45 TON	HP10X57	80.0	78.0
EAST ABUT	45 TON	HP10X57	80.0	78.0

HYDROLOGIC SUMMARY

DRAINAGE AREA: 2.42 SQ MILES

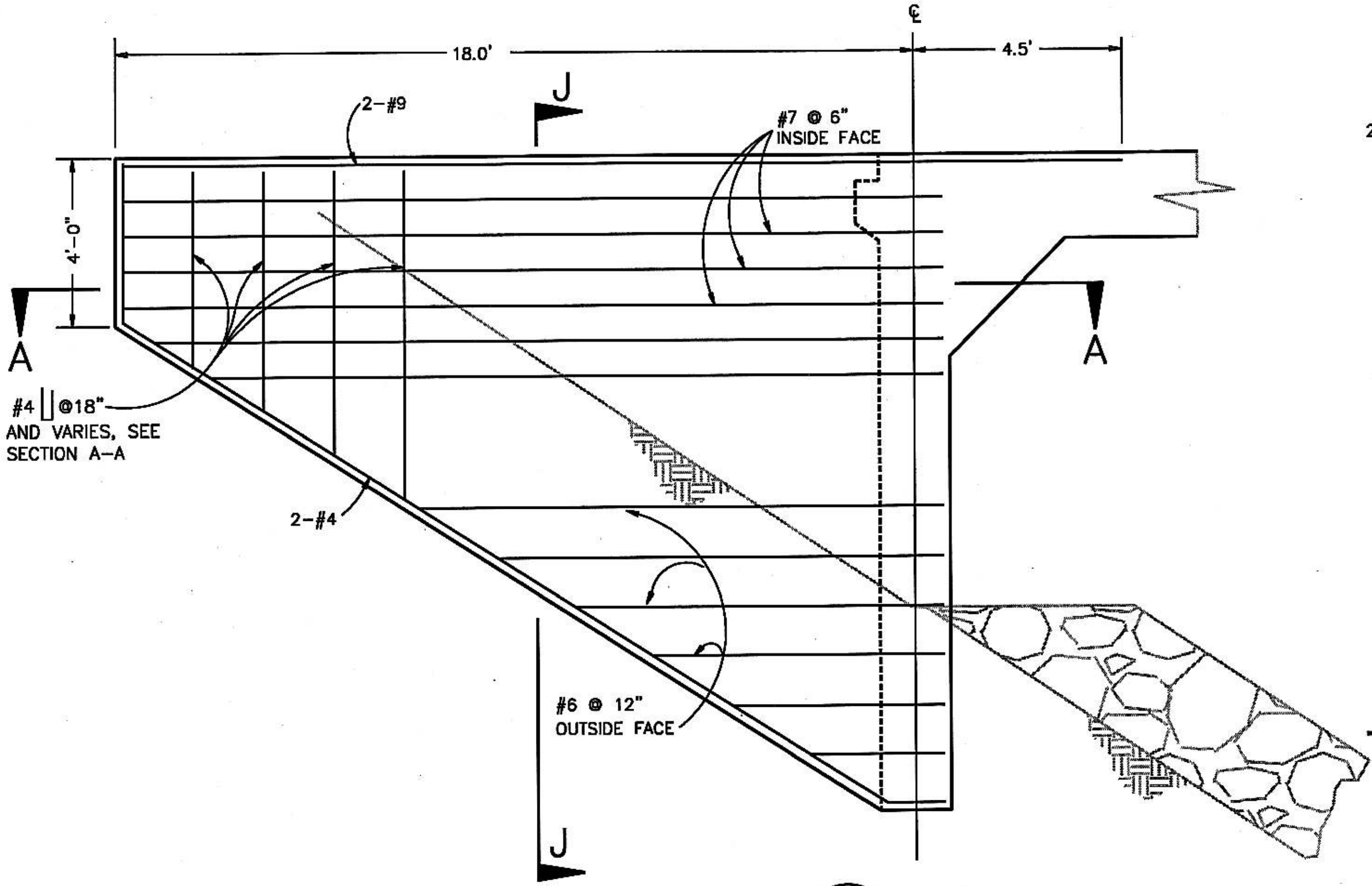
	DESIGN FLOOD	BASE FLOOD	OVERTOPPING FLOOD
FREQUENCY (YEARS)	100	100	
DISCHARGE (C.F.S.)	1123	1123	
WATER SURFACE (ELEV. AT BRIDGE)	105.5	105.5	115.5

Flood plain data is based upon information available when the plans were prepared and are shown to meet federal requirements.

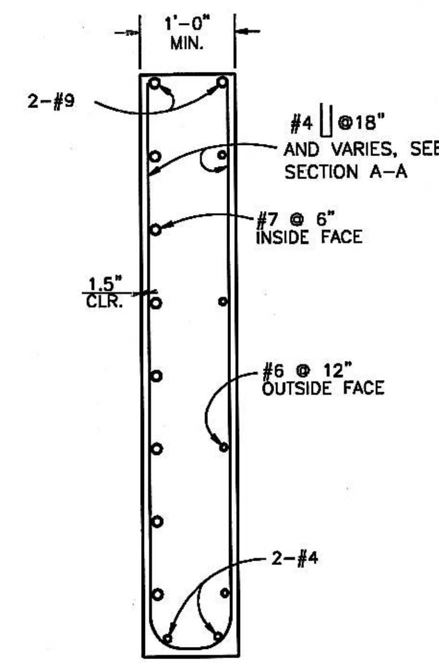
The accuracy of said information is not warranted by Morrison Structures, Inc or the County and interested or affected parties should make their own investigation.

REGISTERED PROFESSIONAL ENGINEER ROBERT E. MORRISON JR No. S 003577 Exp 3/31/07 STRUCTURAL STATE OF CALIFORNIA

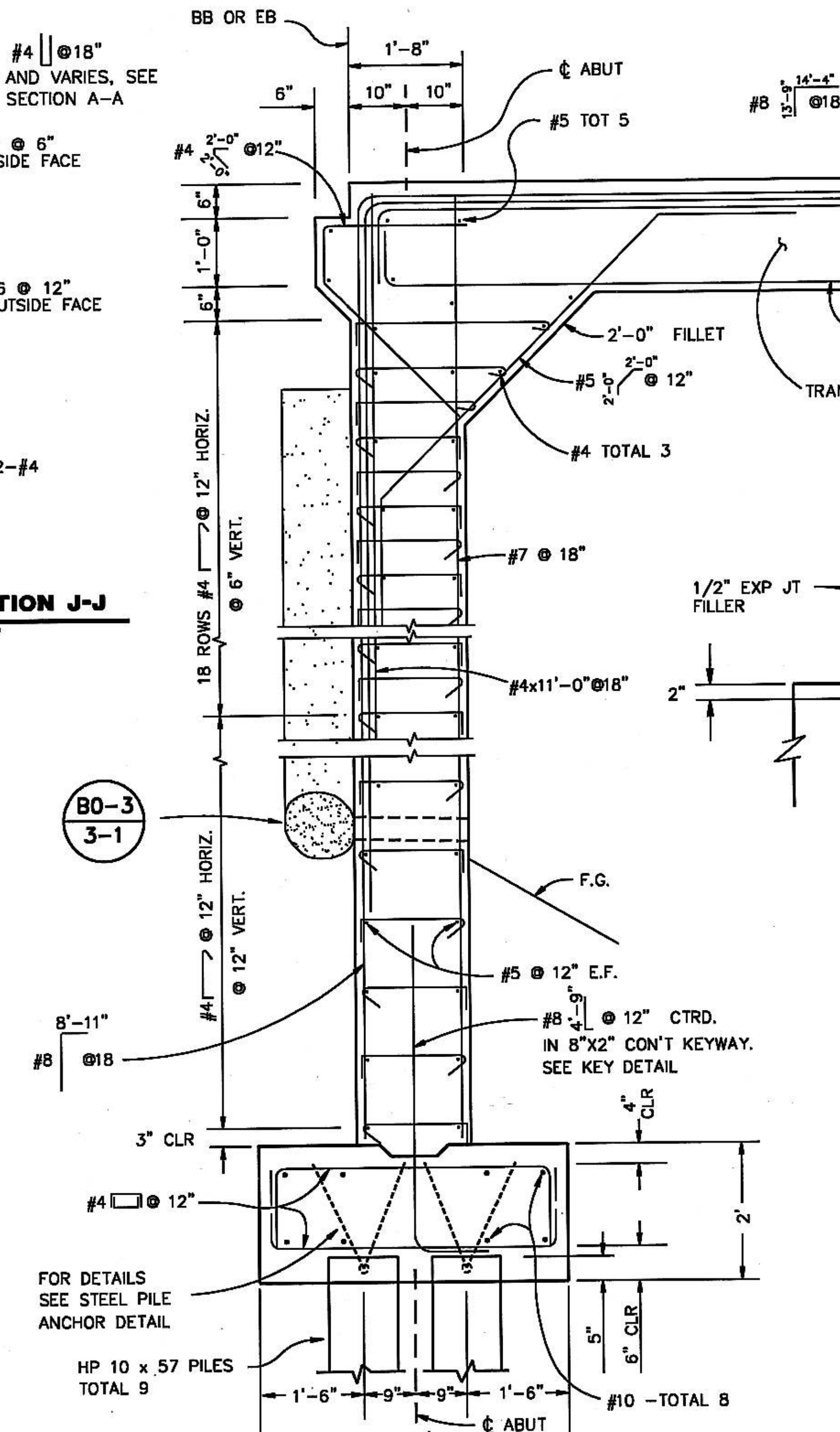
BAR IS ONE INCH ON ORIGINAL DRAWING IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY	ROAD NAME: MATTOLE ROAD ROAD NO: F3C010 MILE POST: 10.0 AGREEMENT No. P0310511 CONTRACT NO.: 204301 DRAWING FILE NAME: L:\PROJECTS\204301\DWG\CDSN05.DWG PLOT DATE: 07/25/2005	DESIGN SECTION R. L. BURNETT DESIGNED BY: LLH/RLM DRAWN BY: JAB/LLH REVIEWED BY: RLB APPROVED BY: CJW	COUNTY OF HUMBOLDT DEPARTMENT OF PUBLIC WORKS INDIAN CREEK BRIDGE – MATTOLE ROAD ABUTMENT, WINGWALL, AND FOOTING DETAILS SHEET 5 OF 12



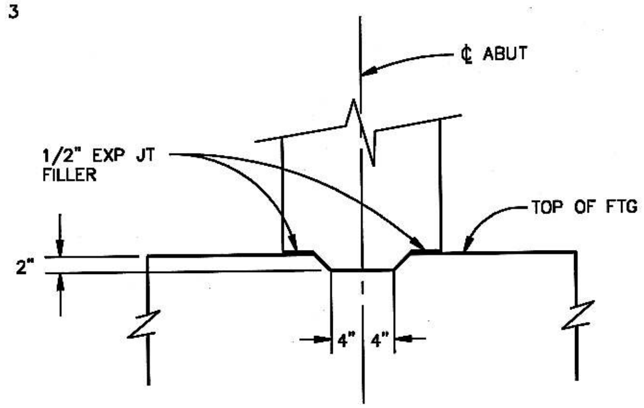
ELEVATION
NTS
B0-1 / 1-5



WINGWALL SECTION J-J
SCALE: 1"=1'



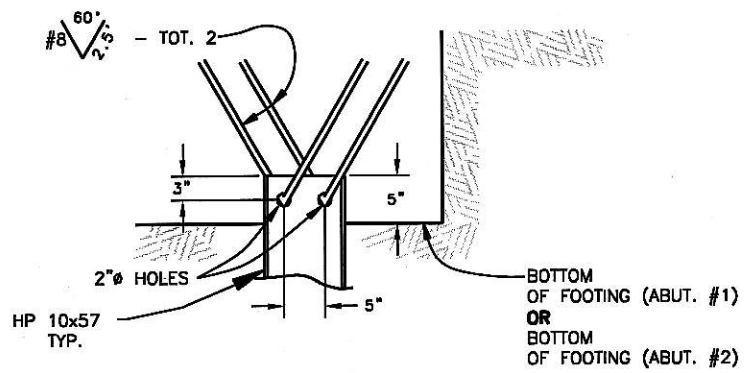
DIAPHRAGM ABUTMENT WITH FOOTING
SCALE: 3/4"=1'



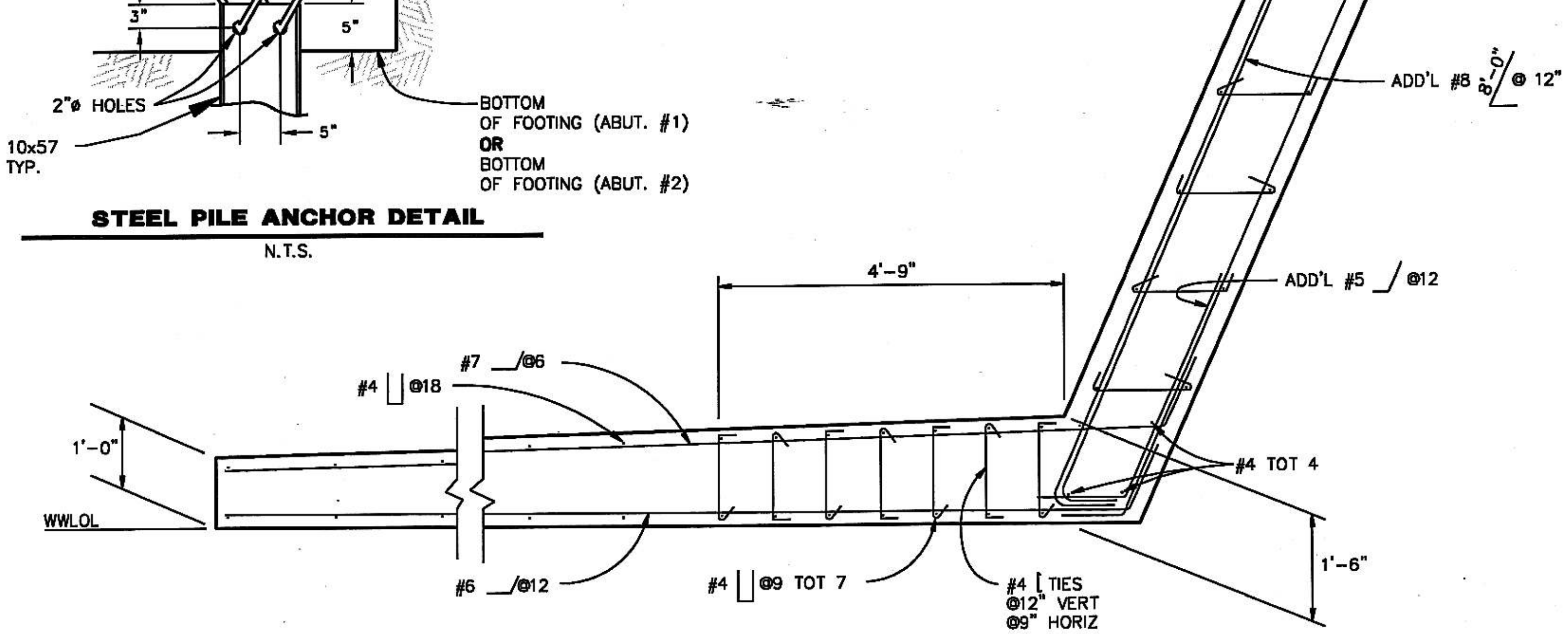
KEY DETAIL
SCALE: 1"=1'

NOTES:

1. PLACE BACKFILL BEHIND BOTH ABUTMENTS SIMULTANEOUSLY AFTER DECK HAS BEEN PLACED.



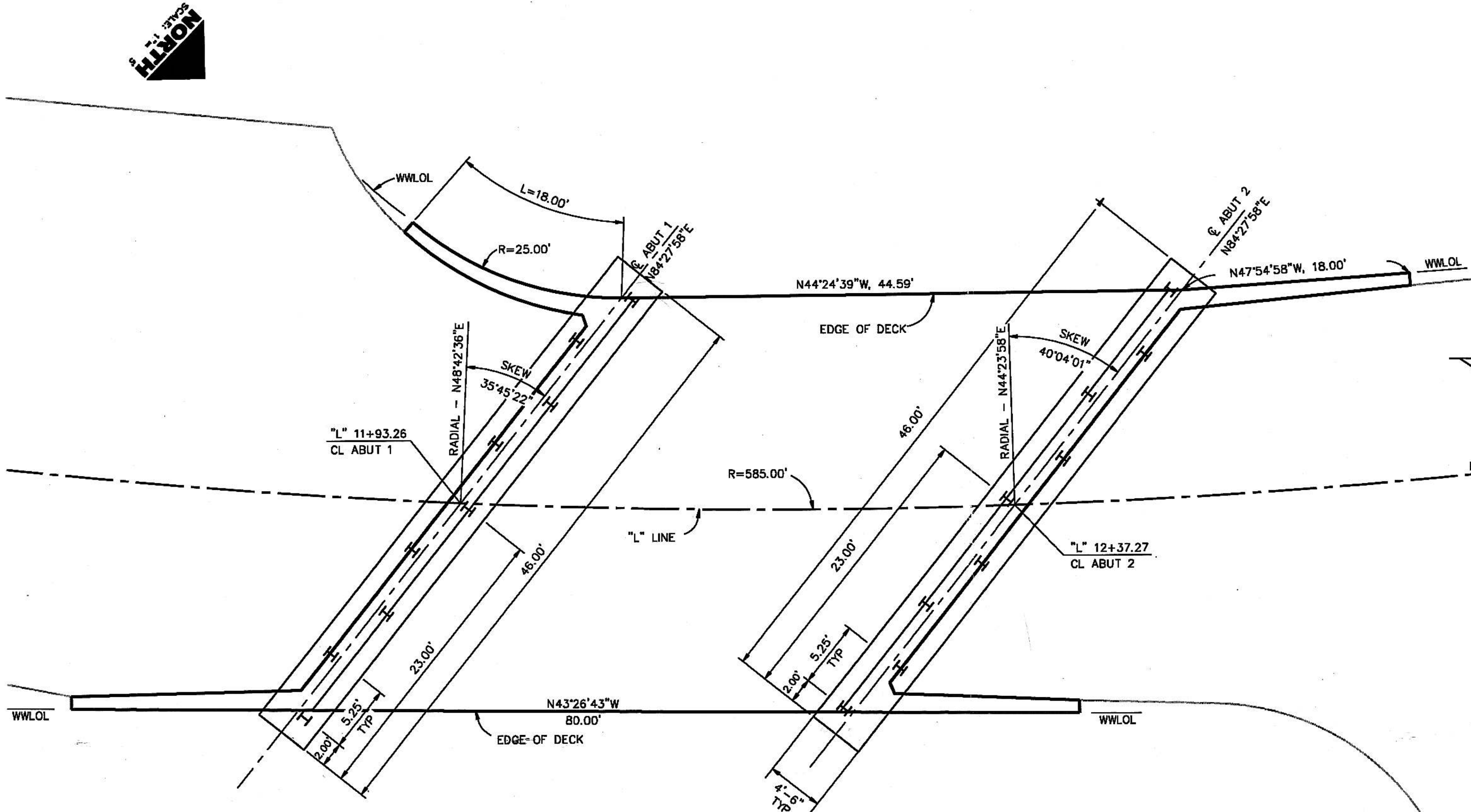
STEEL PILE ANCHOR DETAIL
N.T.S.



SECTION A-A
SCALE: 3/4"=1'

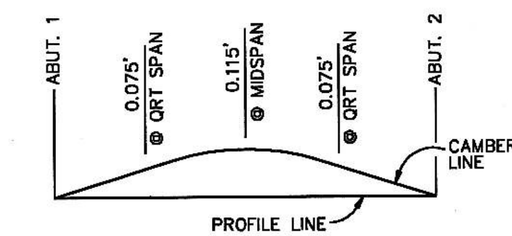
REGISTERED PROFESSIONAL ENGINEER
ROBERT LEE MORRISON JR
No. S 003577
Exp 3/31/07
STRUCTURAL
STATE OF CALIFORNIA

BAR IS ONE INCH ON ORIGINAL DRAWING. IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY	ROAD NAME: MATTOLE ROAD		DESIGN SECTION R. L. BURNETT	COUNTY OF HUMBOLDT DEPARTMENT OF PUBLIC WORKS	SHEET 6
	ROAD NO: F3C010	MILE POST: 10.0	DESIGNED BY: LLH/RLM	INDIAN CREEK BRIDGE – MATTOLE ROAD	OF
	AGREEMENT No. P0310511		DRAWN BY: JAB/LLH	PLAN VIEW – ABUTMENTS WINGWALLS AND PILES	12
	CONTRACT NO.: 204301		REVIEWED BY: RLB		
	DRAWING FILE NAME: L:\PROJECTS\204301\DWG\CDSN06.DWG		APPROVED BY: CJW		
	PLOT DATE: 07/25/2005				



PLAN VIEW - ABUTMENTS

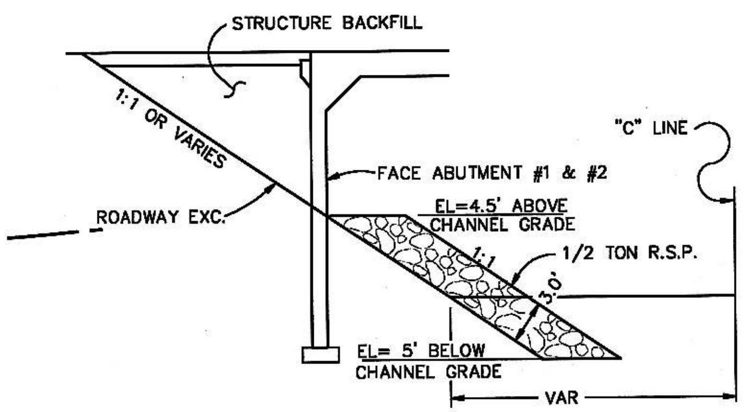
SCALE: 1" = 5'



CAMBER DIAGRAM

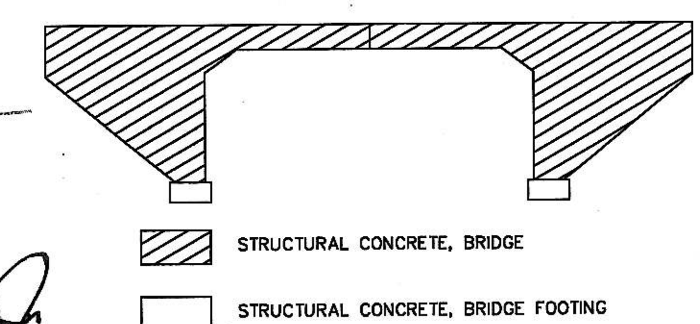
NO SCALE

NOTE: DOES NOT INCLUDE ALLOWANCES FOR FALSEWORK SETTLEMENT



TYPICAL SECTION R.S.P.

NO SCALE

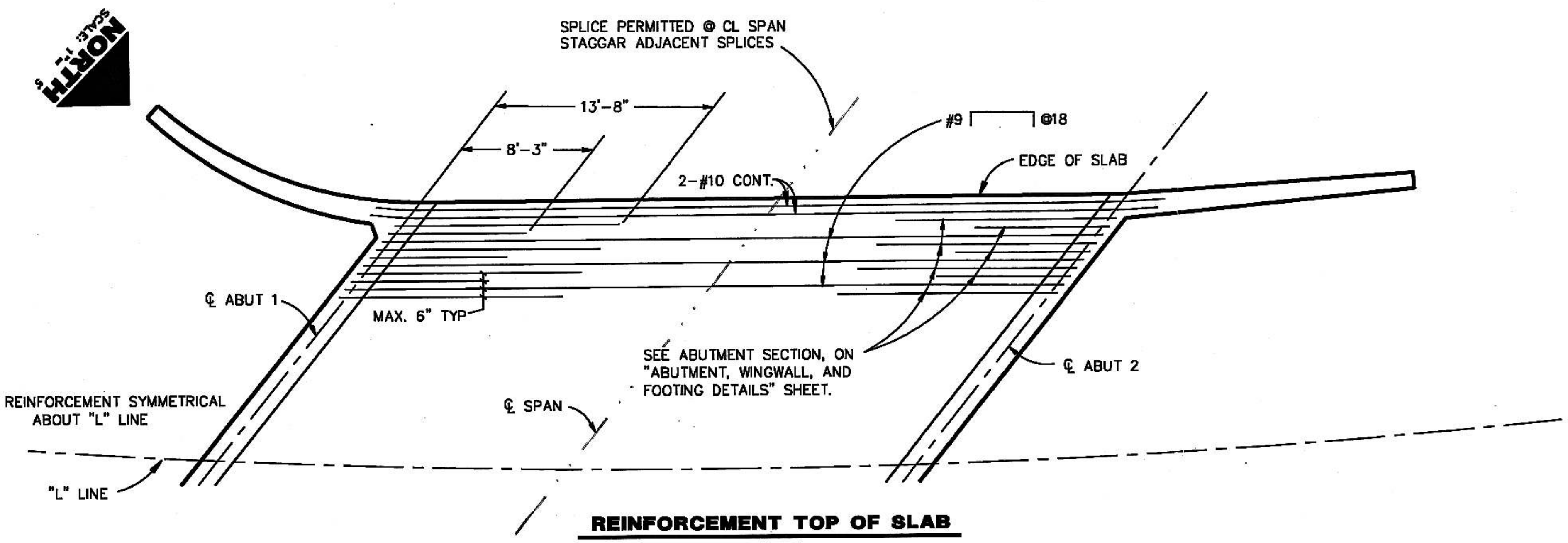


CONCRETE TYPE LIMITS

NO SCALE

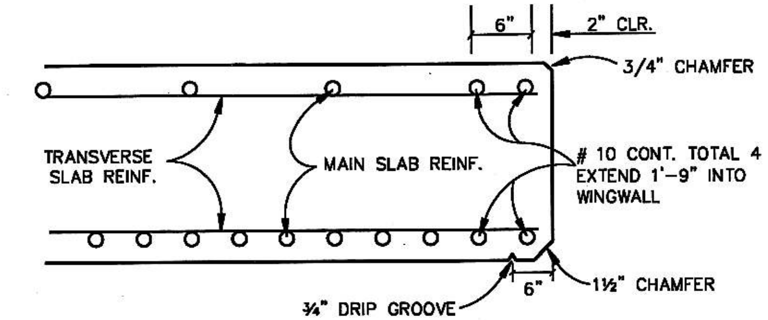
REGISTERED PROFESSIONAL ENGINEER
ROBERT LEE MORRISON JR
No. S 003577
Exp 3/31/07
STRUCTURAL
STATE OF CALIFORNIA

BAR IS ONE INCH ON ORIGINAL DRAWING IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY	ROAD NAME: MATTOLE ROAD ROAD NO: F3C010 MILE POST: 10.0 AGREEMENT No. P0310511 CONTRACT NO.: 204301 DRAWING FILE NAME: L:\PROJECTS\204301\DWG\CDSN07.DWG PLOT DATE: 07/25/2005	DESIGN SECTION R. L. BURNETT DESIGNED BY: LLH/RLM DRAWN BY: JAB/LLH REVIEWED BY: RLB APPROVED BY: CJW	COUNTY OF HUMBOLDT DEPARTMENT OF PUBLIC WORKS INDIAN CREEK BRIDGE – MATTOLE ROAD BRIDGE SLAB REINFORCEMENT AND DETAILS SHEET 7 OF 12



REINFORCEMENT TOP OF SLAB

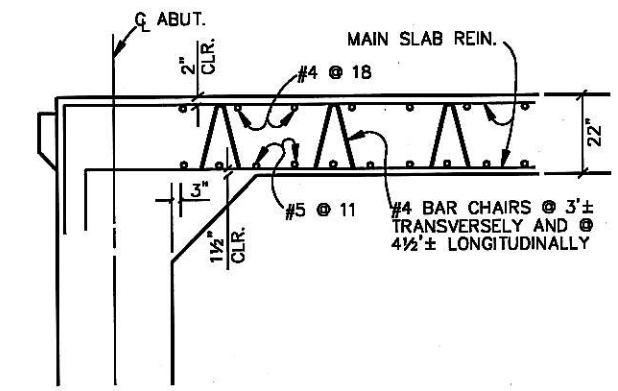
SCALE 1"= 5'



NOTE:
SEE RAIL DETAILS FOR ADDITIONAL REINFORCEMENT AND ANCHOR BOLTS

EDGE OF SLAB DETAIL

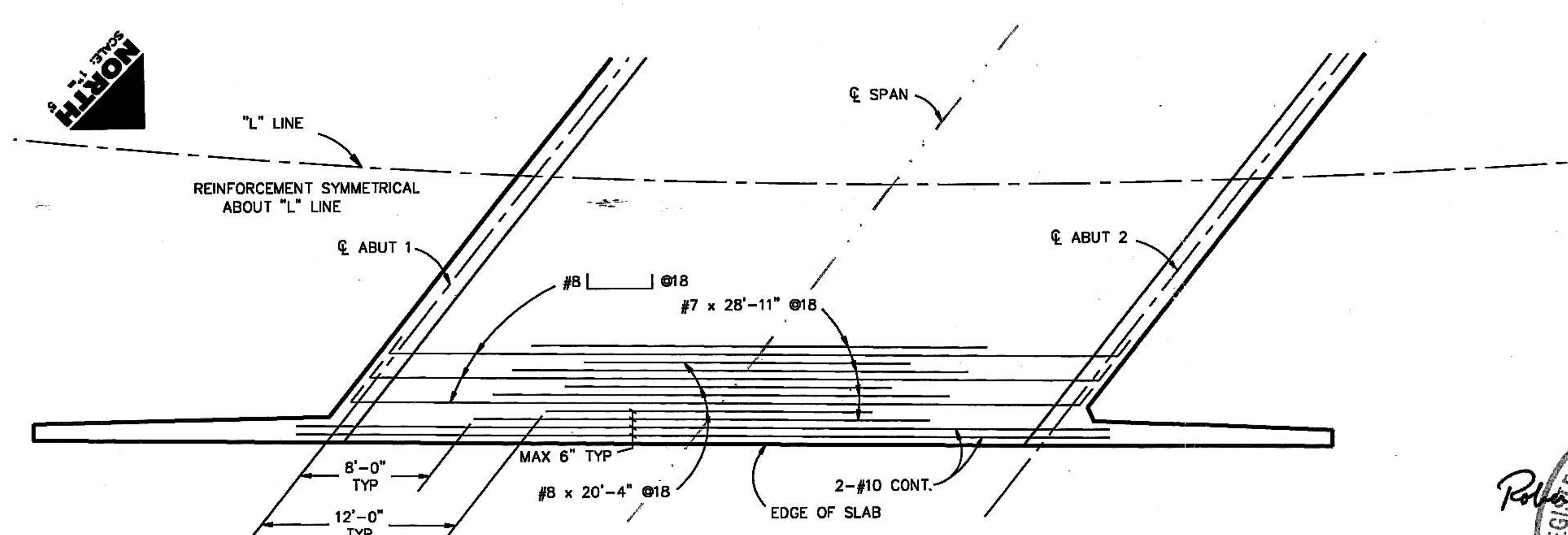
NOT TO SCALE



TRANSVERSE REINFORCEMENT

NOT TO SCALE

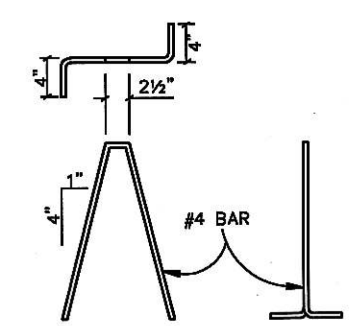
NOTE:
SPACING OF ALL TRANSVERSE BARS IS MEASURED ALONG ℄ OF ROADWAY. PLACE ALL TRANSVERSE BARS PARALLEL TO ABUTMENTS.



REINFORCEMENT BOT. OF SLAB

SCALE 1" = 5'

REGISTERED PROFESSIONAL ENGINEER ROBERT LEE MORRISON JR No. S 003577 Exp 3/31/07 STRUCTURAL STATE OF CALIFORNIA

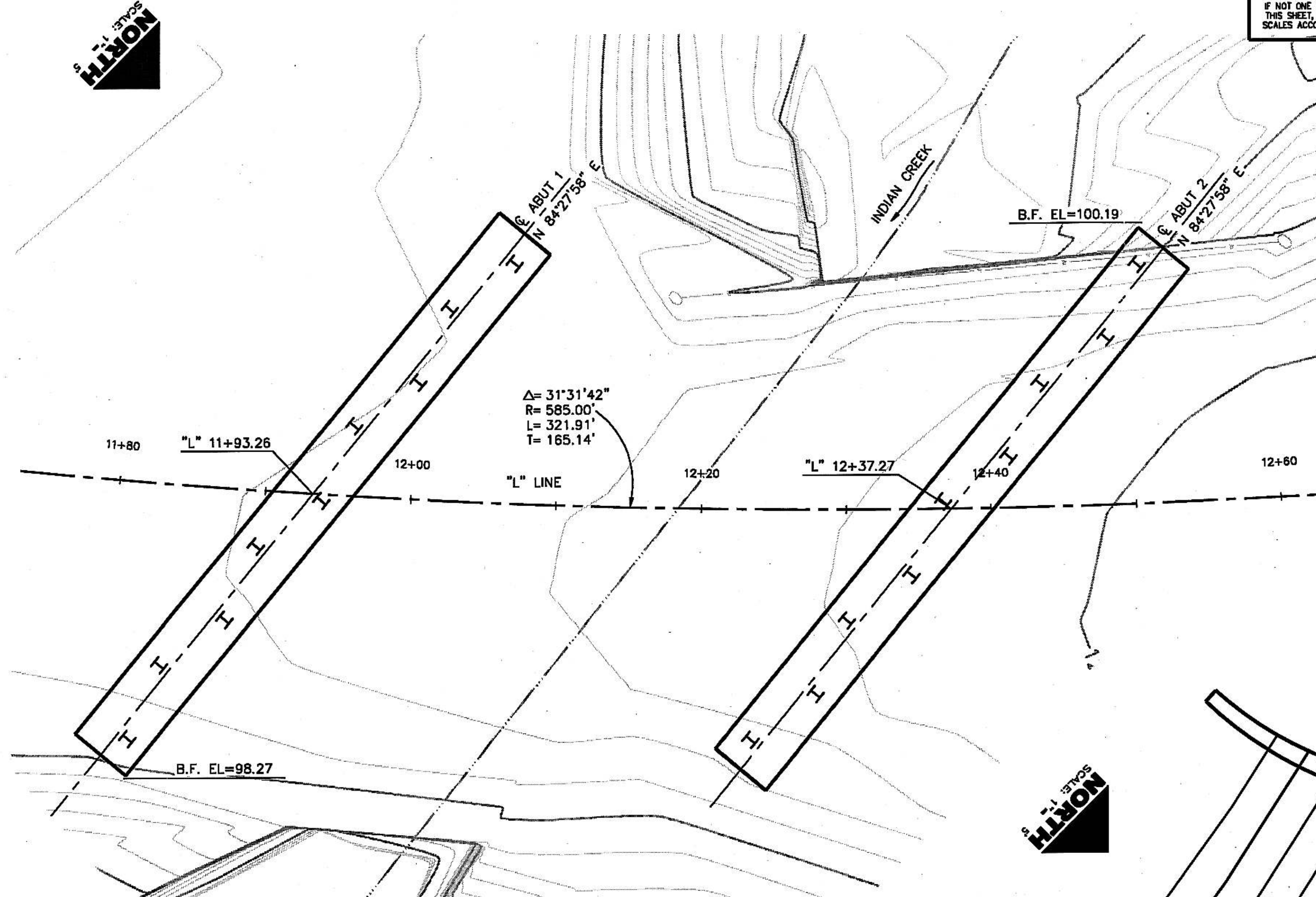


BAR CHAIR DETAIL

NOT TO SCALE

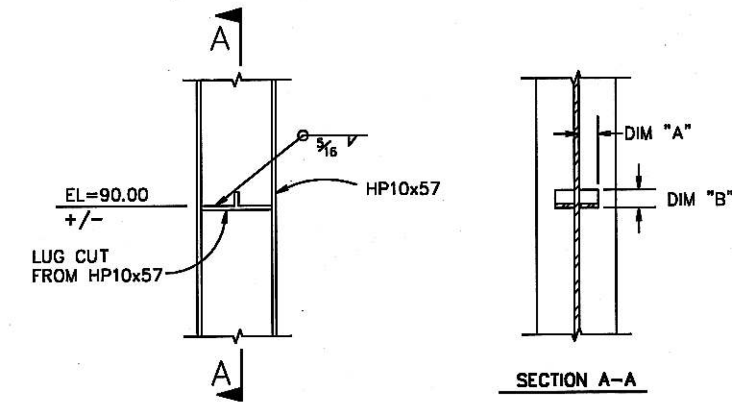
BAR IS ONE INCH ON ORIGINAL DRAWING. IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY	ROAD NAME: MATTOLE ROAD		DESIGN SECTION R. L. BURNETT	COUNTY OF HUMBOLDT DEPARTMENT OF PUBLIC WORKS
	ROAD NO: F3C010	MILE POST: 10.0	DESIGNED BY: LLH/RLM	INDIAN CREEK BRIDGE – MATTOLE ROAD
	AGREEMENT No. P0310511		DRAWN BY: JAB/LLH	FOUNDATION PLAN AND DECK CONTOURS
	CONTRACT NO.: 204301		REVIEWED BY: RLB	
	DRAWING FILE NAME:	L:\PROJECTS\204301\DWG\CDSN08.DWG	APPROVED BY: CJW	
	PLOT DATE: 07/25/2005			

SHEET 8 OF 12



FOUNDATION PLAN

SCALE: 1"=5'
CONTOUR INTERVAL: 1 FEET



NOTES:

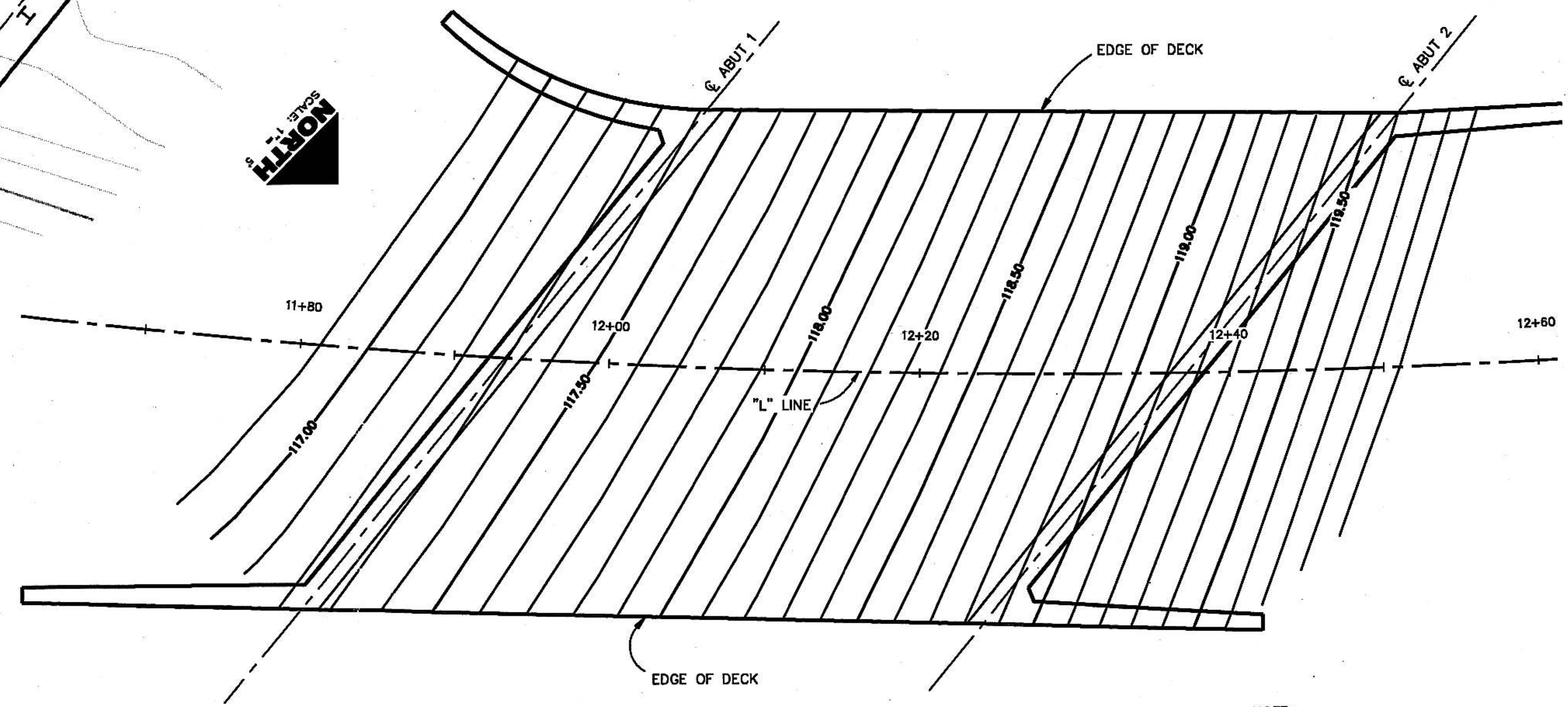
1) LUGS SHALL BE FURNISHED IF ORDERED BY THE ENGINEER AND PAID FOR AS EXTRA WORK.

2) DIMENSIONS "A" AND "B" OF LUG SHALL BE DETERMINED BY THE ENGINEER.

PILE LUG DETAIL

SCALE: 1½"=1'–0"

REGISTERED PROFESSIONAL ENGINEER
ROBERT LEE MORRISON JR
No. S 003577
Exp 3/31/07
STRUCTURAL
STATE OF CALIFORNIA



DECK CONTOURS

SCALE: 1"=5'
CONTOUR INTERVAL: 0.10 FEET

NOTE:
CONTOURS DO NOT INCLUDE CAMBER.

LEGEND

I INDICATES STEEL PILES

FOUNDATION NOTES:

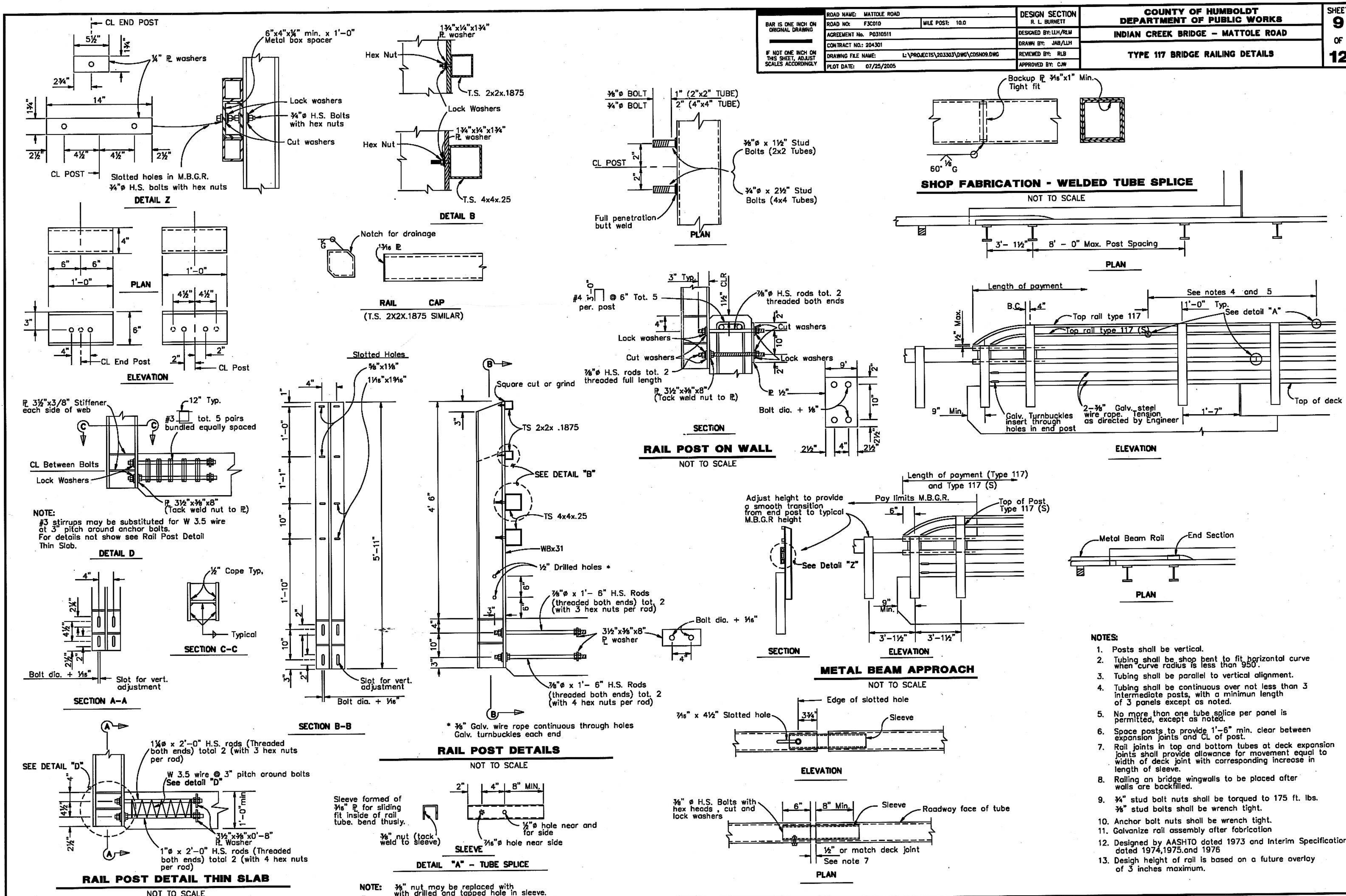
CONTOURS BASED ON TOPOGRAPHIC SURVEY DATED 8/19/04 BY O.L.A.

BENCH MARKS

TBM ON CP#200 – CPSPK ELEVATION 114.98
CP#101 – REBAR ELEVATION 147.27
CP#10 – REBAR ELEVATION 116.85

ROAD NAME: MATTOLE ROAD		DESIGN SECTION	COUNTY OF HUMBOLDT DEPARTMENT OF PUBLIC WORKS	SHEET 9 OF 12
ROAD NO: F3C010	MILE POST: 10.0	R. L. BURNETT		
AGREEMENT No. P0310511		DESIGNED BY: LLH/RLM	INDIAN CREEK BRIDGE – MATTOLE ROAD	
CONTRACT NO.: 204301		DRAWN BY: JAB/LLH	TYPE 117 BRIDGE RAILING DETAILS	
DRAWING FILE NAME: L:\PROJECTS\203303\DWG\CDSN09.DWG		REVIEWED BY: RLB		
PLOT DATE: 07/25/2005		APPROVED BY: CJW		

BAR IS ONE INCH ON ORIGINAL DRAWING. IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY

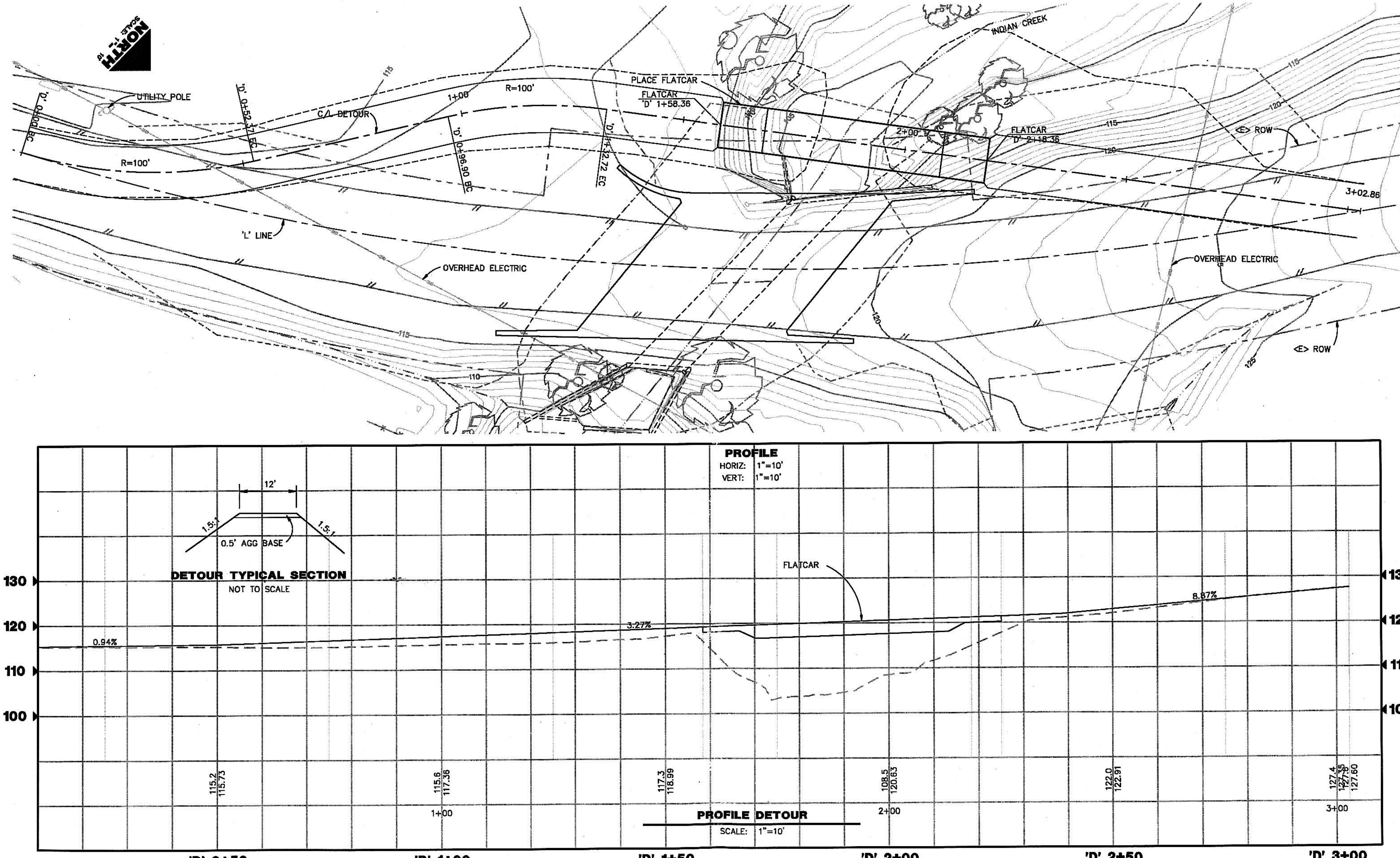


NOTES:

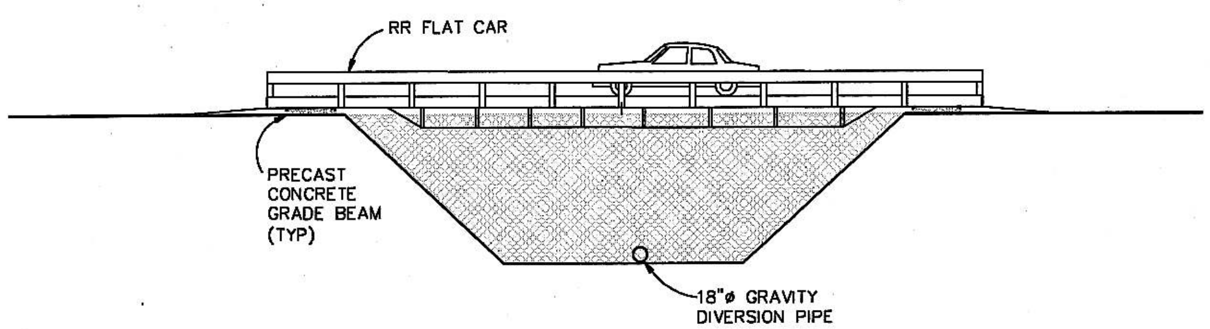
1. Posts shall be vertical.
2. Tubing shall be shop bent to fit horizontal curve when curve radius is less than 950'.
3. Tubing shall be parallel to vertical alignment.
4. Tubing shall be continuous over not less than 3 intermediate posts, with a minimun length of 3 panels except as noted.
5. No more than one tube splice per panel is permitted, except as noted.
6. Space posts to provide 1'-6" min. clear between expansion joints and CL of post.
7. Rail joints in top and bottom tubes at deck expansion joints shall provide allowance for movement equal to width of deck joint with corresponding increase in length of sleeve.
8. Railing on bridge wingwalls to be placed after walls are backfilled.
9. ¾" stud bolt nuts shall be torqued to 175 ft. lbs. ⅜" stud bolts shall be wrench tight.
10. Anchor bolt nuts shall be wrench tight.
11. Galvanize rail assembly after fabrication
12. Designed by AASHTO dated 1973 and Interim Specifications dated 1974,1975.and 1976
13. Design height of rail is based on a future overlay of 3 inches maximum.

BAR IS ONE INCH ON ORIGINAL DRAWING IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY	ROAD NAME: MATTOLE ROAD ROAD NO: F3C010 MILE POST: 10.0 AGREEMENT No. P0310511 CONTRACT NO.: 204301 DRAWING FILE NAME: L:\PROJECTS\204301\DWG\CDSN10.DWG PLOT DATE: 07/25/2005	DESIGN SECTION R. L. BURNETT DESIGNED BY: LLH/RLM DRAWN BY: JAB/LLH REVIEWED BY: RLB APPROVED BY: CJW	COUNTY OF HUMBOLDT DEPARTMENT OF PUBLIC WORKS INDIAN CREEK BRIDGE – MATTOLE ROAD DETOUR PLAN AND PROFILE STA 0+00 TO 3+02.86

SHEET 10 OF 12



BAR IS ONE INCH ON ORIGINAL DRAWING IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY	ROAD NAME: MATTOLE ROAD ROAD NO: F3C010 MILE POST: 10.0 AGREEMENT No. P03I0511 CONTRACT NO.: 204301 DRAWING FILE NAME: L:\PROJECTS\204301\DWG\CDSN11.DWG PLOT DATE: 07/25/2005	DESIGN SECTION R. L. BURNETT DESIGNED BY: LLH/RLM DRAWN BY: JAB/LLH REVIEWED BY: RLB APPROVED BY: CJW	COUNTY OF HUMBOLDT DEPARTMENT OF PUBLIC WORKS INDIAN CREEK BRIDGE – MATTOLE ROAD DETOUR DETAILS, EROSION CONTROL AND WATER MANAGEMENT PLAN	SHEET 11 OF 12



FLATCAR DETOUR ELEVATION VIEW

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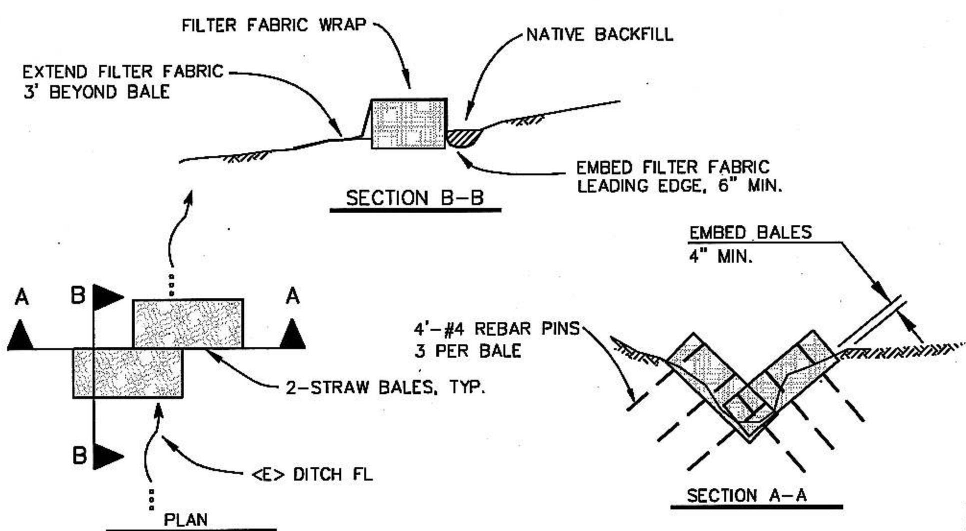

SILT DAM DETAIL

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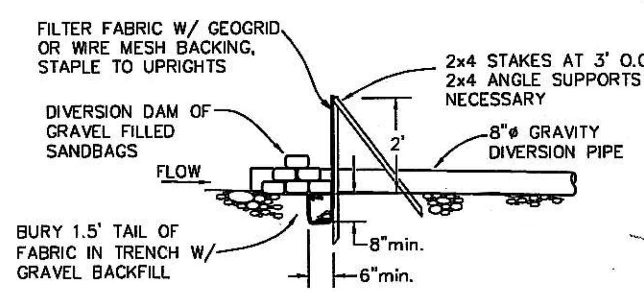

DETAIL

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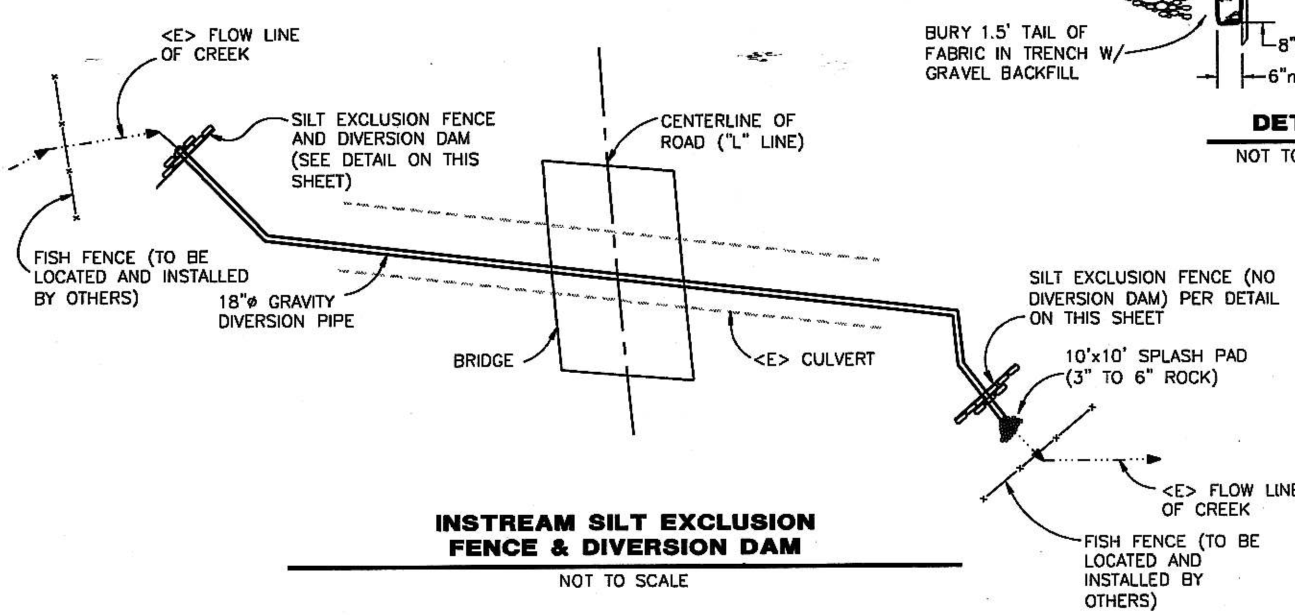

INSTREAM SILT EXCLUSION FENCE & DIVERSION DAM

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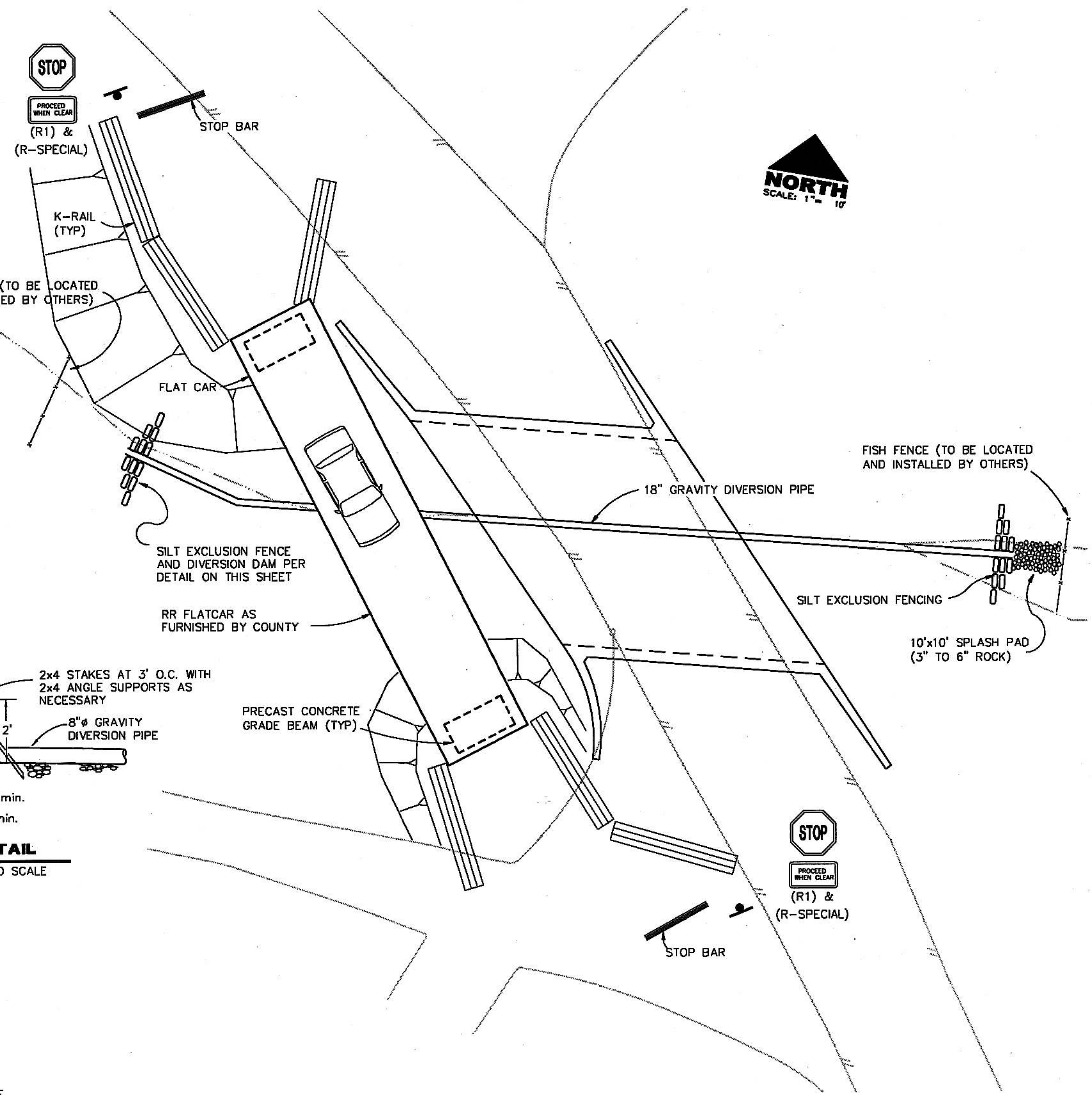


FLATCAR DETOUR PLAN VIEW

NOT TO SCALE

DIST.	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET NO.	TOTAL SHEETS
04	Hum	C.R.		12	12

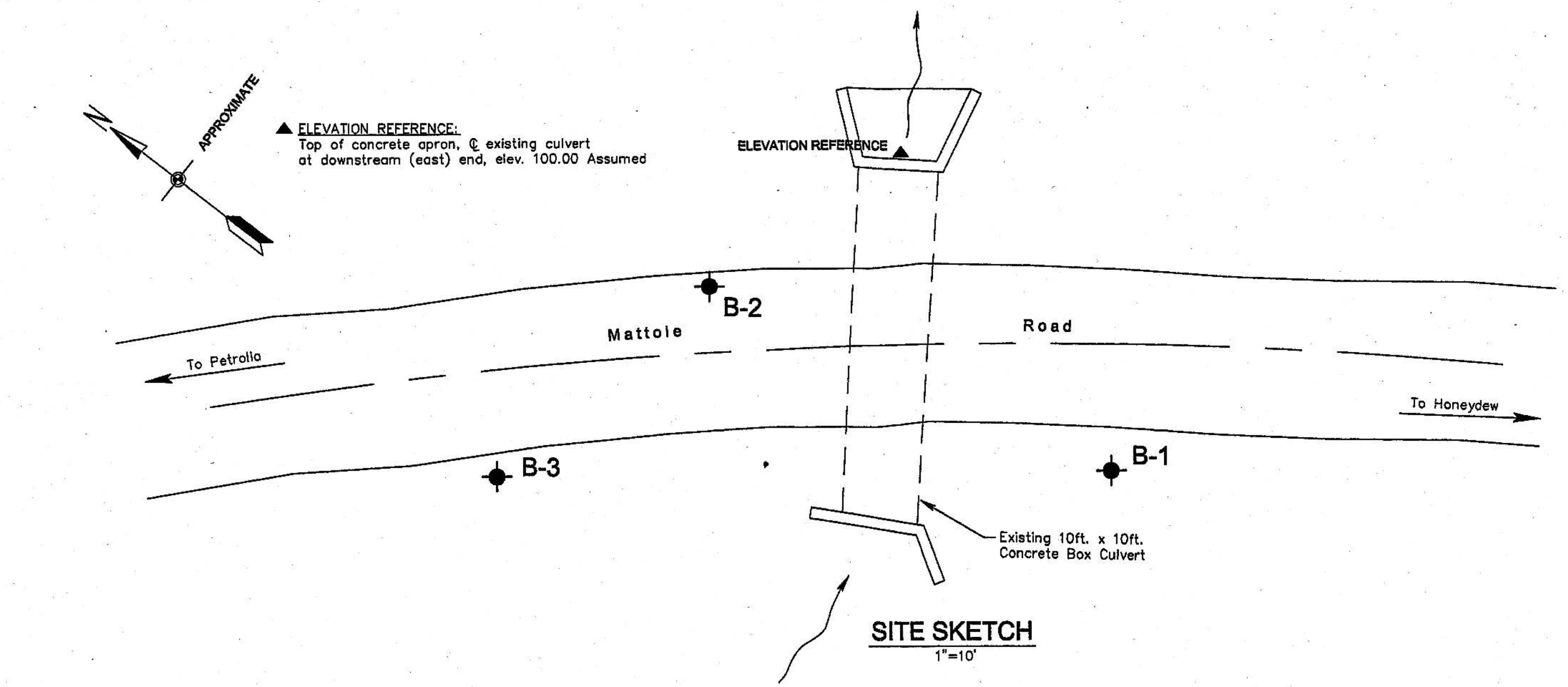
W. Eric Nichols
REGISTERED ENGINEERING GEOLOGIST

10/19/2004
PLANS APPROVAL DATE

TABER CONSULTANTS
3911 West Capitol Avenue
West Sacramento, CA 95691-2116

JOB No. 1P1/304/124 LOCATION: 40124-C3:128N:001W

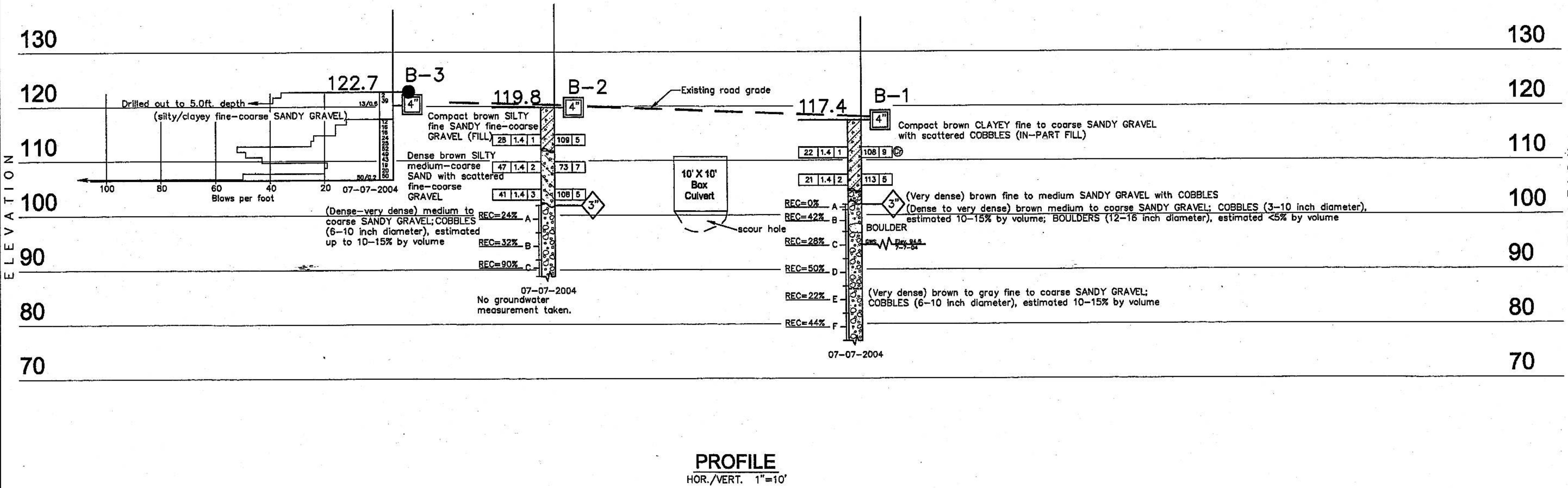
REGISTERED GEOLOGIST William E. Nichols No. 2229 Exp. 1-31-06 CERTIFIED ENGINEERING GEOLOGIST STATE OF CALIFORNIA



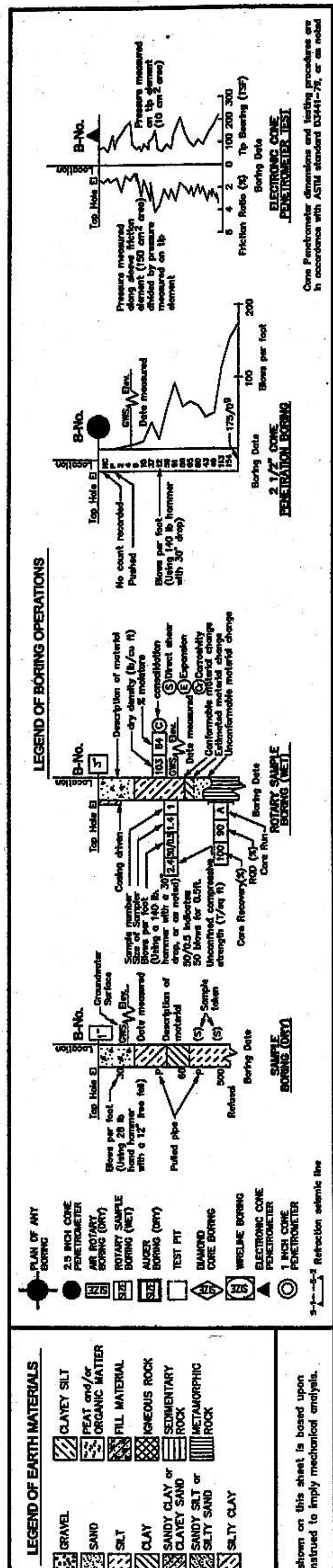
SITE SKETCH
1"=10'

NOTES:

1. Field classification of soils was in accordance with ASTM D 2488-00 "Description and Identification of Soils (Visual-Manual Procedure)".
2. Standard Penetration tests were performed in accordance with ASTM D 1586-99 using a safety hammer operated with cat-head, rope and pully. Drill rods were 1 5/8-inch diameter "A"-rods; sampler was driven with brass liners.
3. The length of each sampled interval is shown graphically on the boring log. Whole number blow counts ("N") represent the "standard penetration resistance" interval in accordance with ASTM D1586-99. Where less than 1 foot of penetration is achieved, the blow count shown is for that fraction of the "standard penetration resistance" interval actually penetrated.
4. Consistency of soils shown in ( ) where estimated.
5. Groundwater surface elevations in the borings indicated on the Log of Test Boring Sheets reflect the fluid level in the borings on the specified date.
6. Groundwater surface elevations are subject to seasonal fluctuations and may occur at higher or lower elevations depending on the conditions at any particular time.



PROFILE
HOR./VERT. 1"=10'



NOTE: Classification of earth material as shown on this sheet is based upon field inspection and is not to be construed to imply mechanical analysis.

DESIGN OVERSIGHT	DRAWN BY	M. D. Robertson	R. C. Pickard FIELD INVESTIGATOR
SIGN OFF DATE	CHECKED BY	R. C. Pickard	DATE July 2004

PREPARED FOR
HUMBOLDT COUNTY
DEPARTMENT OF PUBLIC WORKS

PROJECT ENGINEER

BRIDGE NO.
POST MILE

MATTOLE ROAD BRIDGE AT INDIAN CREEK

LOG OF TEST BORINGS

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

CU
EA

DISREGARD PRINTS BEARING EARLIER REVISION DATES

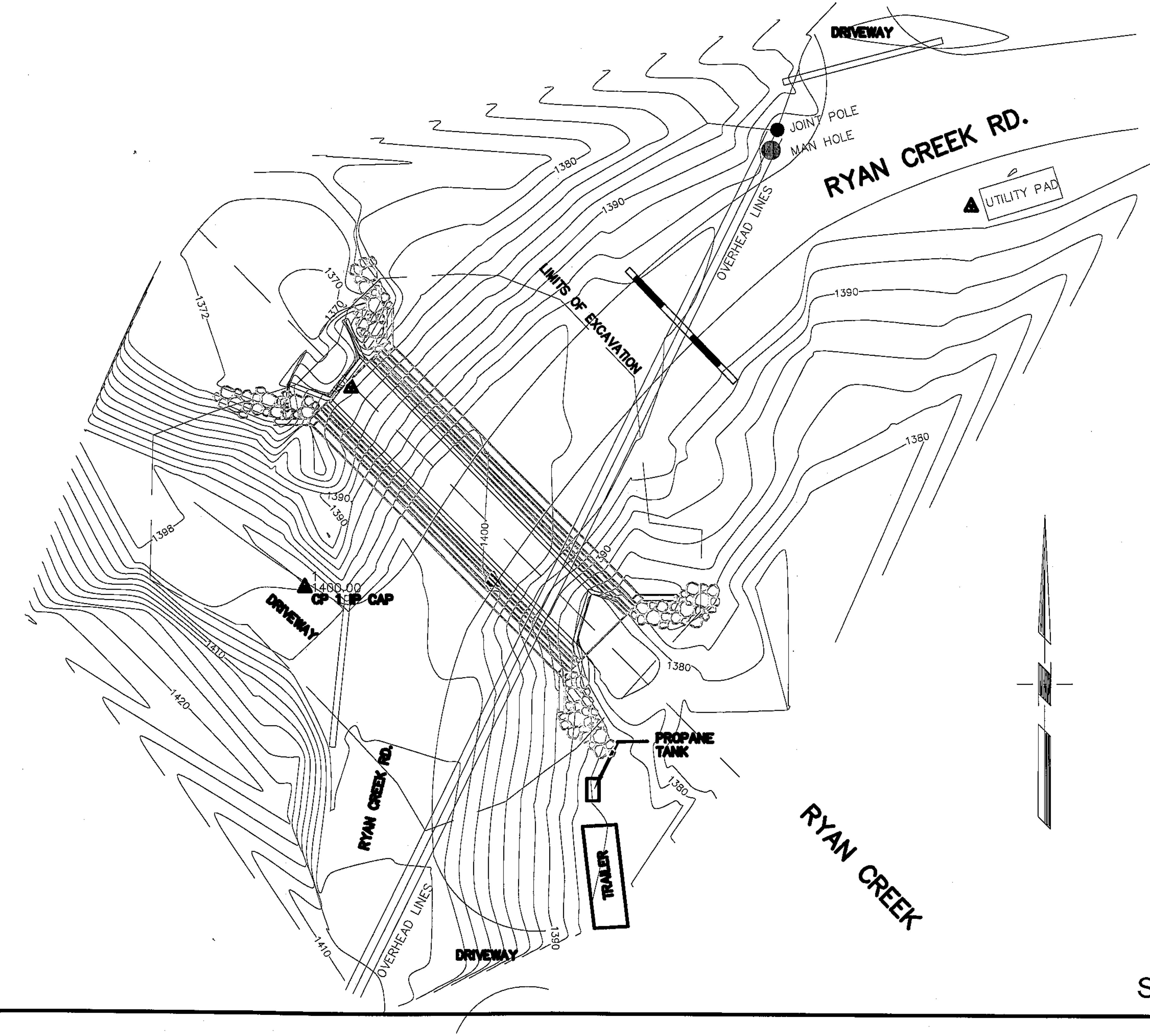
REVISION DATES (PRELIMINARY STAGE ONLY)

SHEET OF

08/12/04 1P1304124.dwg

Attachment 4

Ryan Creek Migration Barrier Removal Project Plans



SCALE 1" = 25'

MENDOCINO COUNTY DEPARTMENT OF TRANSPORTATION

DRAINAGE AND HABITAT CONSERVATION DIVISION OF LAND IMPROVEMENT

340 LAKE MENDOCINO DRIVE UKIAH, CA 95482 (707) 463-4363 FAX (707) 463-5474

DESIGNED BY A.M.S.
CHECKED BY H.N.D.
DRAWN BY A.M.S.

HOWARD N. DASHIELL RCE 42001 DATE XX-XX-01

HOWARD N. DASHIELL DIRECTOR DATE XX-XX-01

RYAN CREEK FISH BARRIER REMOVAL 2007

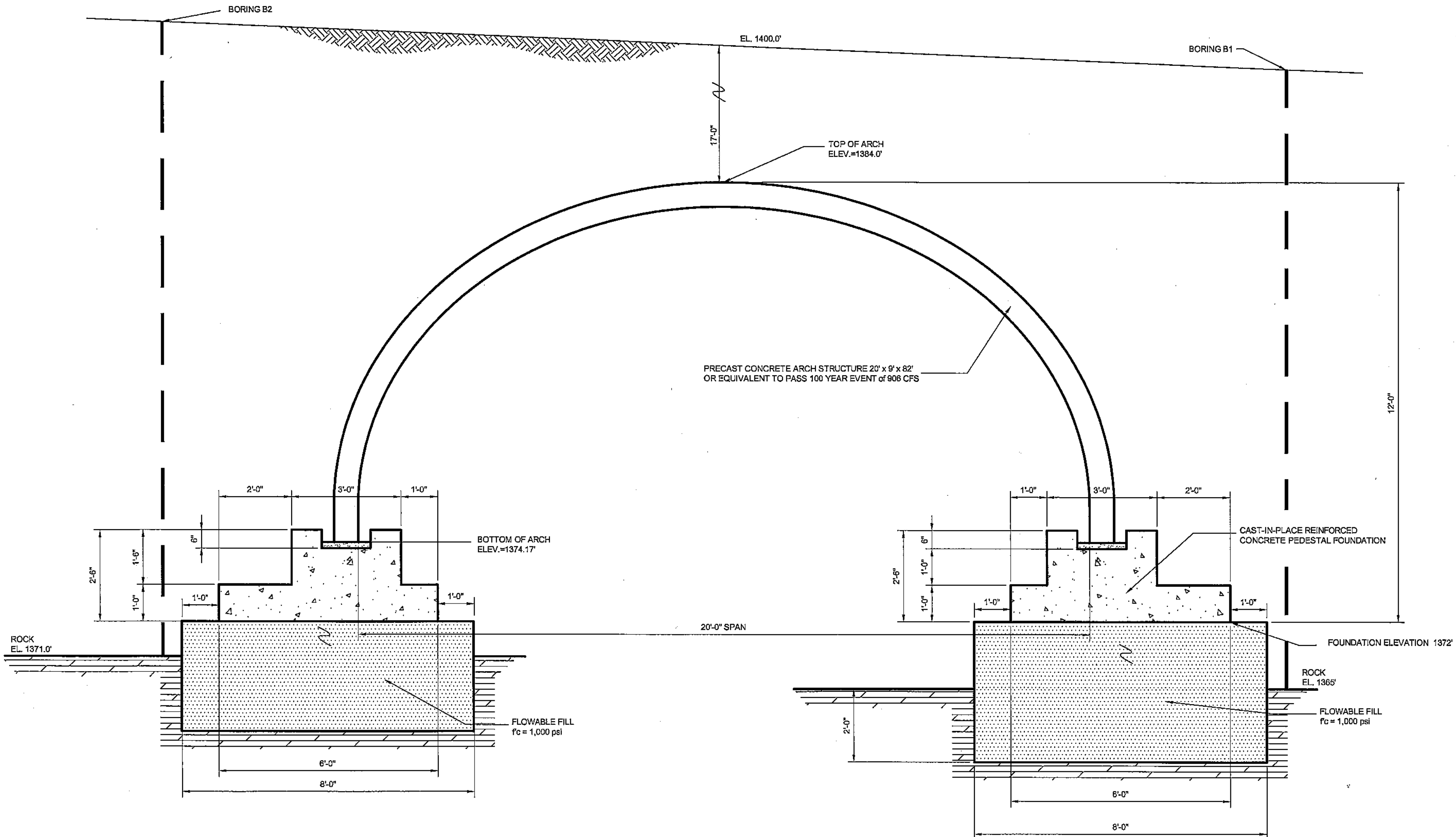
CR.310C.–.MP.0.17.–,WILLITS,CA.
RYAN.CREEK

PLAN VIEW

DATE 03-16-2006

JOB NO. D-0202

DRAWING NUMBER 1 OF 3



TYPICAL SECTION

NOT TO SCALE

DIMENSIONS GIVEN ARE FOR ILLUSTRATIVE PURPOSRES ONLY FROM (BEBO TYPE E20/4 PRECAST CONCRETE ARCH ELEMENT)

MENDOCINO COUNTY DEPARTMENT OF TRANSPORTATION
DRAINAGE AND HABITAT CONSERVATION DIVISION OF LAND IMPROVEMENT
340 LAKE MENDOCINO DRIVE UKIAH, CA 95482 (707) 463-4363 FAX (707) 463-5474

DESIGNED BY A.M.S.
CHECKED BY H.N.D.
DRAWN BY A.M.S.

HOWARD N. DASHIELL RCE 42001 DATE XX-XX-01

HOWARD N. DASHIELL DIRECTOR DATE XX-XX-01

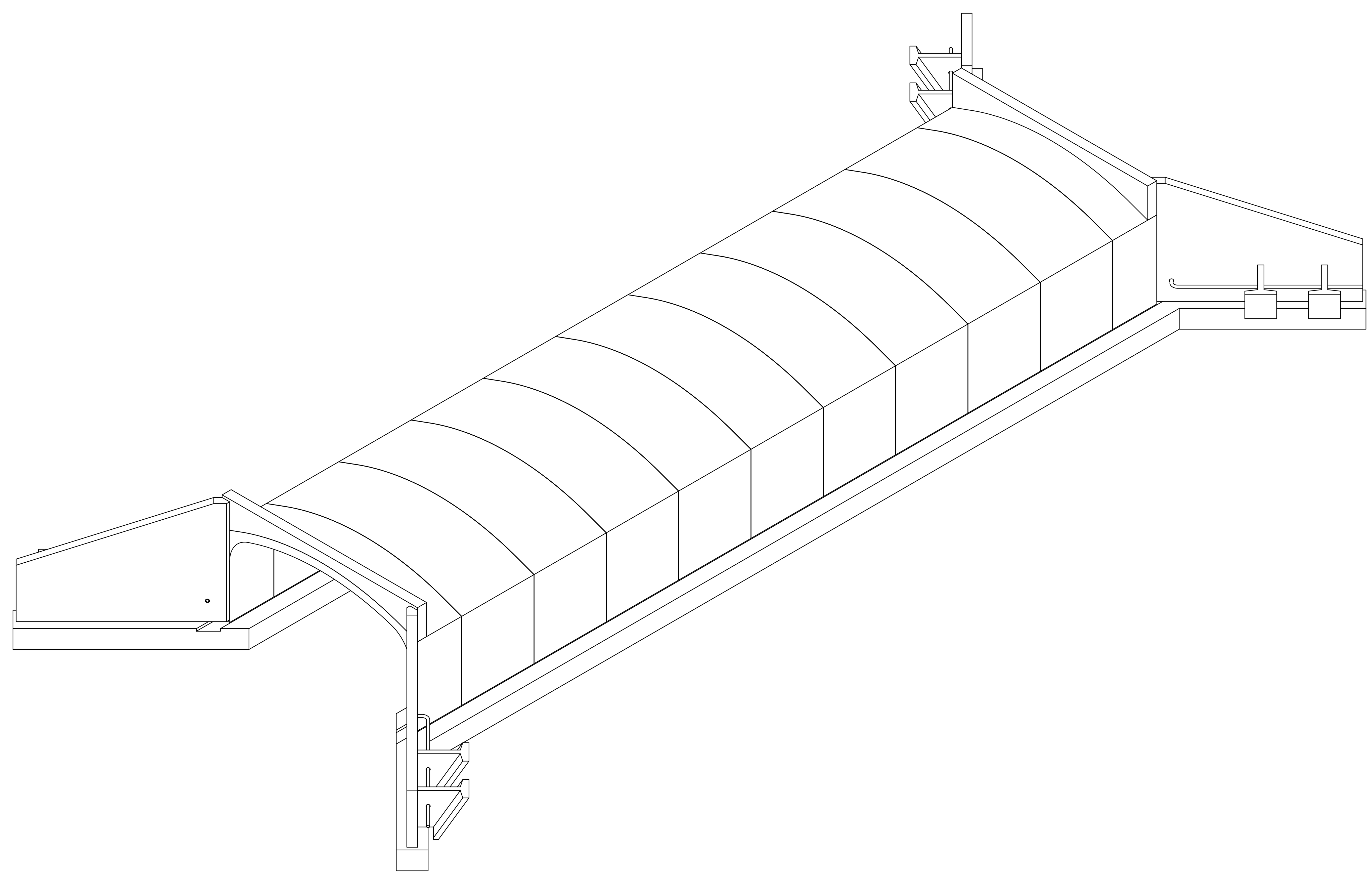
RYAN CREEK FISH BARRIER REMOVAL 2007
CR.310C.—.MP.0.17.—.WILLITS,CA.
RYAN.CREEK

TYPICAL CROSS SECTION

DATE 03-16-2006
JOB NO. D-0202
DRAWING NUMBER 1 OF 3

Ryan Creek

Mendocino County **CA**



ISOMETRIC VIEW

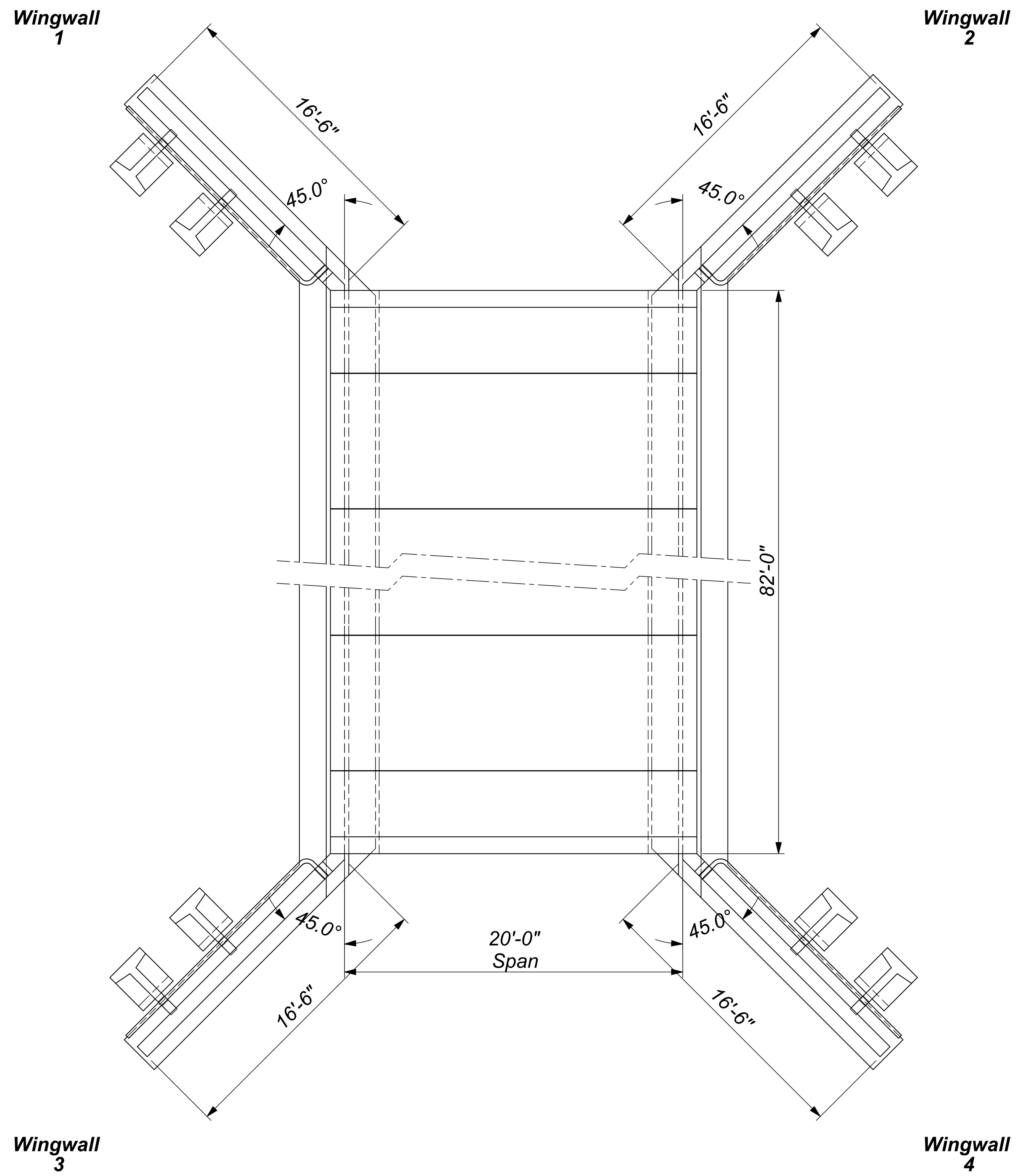
Preliminary Drawings prepared for:
Jason
Leach

CON/SPAN® BRIDGE SYSTEMS
3100 Research Blvd. P.O. Box 20266 Dayton, Ohio 45420-0266
Phone: (800) 526-3999 Fax: 937-254-6365
www.con-span.com

CA
Mendocino County
Ryan Creek

Date: 02/13/07
DYOB No. 115114
Sheet No. **1**

Upstream



Downstream

BRIDGE PLAN

Preliminary Drawings prepared for:
Jason
Leach

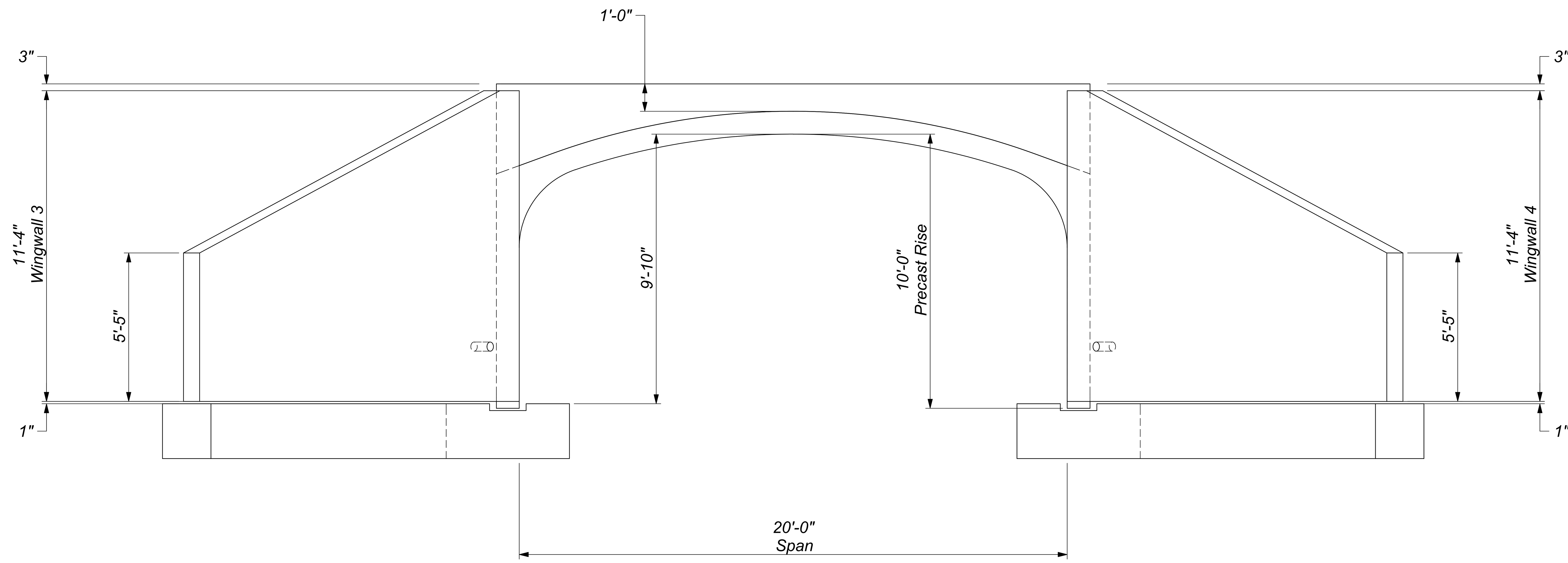
CON/SPAN® BRIDGE SYSTEMS
3100 Research Blvd. P. O. Box 20266 Dayton, Ohio 45420-0266
Phone: (800) 526-3999 Fax: 937-254-8365
www.con-span.com

CA

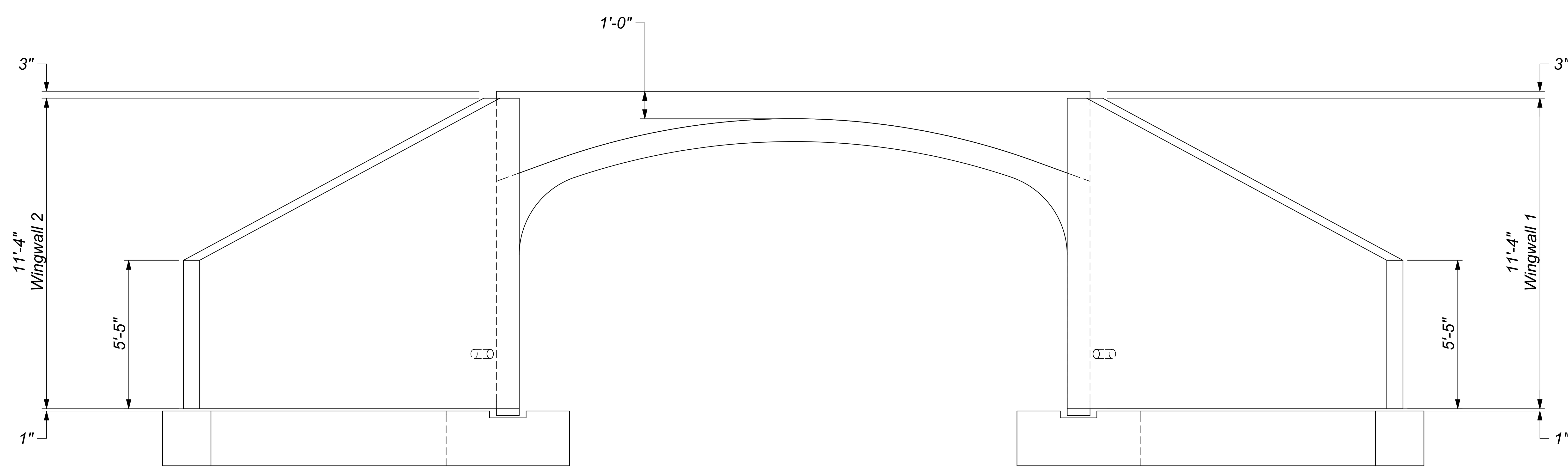
Mendocino County

Ryan Creek

Date: 02/13/07
DYOB No. 115114
Sheet No. **2**



DOWNSTREAM END ELEVATION



UPSTREAM END ELEVATION

Preliminary Drawings prepared for:
Jason
Leach

CON/SPAN® BRIDGE SYSTEMS
3100 Research Blvd. P.O. Box 20266 Dayton, Ohio 45420-02366
Phone: (800) 526-3999 Fax: 937-254-8365
www.con-span.com

CA
Mendocino County
Ryan Creek

Date: 02/13/07
DYOB No. 115114
Sheet No. **3**

Attachment 5

Conner Creek Fish Passage Improvement Project
Conceptual Design Report

Reference: 506057

Conceptual Design for Improvement of Juvenile and Salmonid Fish Passage in Conner Creek

Conner Creek Migration Barrier Removal Project

Prepared for:

Trinity County Natural Resources Division
60 Glen Road
Weaverville, CA 96093

Prepared by:
SHN
Consulting Engineers & Geologists, Inc.
350 Hartnell Ave., Suite B
Redding, CA 96002-1875
530-221-5424

March 2007

QA/QC: QA Initials___

K:_STAFF FILES\dstrege\06\506057 Conner Creek\Final Report 4-07\Final Draft.doc

Executive Summary

The Trinity County Natural Resources Division, in cooperation with the Five Counties Salmonid Conservation Program, has contracted with SHN Consulting Engineers & Geologists, Inc. (SHN) to prepare a conceptual design scoping report for the enhancement of fish passage through two culvert crossings on Conner Creek. Fish passage criteria is based on the National Marine Fisheries Service (NMFS) "Guidelines for Salmonid Passage at Stream Crossings" (NMFS, 2001). The calculated fish passage flows for juvenile and adult salmonids for Conner Creek are 1 cubic feet per second (cfs) to 15 cfs, and 3 cfs to 57 cfs, respectively. Replacement or retrofit of the existing crossings is required to pass all life stages of salmonids at all fish migration flows.

Crossing #1 (Conner Creek at Conner Creek Road)

The downstream crossing, at Conner Creek Road, is an existing reinforced concrete box, which impedes migration of adult and juvenile salmonids at all fish passage flows due to high velocities inside the culvert, and an outlet drop greater than 2 ft. Alternatives to improve fish passage include 1) replace with a 19.5 ft x 6.75 ft open bottom arch, and 2) reconfigure bottom of existing box to 2.5 ft lower (at the inlet) at 1:1 side slopes, with a 6% maximum slope. According to the HEC-RAS model, the average velocity inside the culvert at the juvenile and adult high pass flow is 0.5 feet per second (ft/s) and 1.4 ft/s, respectively. The replacement alternative provides capacity to convey the 100-year peak flow with a Headwater to Diameter (Hw/D) equal to one. The new culvert would be 19.5 ft wide compared to an 11.5-ft bankfull channel width, with a 6% maximum slope. Therefore, this alternative complies with the NMFS guidelines for a natural bottom culvert and provides passage for salmonids at migration flows. The cost estimate for replacement is $131,400. The retrofit alternative provides capacity to convey the 50-year peak flow with an Hw/D equal to one and the 100-year peak flow with a Height of fill to Diameter (Hf/D) equal to one. According to HEC-RAS simulations, the average velocity at the juvenile and adult high passage flows is 2.0 ft/s and 3.5 ft/s, respectively. The average depth at the juvenile and adult low passage flows is 1.0 ft and 1.1 ft, respectively. The cost estimate of retrofit is $88,400. If constructed, the retrofit alternative will allow fish passage of all life stages at all migration flows through the downstream crossing. This alternative provides conveyance of a 50-year peak flow, and has a slightly lower cost than full culvert replacement. Removing the existing bottom will reduce the observed clogging in the existing baffles, and provide sufficient water depth. Therefore, SHN recommends retrofitting the existing box culvert with a lowered invert and embedding it with rock bottom.

Crossing #2 (Conner Creek at Red Hill Road)

The upstream crossing, at Red Hill Road, is an existing 10-ft diameter corrugated metal pipe, with metal baffles. The existing culvert impedes migration of juvenile salmonids at all passage flows, and adults at 55% of passage flows. Alternatives to improve fish passage include 1) replace with an 18 ft x 8.25 ft open bottom arch, and 2) retrofit with a concrete lining, new metal baffles, outlet jump pools, and a new 5-ft diameter CMP overflow pipe at 5% slope. According to the HEC-RAS model, the replacement alternative provides capacity to convey the 100-year peak flow with an Hw/D equal to one, and complies with the requirements of the NMFS Stream Simulation Method in the NMFS Guidelines (2001) for width, and slope. The cost estimate of replacement is $206,000. The retrofit alternative with the overflow pipe, provides capacity to convey the 50-year peak flow with an Hw/D equal to one. The road is overtopped by less than 1 ft during the 100-year peak flow.

The average velocities at the juvenile and adult high passage flows are 4.0 ft/s and 6.2 ft/s, respectively. The average depths at the juvenile and adult low passage flows are 0.6 ft and 1.9 ft, respectively. New baffles would provide resting pools inside the culvert, for juvenile passage, to mitigate higher velocities. The cost estimate of retrofit is $70,300. Based on cost alone, SHN recommends the retrofit alternative, which includes boulder weir jump pools at the outlet and an overflow pipe to increase high-flow capacity.

Table of Contents

List of Illustrations

Figures **Follows Page**

Tables **Page**

Acronyms and Abbreviations

cfs	cubic feet per second
ft	feet
ft/s	feet per second
in/hr	inches per hour
BMPs	Best Management Practices
CMP	Corrugated metal pipe
DFG	California Department of Fish and Game
Hw/D	Headwater to Diameter
Hw/F	Headwater to fill ratio
NMFS	National Marine Fisheries Service
RCB	Reinforced concrete box
USFS	U.S. Forest Service
USGS	U.S. Geological Survey

Introduction

The Trinity County Natural Resources Division in cooperation with the Five Counties Salmonid Conservation Program has contracted with SHN Consulting Engineers & Geologists, Inc. (SHN) to prepare a conceptual design scoping report for the enhancement of fish passage through two culvert crossings on Conner Creek, a tributary to the Trinity River.

Project Description

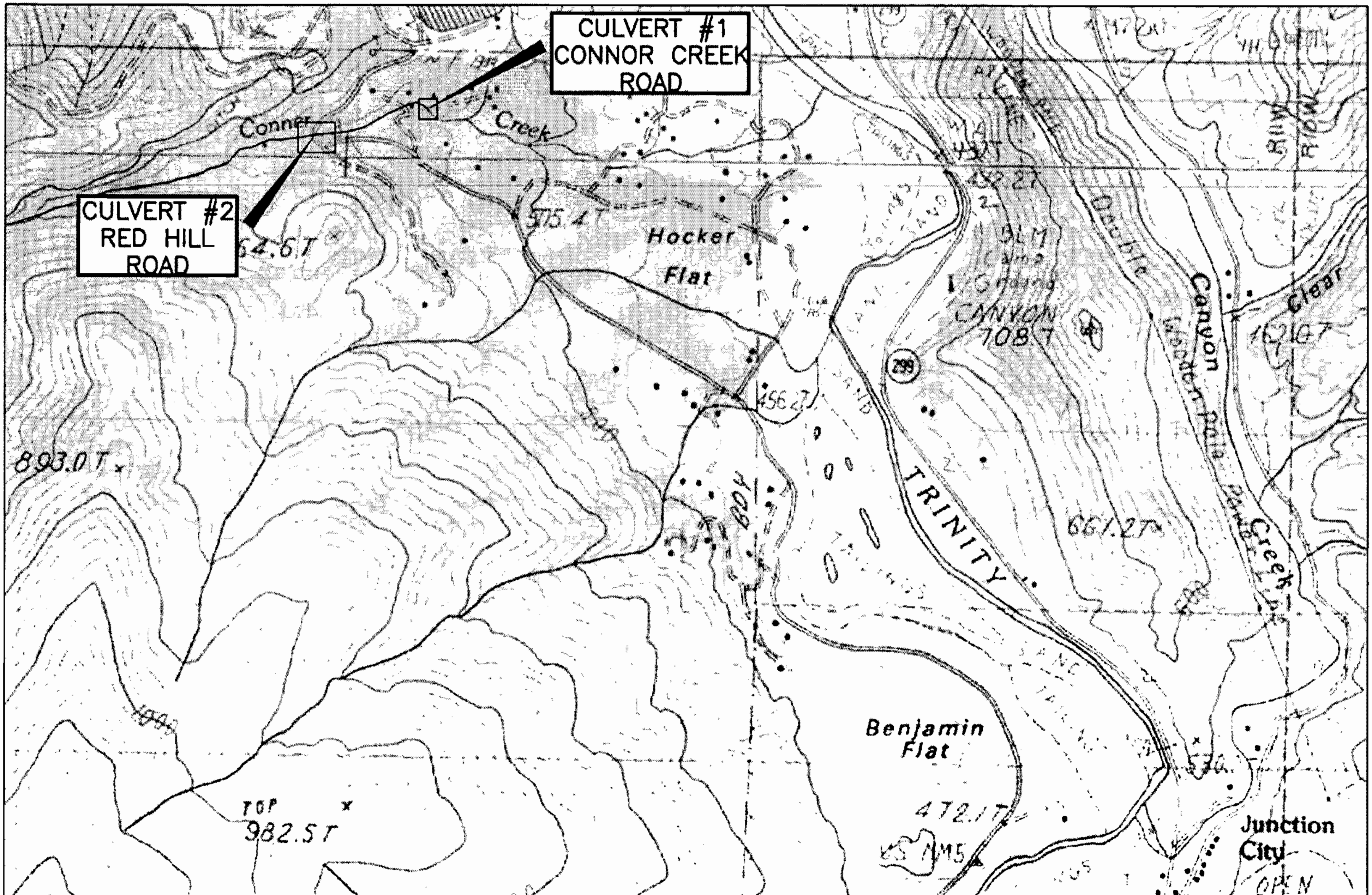
The proposed project involves the retrofit or replacement of two culverts on Conner Creek to allow fish passage and improve access to habitat upstream. The existing downstream culvert, Culvert #1, is located on Conner Creek Road and is a reinforced concrete box (RCB) culvert with an opening 14.3 feet (ft) wide by 5.75 ft high. The existing upstream culvert, Culvert #2, is located on Red Hill Road and is a 10-foot diameter corrugated metal pipe (CMP). These culverts were ranked according to species diversity, extent of barrier, sizing, current condition, and habitat score. They placed 9th and 13th place, respectively, in a County-wide culvert inventory and fish passage evaluation (Taylor et al, 2002). As part of this project, one retrofit and one replacement alternative for each culvert were considered for the improvement of juvenile and adult fish passage. Although the primary objective is to improve fish passage through these two locations, it was also important to verify the retrofit alternatives did not affect the capacity of the existing culvert. In addition, the replacement alternatives must be able to convey the 100-year recurrence interval flows. This report presents the conceptual design for both crossings, along with a hydrologic analysis, hydraulic study, site plan, preliminary construction details, and preliminary construction cost estimate. A final design is not within the scope of this study.

Project Location

The two culverts are located on Conner Creek, northwest of Junction City in Trinity County. Culvert #1 and Culvert #2 are located where Conner Creek is crossed by Conner Creek Road and Red Hill Road, respectively. Conner Creek is the primary watercourse for a 4.9 square-mile watershed which is a tributary to the Trinity River. The project site is shown in Township 33N, Range 11W, Section 2 on the Dedrick 7.5' U.S. Geological Survey (USGS) Quadrangle Map (Figure 1).

Background

An inventory and fish passage evaluation of road crossings within the Trinity County road system was provided to the Trinity County Planning Department by Taylor et al. (2002). The inventory identified Conner Creek as a stream reach within the Trinity River basin known to historically and/or currently support runs of coho salmon (*Oncorhynchus kisutch*), Chinook salmon (*O. tshawytscha*), and/or steelhead (*O. mykiss irideus*). It also identified the two County-maintained crossings at Conner Creek Road (Culvert #1) and Red Hill Road (Culvert #2) as impediments to fish passage. The inventory estimated the full-pipe capacities of Culvert #1 and Culvert #2 as capable of conveying no larger than 14-year and 19-year return period storm flows, respectively. The recurrence interval flows were determined using the Wannanen and Crippen equations for regional flow estimation.



SHN Consulting Engineers & Geologists, Inc.	Trinity County Connor Creek Culvert Connor Creek and Red Hill Roads	Project Location Dedrick USGS Quadrangle SHN 506057
	April 2007 / QUAD.dwg	Figure 1

Photo 1
Conner Creek #1 Looking Downstream

The existing structure at Culvert #1 is a RCB with dimensions 14.3 feet wide by 5.75 feet high as shown in Photo 1. To facilitate fish passage, one foot high baffles are present in the right half of the box. Taylor et al. (2002) state that Culvert #1 fails to meet passage criteria for all species of adult salmonids and all age classes of juveniles due to excessive flow velocities through the culvert along with a drop into the outlet pool in excess of two feet. Additional information on this culvert is provided in the Design Criteria section of this report, including migration flows and other passage criteria along with site photographs (Appendix A).

The existing structure at Culvert #2 is a 10-foot diameter CMP with 6-inch by 2-inch corrugations. To facilitate fish passage, steel ramp baffles are present, as shown in Photo 2. Taylor et al. (2002) state that Culvert #2 meets passage criteria for adult salmonids on approximately 45% of migration flows but fails to meet criteria on the entire range of migration flows for all age classes of juveniles. Additional information on this culvert is provided in the Design Criteria section of this report, including migration flows and other passage criteria along with site photographs (Appendix A).

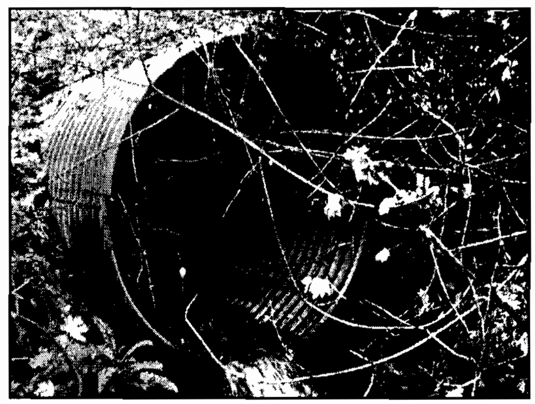


Photo 2 - Conner Creek #2 Outlet

There are approximately 1.6 miles of good potential fish-bearing habitat upstream of the two crossings. Surveys conducted by the U.S. Forest Service (USFS) in August 1974, May 1980, and March 1980 provide the basis for the following description given by Taylor et al, (2002):

> "Steelhead were presumed to use the lower 1.5 miles of creek, with suitable spawning areas located primarily in the lower mile. Pools were numerous and formed mostly by boulder and bedrock. USFS steelhead spawning surveys conducted on 3/25/80- no evidence of spawning was observed. Approximately 2,300' above Red Hill Road, the channel steepens to an average slope of nearly 6% until the limit of anadromy at 8-10%."

Design Criteria

The National Marine Fisheries Service (NMFS) Guidelines for Salmonid Passage at Stream Crossings (September 2001) were used as reference for the design to meet fish passage criteria.

According to the NMFS Guidelines for existing culverts that are being modified or retrofitted to improve fish passage, the Hydraulic Design Method criteria should be used as the goal for design, but not necessarily the required design threshold. These criteria are given in Table 1. The NMFS Guidelines (2001) were consulted for the design criteria for a complete culvert replacement. The following criteria from the Stream Simulation Design Method are applied to analyze the culvert:

1. The culvert width shall be greater than or equal to the bankfull channel width, at a minimum of 6 feet. (The Caltrans Highway Design Manual defines a culvert as a closed conduit with a span of less than 20 feet.)
2. The culvert slope shall approximate the slope of the natural stream channel through the reach in which it is being placed, at a maximum slope of 6%.
3. Footings for open bottom arches should be designed for the largest anticipated scour depth.
4. The replacement culvert should be sized to convey the 100-year flood flow.

In addition to the criteria below, the NMFS Guidelines require that all new culverts be designed to withstand the 100-year peak flow without structural damage to the crossing. If there is a risk of the inlet plugging, the culvert should be designed to pass the 100-year peak flow with a Headwater to Diameter ratio (Hw/D) less than one. The design criteria for capacity of retrofitted culverts is not defined in the NMFS Guidelines, but the Trinity County Natural Resources Division requires that retrofitted culverts for this project be able to convey the 50-year flow.

Table 1
Hydraulic Design Method Criteria

High Fish Passage Design Flow	Adults- 1% Annual Exceedance Flow (Q1%) Juveniles- 10% Annual Exceedance Flow (Q10%)
Low Fish Passage Design Flow	Adults- Greater of 50% Annual Exceedance Flow (Q50%) or 3 cfs Juveniles- Greater of 95% Annual Exceedance Flow (Q95%) or 1 cfs
Maximum Average Water Velocities	Adults- 6 ft/s for culverts less than 60 feet long, and 5 ft/s for up to 100 feet Juveniles- 1 ft/s or less for any length culvert
Minimum Water Depth	Adults- 12 inches Juveniles- 6 inches
Maximum Outlet Drop	Adults- 12 inches Juveniles- 6 inches

1. Criteria from the NMFS Guidelines for Salmonid passage at Stream Crossings, September 2001
2. cfs = cubic feet per second
3. ft/s = feet per second

Hydrologic Analysis

Objective

Peak flood flows determined for Conner Creek are used to evaluate the existing culverts, as well as evaluate alternatives for retrofit and replacement. As mentioned in the NMFS Guidelines, new culverts should be designed to pass the peak flow of the 100-year storm , and adult and juvenile fish passage are addressed by criteria at high and low passage design flows. These flows are used in the HEC-RAS model (U.S. Army Corps of Engineers, HEC-RAS River Analysis System v3.1.3, May 2005) to assess fish passage criteria and culvert performance. Computations of the Conner Creek flows are discussed below.

Methods of Analysis

There are no stream records for Conner Creek, nor are there streams in the vicinity with sufficient gage data to perform hydrology calculations. Therefore, streamflow values were estimated using: 1) The Rational Method, and 2) The USGS Regional Waananen and Crippen Regression Equations. Appendix B provides the calculation worksheet for each method.

The Rational Method

The rational method is used to estimate peak runoff resulting from various rainfall intensities for a given area. The equation is (Viessman and Lewis, 1996):

$$Q=CiA$$

Where:
Q is the calculated peak flow for a given recurrence interval (cfs)
C is a runoff coefficient (unitless)
i is the rainfall intensity (in/hr)
A is the watershed area (acres)

The rational method is commonly used to size culverts and storm drains. It is applicable and most commonly used for small areas of up to approximately 600 acres. The following assumptions are made to express a complex hydrologic system in a simple model (Lindeburg, 2003): 1) the frequency of the peak runoff event is equal to the frequency of the rain event, 2) the runoff coefficient is constant over the entire watershed area, and 3) rainfall occurs at a constant rate and is spatially uniform over the drainage area.

The USGS Regional Regression Equations

The USGS Regional Regression Equations are used to determine peak flow in ungaged watersheds. The equations for the North Coast California hydrologic region are (USGS, 1993):

$$Q_{100} = 9.23\,(A)^{0.87}\,(P)^{0.97}$$
$$Q_{50} = 8.57\,(A)^{0.87}\,(P)^{0.96}\,(H)^{-0.08}$$
$$Q_{25} = 7.64\,(A)^{0.87}\,(P)^{0.94}\,(H)^{-0.17}$$
$$Q_{10} = 6.21\,(A)^{0.88}\,(P)^{0.93}\,(H)^{-0.27}$$

Where:
Q is the calculated peak flow for a given recurrence interval (cfs)
P is the mean annual precipitation (inches)
H is the altitude index (H), which is the average of altitudes at points along the main channel at 10% and 85% of the distances from the site to the divide (thousand feet)
A is the watershed area (square miles)

These equations are based on a nationwide study conducted by the USGS to determine flood magnitude and frequency in ungaged watersheds (Viessman and Lewis, 1996). The equations are based on correlations of flood flow magnitudes and frequencies with readily available rainfall data and drainage basin characteristics. Use of the USGS Regional Regression Equations is appropriate for drainage areas larger than approximately 100 acres, but the equations are based on generalizations of vast regions of the state and, therefore, may overestimate or underestimate peak flow depending on the project area characteristics.

Table 2 provides watershed parameters used in the above equations for this study.

Table 2
Conner Creek Watershed Properties

Property	Value
Watershed Area, A	4.9 square miles 3,146 acres
Runoff Coefficient, C	0.35 for unimproved, forested[1]
Altitude Index, H	1.0 (thousand feet)
Mean Annual Precipitation, P	37 inches
Rainfall Intensity over a duration equal to time of concentration, i	Varies by storm frequency (see Appendix B for values)[2]

1. The values for the runoff coefficients utilized were obtained from Lindeburg, *Civil Engineering Reference Manual 10th ed.*, Appendix 20.A.
2. The values for the rainfall intensity were obtained from the Weaverville IDF Curve given in Appendix B (Department of Water Resources, 1976).

Results

Design Peak Flows

Table 3 summarizes the results of the peak flow calculations for Conner Creek for this analysis. Appendix B provides the worksheets, including the formulas, calculations, and the watershed variables used for this analysis.

Table 3
Design Peak Flows for Conner Creek

Design Flow Return Period	Discharge (cfs) by the Rational Method	Discharge (cfs) by Regional Regression Equations	Combined Average Used in Analysis (cfs)
100-year	1,038	1,225	**1,131**
50-year	944	1,096	**1,020**
25-year	802	908	**855**
10-year	661	750	**705**

1. cfs = cubic feet per second

Results from the two methods are averaged for use in the HEC-RAS analysis to determine culvert capacity of proposed alternatives for retrofit or replacement. The Rational Method, although regularly used to size culverts and storm drains, commonly overestimates peak flow rates in non-urban watersheds. Although the Regional Regression Equations are appropriate for the Conner Creek watershed and are widely used, an average of the two methods is used to reduce the potential error in applying the generalized regional constants to this small watershed.

Design Fish Passage Flows

The results of the fish passage analysis for Conner Creek at Culvert #1 and Culvert #2 are presented below. Appendix C contains the fish passage flow worksheet created by Ross Taylor and Associates (no date). The results are summarized in Table 4.

Table 4 Design Fish Flows for Conner Creek		
Design Flow	**Juveniles**	**Adults**
Low Fish Passage Flow	*Q95% or 1cfs*	*Q50% or 3cfs*
	1 cfs	3 cfs
High Fish Passage Flow	*Q10%*	*Q1%*
	15 cfs	57 cfs
Flows calculated by Ross Taylor and Associates (see Appendix C)		

Hydraulic Analysis

Objective

The objective of this hydraulic analysis is to determine viable alternatives for culvert retrofit or replacement for the primary purpose of increasing upstream migration for juvenile and adult salmonids. By utilizing the results of the hydrologic study for Conner Creek, a hydraulic analysis of the existing crossings and alternatives can be completed. The hydraulic study is used to determine the flow capacity and the fish passage characteristics of the culverts for the proposed alternatives. As directed by the Trinity County Natural Resources Division, replacement culverts shall convey the 100-year peak flow, and retrofit alternatives shall convey the 50-year peak flow.

Methods of Analysis

Two software programs were used to analyze potential alternatives for the replacement or retrofit of Culvert #1 and Culvert #2. An iterative approach was conducted with HEC-RAS for stream flow simulation and with the FishXing program for fish passage evaluation. This approach allows for alternatives to be analyzed according to two sets of criteria: 1) conveyance of the 100- or 50-year peak flows, and 2) the NMFS Guidelines for Salmonid Passage.

Consideration of Alternatives

This report considers one replacement and one retrofit alternative for each crossing. HEC-RAS and FishXing software were used to evaluate compliance with the fish passage criteria from the NMFS Guidelines.

The NMFS Guidelines (2001) state:

> "The extent of the needed fish passage improvement work depends on the severity of fisheries impacts, the remaining life of the structure, and the status of salmonid stocks in a particular stream or watershed…The decision to replace or improve a crossing should fully consider actions that will result in the greatest net benefit for fish passage. If a particular

stream crossing causes substantial fish passage problems which hinder the conservation and recovery of salmon in a watershed, complete redesign and replacement is warranted."

One alternative for retrofitting the existing crossings and one option for replacement of each crossing are considered in this conceptual design. Trinity County, California Department of Fish and Game (DFG), and Mike Love & Associates were consulted during a site visit (November 21, 2006), along with information provided by Taylor et al. (2002), to determine viable alternatives to evaluate in a HEC-RAS hydraulic analysis. The following sections describe the preferred alternatives for the retrofit and replacement of Culvert #1 and Culvert #2. Preliminary cost estimate worksheets for construction of each alternative are given in Appendix D.

Existing Conditions at the Design Flows

The fish passage flows presented in Table 4 were used to analyze existing conditions at the culverts and to compare existing conditions to allowable fish passage criteria. Currently, Culvert #1 is a barrier to fish passage at all life stages and migration flows. This concrete box culvert exhibits sheet flow and excessive velocities, and the boulder weir at the outlet creates a jump greater than 2 feet; thus, the crossing is impassable for adult and juvenile salmonids. According to peak flows calculated by the USGS Regional Regression Equations, Culvert #1 has capacity to pass up to the 14-year storm with an Hw/D ratio equal to 1.

Culvert #2 is passable for adult salmonids at 45% of the design fish flows, yet for juveniles, the culvert presents a 100% barrier to upstream migration. According to peak flows calculated by the USGS Regional Regression Equations, the existing CMP, at Culvert #2 has capacity to pass up to the 19-year storm with an Hw/D ratio equal to 1.

Alternatives for Culvert #1 (At Conner Creek Road)

A summary of the results of the HEC-RAS modeling of the alternatives for Crossing #1 are given in Table 5. Appendix E provides the detailed analysis output for depth and velocity inside the culvert and culvert capacity at the design flows. The results of the FishXing analysis of this alternative are given in Appendix F.

Table 5 Culvert #1 Alternatives Results			
Design Criteria	**Existing**	**Alternative 1-a Replace w/ 19'x6' Open Bottom Arch**	**Alternative 1-b Reconfigure Bottom**
Average Velocity[1]	6.93 ft/s	Juvenile: 0.54 ft/s Adult: 1.4 ft/s	Juvenile: 2.0 ft/s Adult: 3.5 ft/s
Average Depth[2]	0.06 ft	Juvenile: 0.04 ft Adult: 0.48 ft	Juvenile: 1.0 ft Adult: 1.1 ft
Maximum Outlet Drop	2.54 ft	1.0 ft	1.0 ft
Capacity[4]	14-year[3]	100-year	50-year
Cost[5]	N/A	$131,400	$88,400

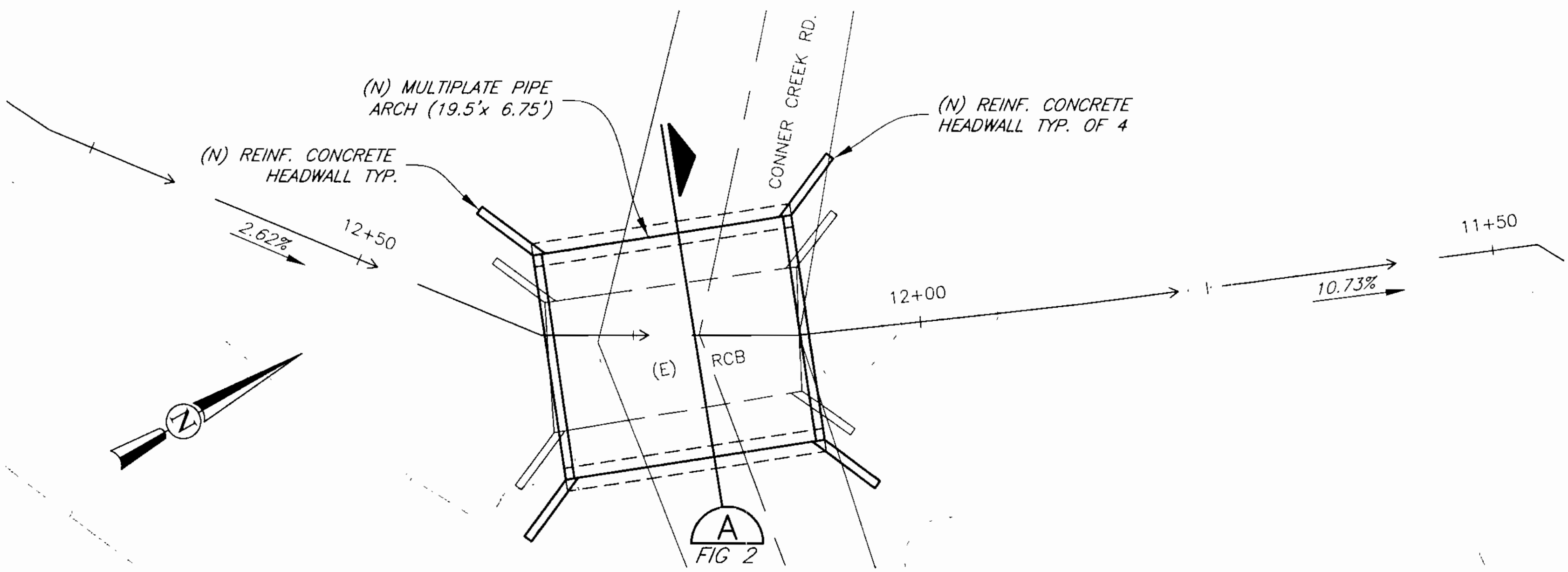
1. Average Velocity is measured at the juvenile and adult high fish passage design flows
2. Average Depth is measured at the juvenile and adult low fish passage design flows
3. From Ross Taylor and Associates (No Date)
4. Capacity is presented as a recurrence interval at Hw/D=1
5. Cost Estimate given in Appendix D
6. ft/s = feet per second
7. NA = Not Applicable

Alternative 1-a

One alternative for full culvert replacement is considered for this project. As recommended by Ross Taylor and Associates, full replacement with an open bottom pipe arch is preferred. With consideration given to the above criteria, the design replacement culvert was modeled using HEC-RAS with the criteria given by the Stream Simulation Method (NMFS Guidelines 2001). Full replacement for Culvert #1 would involve constructing a 19.5-foot wide by 6.75-foot high open bottom arch. The arch could be placed at a 6% slope. With an open bottom, this alternative complies with the NMFS guidelines because: 1) it has a span of 19.5 feet which is greater than bankfull channel width (11.5 feet), and 2) the culvert will be placed at a 6% slope, which is the approximately the average slope of the stream channel (2.6% upstream and 10% downstream). This configuration also allows for conveyance of the 100-year flow with an Hw/D ratio equal to one. The cost estimate for replacement is $131,400. See Figures 2 and 3 for a plan and profile, and section view of this alternative.

Alternative 1-b

As requested by Trinity County, one retrofit option is considered. The retrofit would involve removing the bottom of the existing RCB and reconfiguring it a maximum of 2.5 feet lower, with concrete sides sloping at a 1:1 slope. Figures 4 and 5 show a layout of this alternative. The resulting culvert is a 14-foot by 8.75-foot RCB at an overall culvert slope of 6%with baffles or an embedded natural bottom. As stated above, the existing culvert is not only undersized, but is also a barrier due to an outlet drop and excessive velocities. By removing and lowering the bottom of the concrete box, this alternative provides sufficient increased capacity to convey the 50-year storm, and reduces the outlet drop to allow salmonid migration. The average velocities inside the culvert at the juvenile and adult high fish passage flows are 2.0 and 3.5 ft/s, respectively. The minimum



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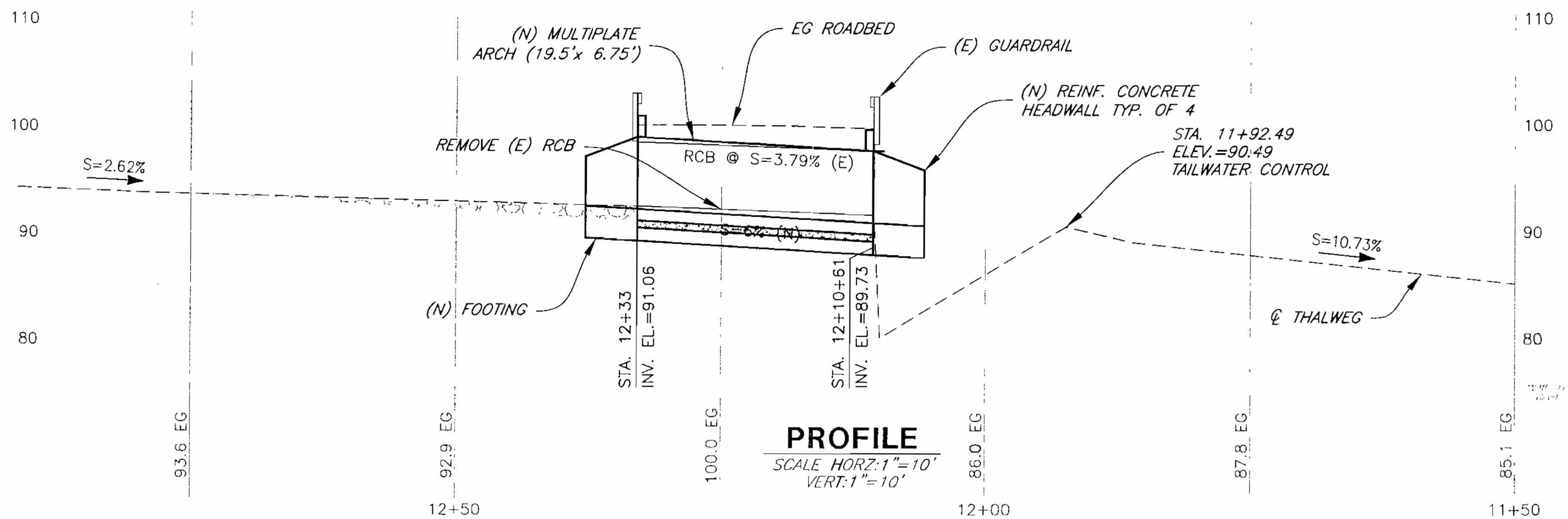


PROFILE
SCALE HORZ:1"=10'
VERT:1"=10'

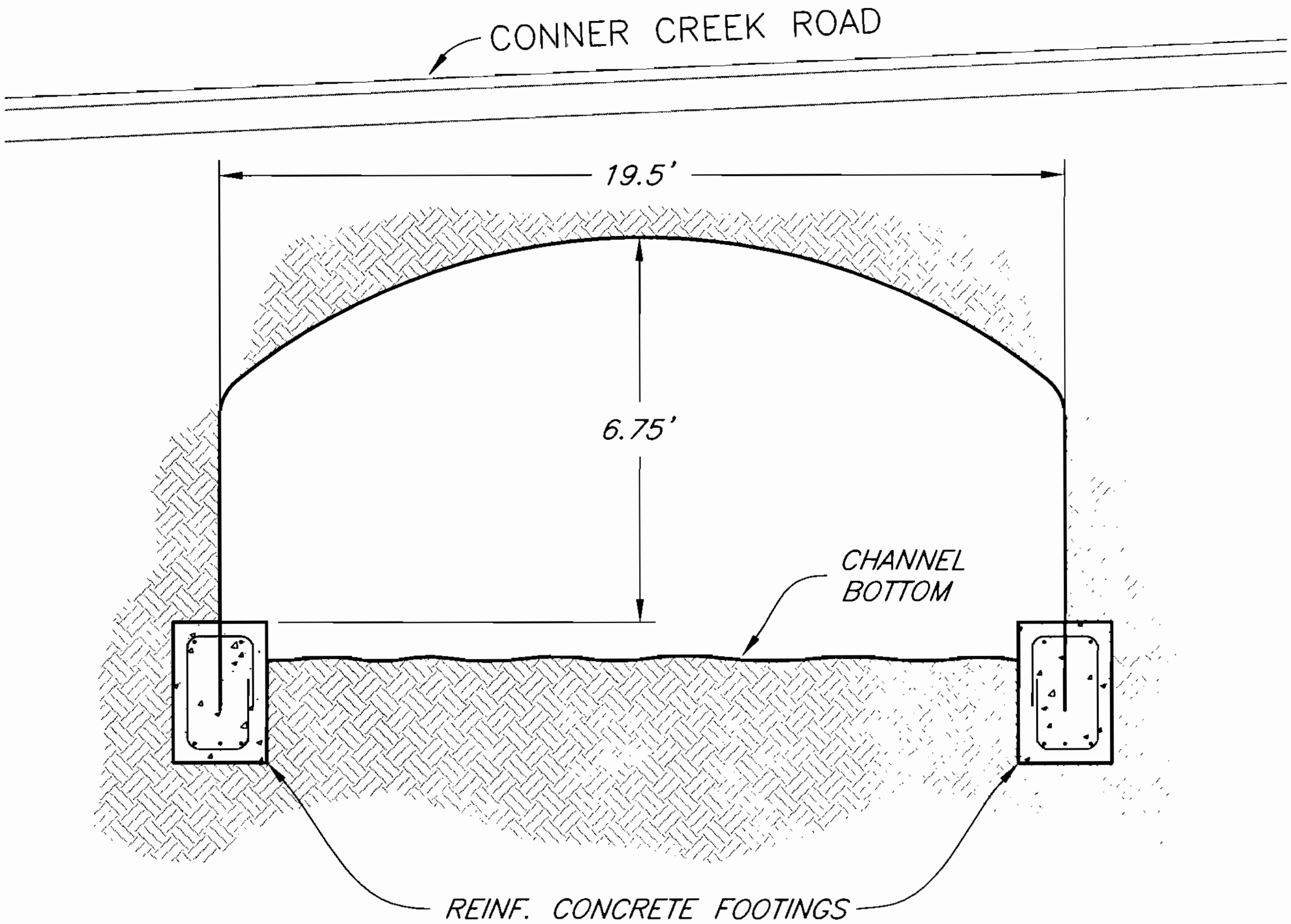
P:\2006\506057 Conner Creek\dwg

SHN Consulting Engineers & Geologists, Inc.

TRINITY COUNTY
Conner Creek Fish Passage
60 Glen Road, Weaverville, California

CONNER CREEK CULVERT #1
REPLACEMENT ALT. 1a PLAN AND PROFILE
SHN 506057

March 2007 | 506057-Hydrology.dwg | Figure 2



SECTION A

NO SCALE

SHN Consulting Engineers & Geologists, Inc.	Conner Creek Culvert #1 Trinity County, California 60 Glen Road, Weaverville, California	Alternative 1a Culvert Section A SHN 506057
	March 2007 506057-CBS-1	Figure 3

water depth inside the culvert at the juvenile and adult low fish passage flows are 1.0 and 1.1 feet, respectively. The cost estimate of retrofit is $88,400.

Alternatives for Culvert #2 (At Red Hill Road)

A summary of the results of the HEC-RAS modeling of the alternatives for Crossing #2 are given in Table 6. Appendices E and F contain the detailed program output.

Table 6
Culvert #2 Alternatives Results

Design Criteria	Existing	Alternative 2-a Replace w/ 18'x 8.25' Open Bottom Arch	Alternative 2-b Concrete and Baffle with Overflow and Step Pools
Average Velocity[1]	7.3 ft/s	Juvenile: 7.0 ft/s Adult: 6 ft/s	Juvenile: 4.0 ft/s Adult: 6.2 ft/s
Average Depth[2]	0.44 ft	Juvenile: 0.1 ft Adult: 0.1 ft	Juvenile: 0.6 ft Adult: 0.8 ft
Maximum Outlet Drop[3]	1.6 ft	1.0 ft	1.0 ft
Capacity[4]	19-year[3]	100-year	50-year
Estimated Cost[5]	N/A	$206,000	$70,300

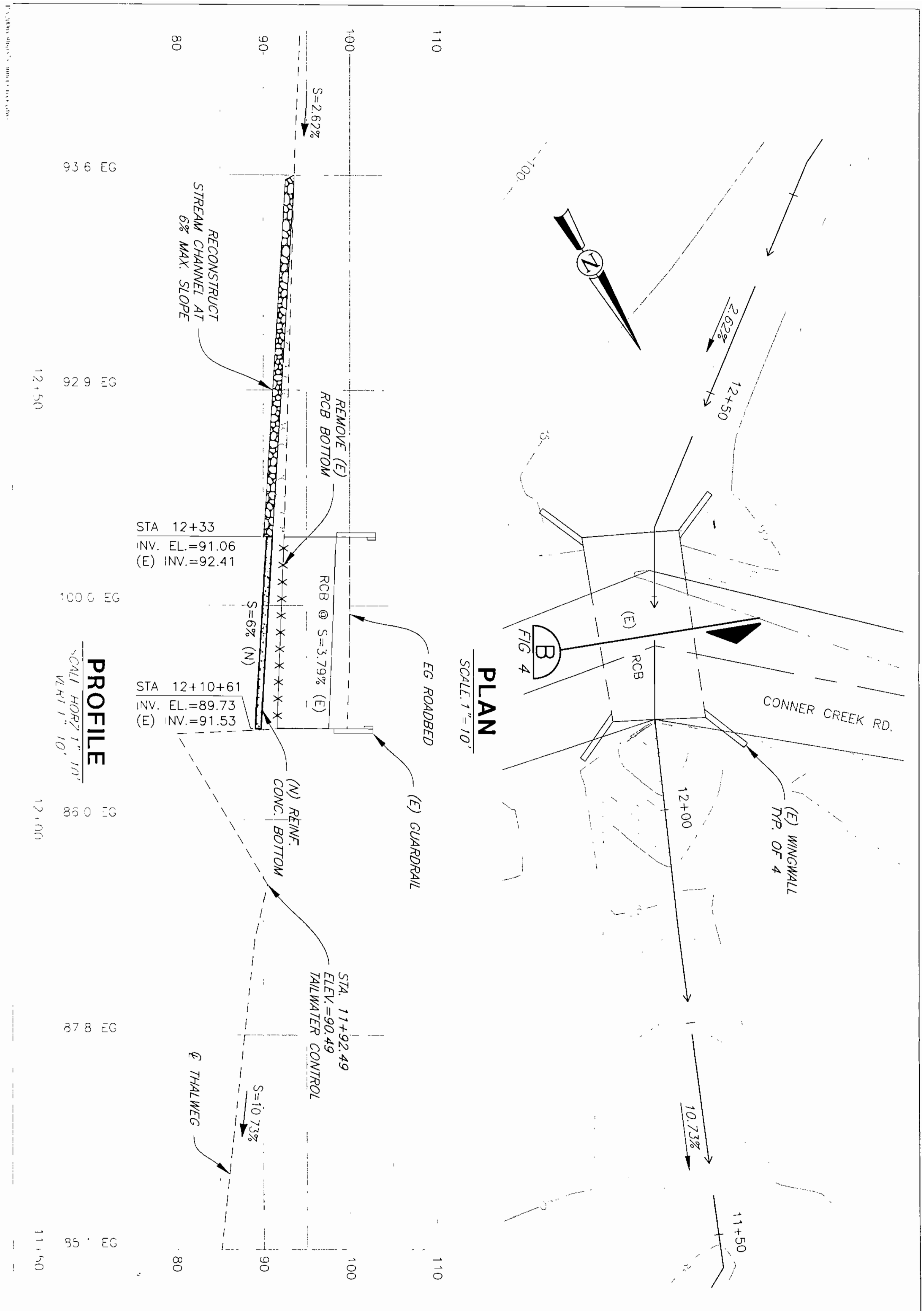
1. Average velocity is measured at the juvenile and adult high fish passage design flows
2. Average depth is measured at the juvenile and adult low fish passage design flows
3. A negative outlet drop indicates an outlet invert lower than the tailwater control
4. Capacity is presented as a recurrence interval at Hw/D=1
5. Cost Estimate given in Appendix D
6. ft/s = feet per second
7. NA = Not Applicable

Alternative 2-a

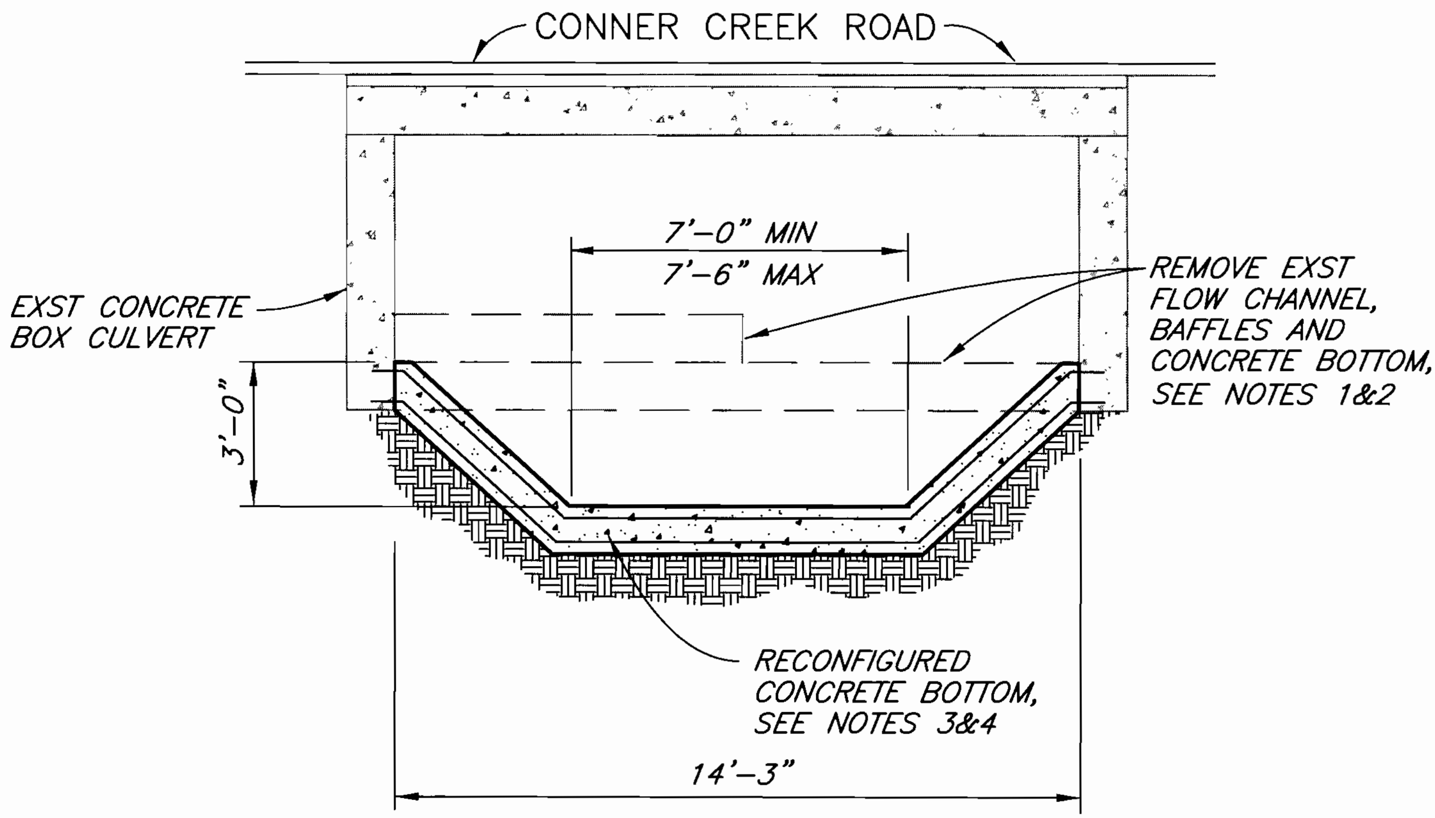
A replacement alternative is considered for the existing CMP at Red Hill Road. As recommended by Taylor et al. (2002), an open bottom pipe arch with an 18-foot span and 8.25 foot height is modeled using HEC-RAS. This alternative allows for conveyance of the 100-year flow with an Hw/D ratio equal to one. The width of the replacement is 18 feet which is greater than the bankfull channel width of 11.5 feet, and the slope is 6% which approximates the average natural channel slope (4% upstream and 8.5% downstream). Therefore, this design complies with the NMFS Stream Simulation Method. The cost estimate of replacement is $206,000. See Figures 6 and 7 for a plan and profile, and section view of this alternative.

Alternative 2-b

The retrofit alternative considered for the existing CMP is similar to a previously completed project on Deadwood Creek in Trinity County. This alternative consists of installing steel baffles in the existing culvert by placing them in a 6-inch thickness of concrete lining. The outlet drop will be reduced with the construction of five boulder weir step pools downstream of the outlet. The tailwater control of the first pool will be raised 5 feet and subsequent pools will have 1-foot maximum steps. Installing an additional 5-foot diameter overflow pipe compensates for the reduction in capacity resulting from the concrete lining and baffles. The addition of a corrugated



SHN Consulting Engineers & Geologists, Inc	TRINITY COUNTY Conner Creek Fish Passage 60 Glen Road, Weaverville, California	CONNER CREEK CULVERT #1 RETROFIT ALT. 1b PLAN AND PROFILE SHN 506057
	March 2007 / 506057-Hydrology.dwg	Figure 4



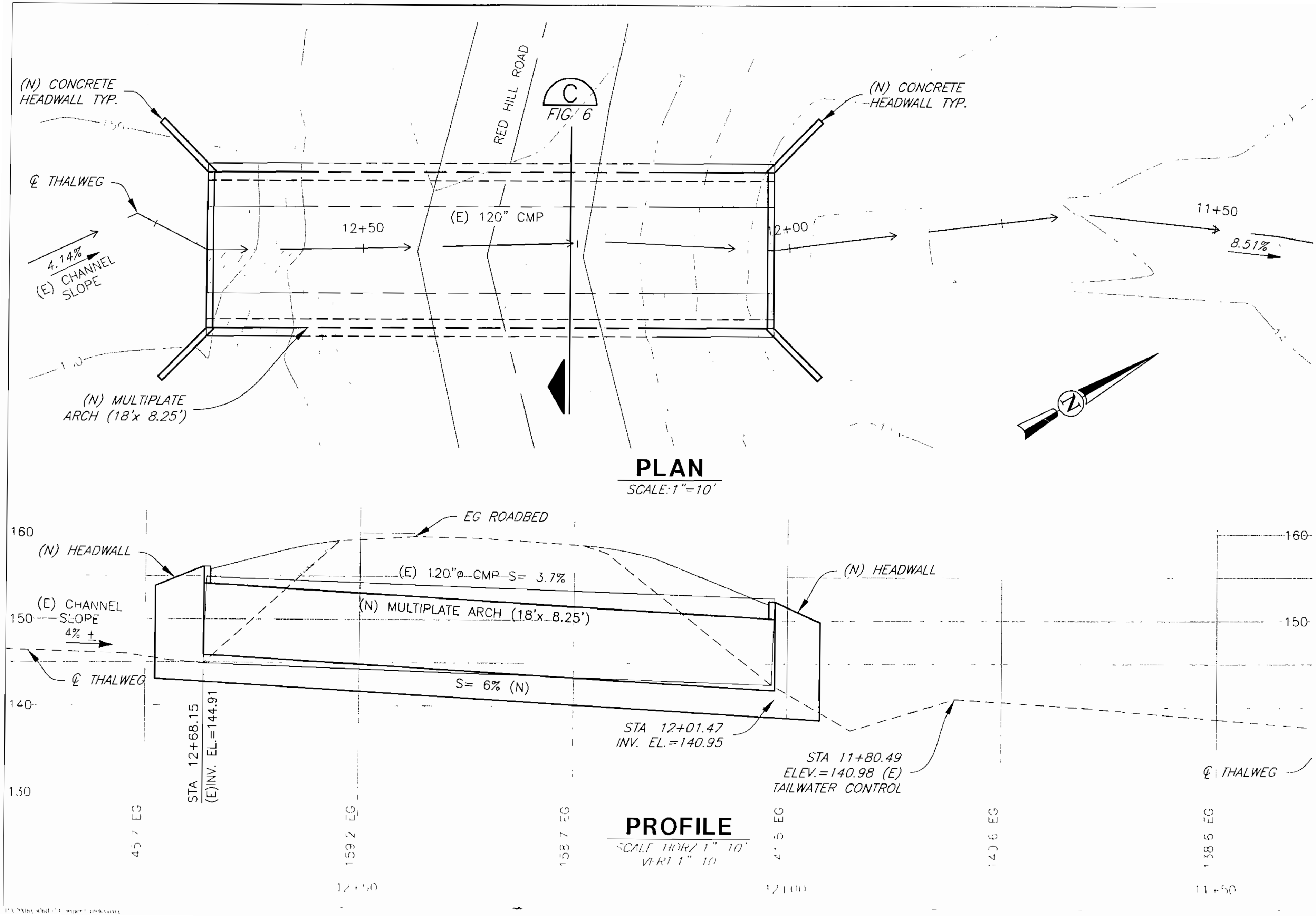
SECTION B

NO SCALE

NOTES

1. *CUT BOTTOM SLAB AS NEAR AS PRACTICAL TO SIDE WALLS BUT DO NOT CUT EXST STEEL REINFORCING BARS*
2. *RETAIN EXST REINFORCING TO SPLICE INTO NEW REINFORCING MATS.*
3. *LOWER BOTTOM OF BOX CULVERT BY SLOPING AT 1 TO 1 FOR 3'-0" MAXIMUM TOTAL DROP.*
4. *USE DOUBLE MAT OF STEEL REINFORCING.*

SHN Consulting Engineers & Geologists, Inc.	Conner Creek Culvert #1 Trinity County, California 60 Glen Road, Weaverville, California	Alternative 1b Culvert Section B SHN 506057
	March 2007 / 506057-CBS-1	Figure 5

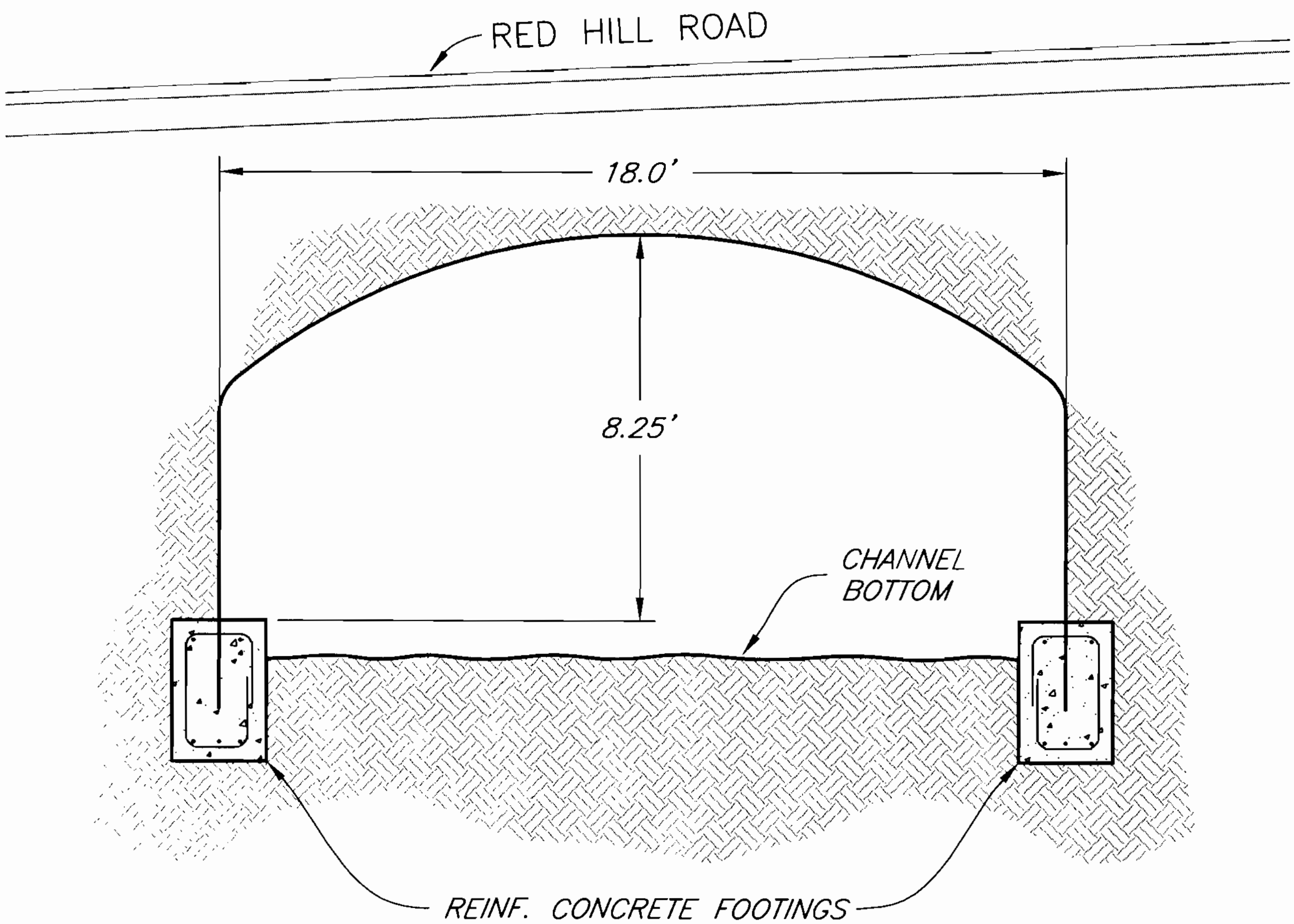


TRINITY COUNTY
Conner Creek Fish Passage
60 Glen Road, Weaverville, California

CONNER CREEK CULVERT #2
REPLACEMENT ALT. 2a PLAN AND PROFILE
SHN 506057

SHN Consulting Engineers & Geologists, Inc.

March 2007 | 506057-Hydrology.dwg | Figure 6



SECTION C

NO SCALE

SHN Consulting Engineers & Geologists, Inc.	Conner Creek Culvert #2 Trinity County, California 60 Glen Road, Weaverville, California		Alternative 2a Culvert Section C SHN 506057
	March 2007	506057-CBS-1	Figure 7

metal overflow pipe placed parallel and offset to the existing culvert, and installed at a 5% slope, results in system capacity to convey the 50-year flow. See the Plan and Profile on the next page for details. The cost estimate of retrofit is $70,300. See Figures 8 and 9 for a plan and profile, and section view of this alternative.

Recommendations

The following recommendations are given in order to facilitate planning of the project. There may be additional requirements not reflected in these recommendations that should be addressed for permitting, final design, and construction of the project. The recommendations below are based on the NMFS Guidelines (2001) and the cost estimate in Appendix D. SHN makes the following recommendations for enhancing fish migration through the two crossings of Conner Creek:

- If constructed, the retrofit Alternative 1-b at Crossing #1 (Conner Creek at Conner Creek Road) will allow fish passage of all life stages at all migration flows through the downstream crossing. This alternative provides conveyance of a 50-year peak flow, and has a lower cost than full culvert replacement. Removing the existing bottom will reduce the observed clogging in the existing baffles, and provide sufficient water depth. Therefore, SHN recommends retrofitting the existing box culvert with a lowered invert and embedding it with natural bottom.
- Based on cost alone, SHN recommends the retrofit Alternative 2-b at Crossing #2 (Conner Creek at Red Hill Road) with boulder weir jump pools at the outlet, and the overflow pipe to increase capacity.

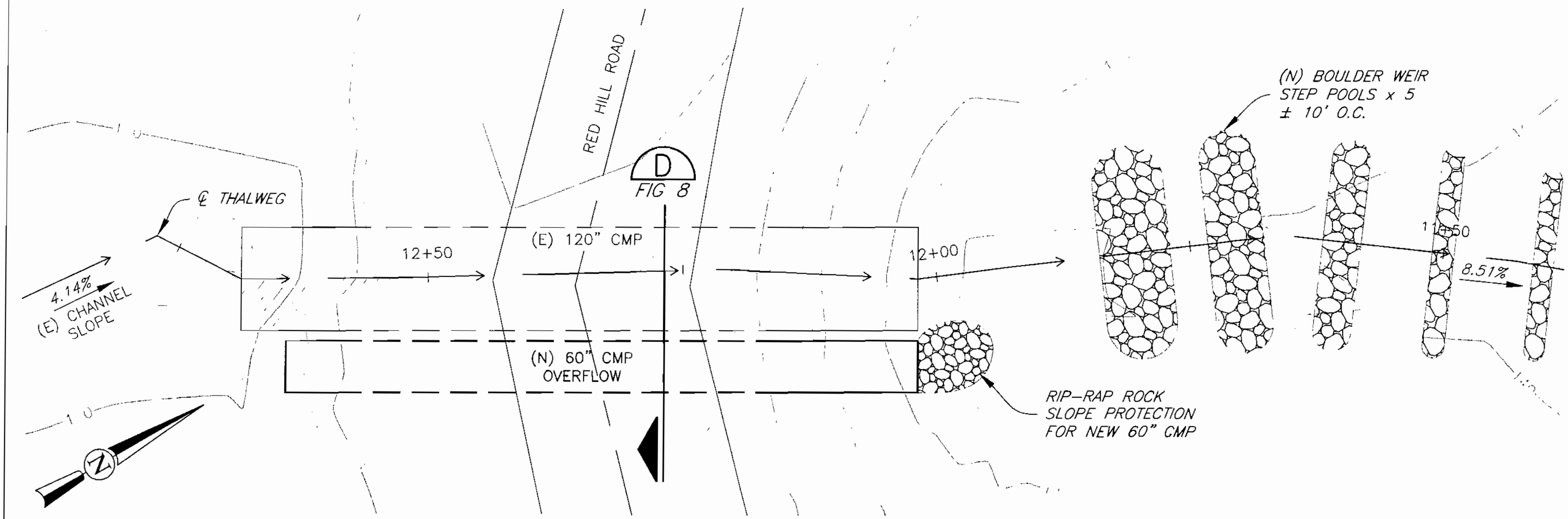
Structural Analysis

The design of Alternative 1-b shall be evaluated by an engineer for structural stability during the removal and reconstruction of the bottom of the concrete box. Temporary shoring will most likely be required for installation of this alternative, which may create various obstacles to work around during demolition of the existing slab and placement of the new bottom.

Retrofit and replacement culverts should be evaluated by an engineer to verify proper design and construction.

We recommend the following:

1. Involve an engineer to evaluate proper shoring techniques for the concrete side walls in Culvert #1 for Alternative 1-b.
2. Limited information is known regarding the type, size, and location of reinforcement in the existing concrete bottom. A particular concern with Alternative 1-b is maintaining the structural integrity of the box culvert during removal and replacement of the bottom slab. Evaluation of attachment methods of the reconfigured bottom to the existing sidewalls may also present some design and construction challenges.



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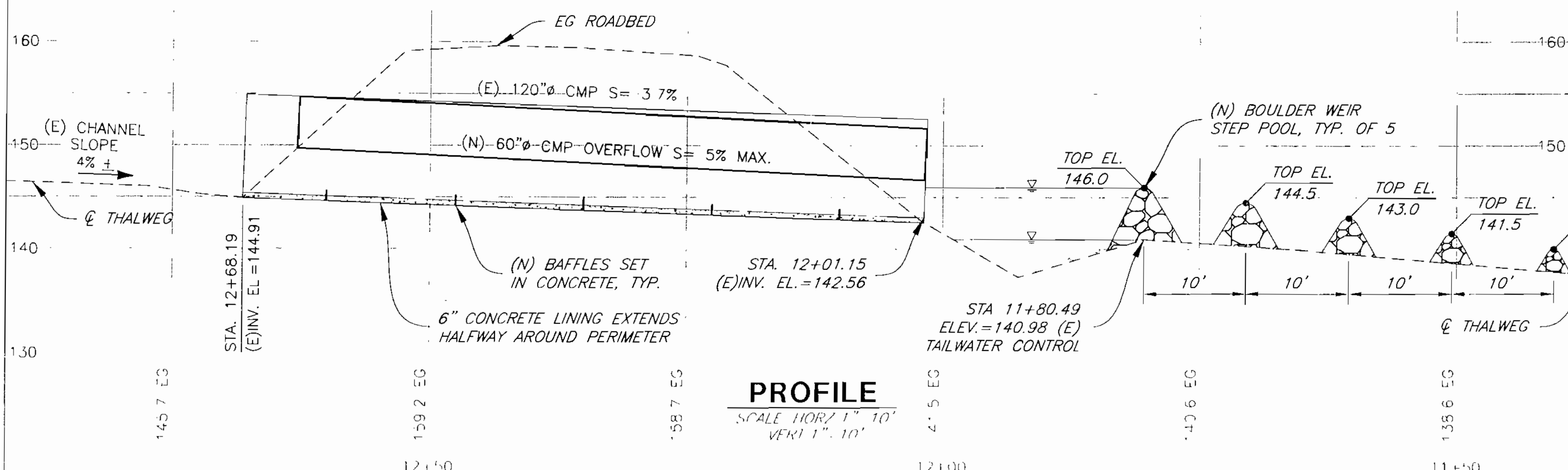


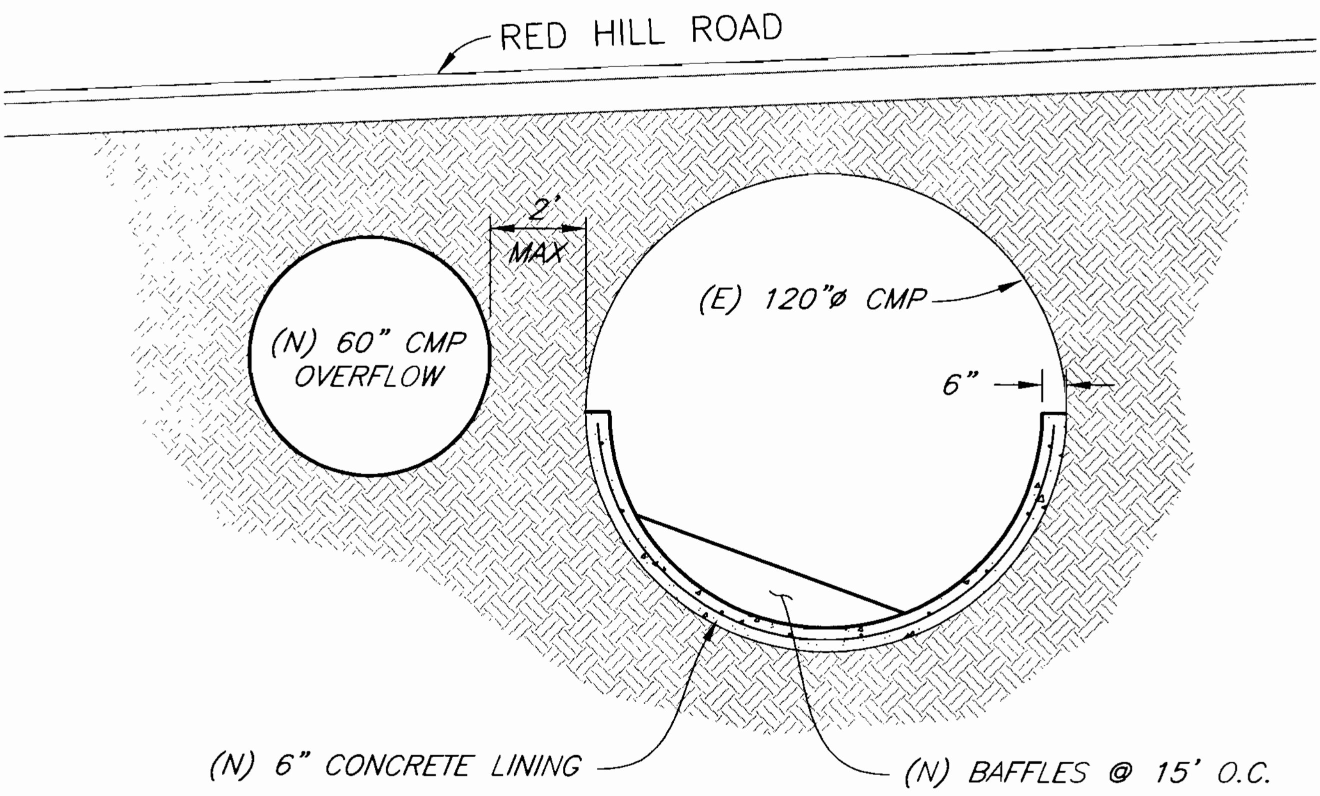
PROFILE
SCALE HORZ 1" 10'
VERT 1" 10'

Consulting Engineers & Geologists, Inc.

TRINITY COUNTY
Conner Creek Fish Passage
60 Glen Road, Weaverville, California

CONNER CREEK CULVERT #2
RETROFIT ALT. 2b PLAN AND PROFILE
SHN 506057

March 2007 | 506057-Hydrology.dwg | Figure 8



SECTION D

NO SCALE

SHN Consulting Engineers & Geologists, Inc.	Conner Creek Culvert #2 Trinity County, California 60 Glen Road, Weaverville, California	Alternative 2b Culvert Section D SHN 506057
March 2007	506057-CBS-1	Figure 9

Soils

Information regarding soil types, characteristics, and classification is limited in the project vicinity.

We recommend the following:

1. Site-specific soils report to determine if underlying bedrock in the stream channel will prevent grading necessary for rehabilitation of channel slopes upstream of the culvert for retrofit Alternatives 1-b and 2-b.
2. Imported or reused material for graded stream channels, and embedded culverts, should consist of a mixture similar to the adjacent channel of cobbles, coarse gravel and sand material, and should contain no organic material or debris.

Grading and Erosion Control

All reasonable measures should be taken to ensure the construction retrofit or replacement of culverts for this project do not degrade the stream or surrounding areas. Work areas should be restored upon completion of construction. A grading and erosion control plan and dewatering plan, prepared by a qualified individual, should contain recommendations to the contractor for measures to be taken prior to, during, and after construction.

We recommend the following:

1. Disturbance to the stream channel, and associated riparian areas should be minimized and the construction activity should not adversely impact fish migration or spawning. Consultation with NMFS and DFG biologists is required for construction authorization.
2. Excavated material, that is not to be used on the site, should be hauled offsite to an approved storage or disposal area. Stockpiles of fill material stored for reuse or imported fill should be located away from the stream channel and covered. Best Management Practices (BMPs) should be implemented at stockpiles to prevent erosion into waterways.
3. If replacement Alternatives 1-a and 2-a are chosen, a temporary detour bridge will be placed over the channel to provide resident access. BMPs should be utilized to minimize potential sediment and riparian impacts during placement and removal of the bridge.
4. Erodable cut or fill slopes, or other soil surfaces, should be protected by using vegetative cover, jute mesh and straw, rock slope protection, or other measures to provide erosion resistance.
5. Perform site work and vegetation establishment during seasons not subject to frequent repeated or prolonged rainfall.

Water Diversion

It is recommended that stream flow be diverted around all work areas. A cofferdam with a diversion pipe is a common method of dewatering the work area. A dewatering plan should be prepared by a qualified person.

We recommend the following:

1. Authorization from DFG and NMFS is required prior to dewatering. A dewatering plan including BMP sediment and erosion control measures should be prepared and followed throughout construction.
2. Consultation is required with the U.S. Fish and Wildlife Service under Section 7 of the Endangered Species Act.

Post-Construction Evaluation and Monitoring

Post construction evaluation of proper design/construction and erosion control measures is important to assure the anticipated results for fish passage are accomplished. An evaluation and monitoring plan should be prepared in the design phase of this project.

We recommend the following:

1. Follow the NMFS Guidelines for a post-construction biological assessment of the hydraulic conditions to confirm successful fish passage.
2. Annual inspection during a period of prolonged rainfall to assure the culverts are functioning properly with respect to culvert capacity. Inspection of erosion control measures should be conducted until vegetation is established in disturbed areas.
3. Involve a qualified biologist to perform an evaluation of the fish passage results.

References

Department of Water Resources, Bulletin No. 195 Rainfall Analysis for Drainage Design Vol III. Intensity-Duration-Frequency Curves, October 1976.

Lindeburg, Michael R. (2003). *Civil Engineering Reference Manual for the PE Exam, 10th Edition*. 1376 pp. NR: Professional Publications, Inc.

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Ross Taylor and Associates (no date), Site Specific Spreadsheets – Fish Passage Flows Worksheet.

Taylor, Ross et al. Final Report: Trinity County Culvert Inventory and Fish Passage Evaluation, August 2002.

U.S. Geological Survey, Nationwide summary of U.S. Geological Survey regional regression equations for estimating magnitude and frequency of floods for ungaged sites, 1993.

Viessman, Warren Jr., Lewis, Gary L. Introduction to Hydrology, 4th Edition 1996.

Appendix A

Site Photos

Connor Creek
Crossing #1

Inlet view from above

Looking downstream

Connor Creek
Crossing #1

Close-up of inside

Looking downstream

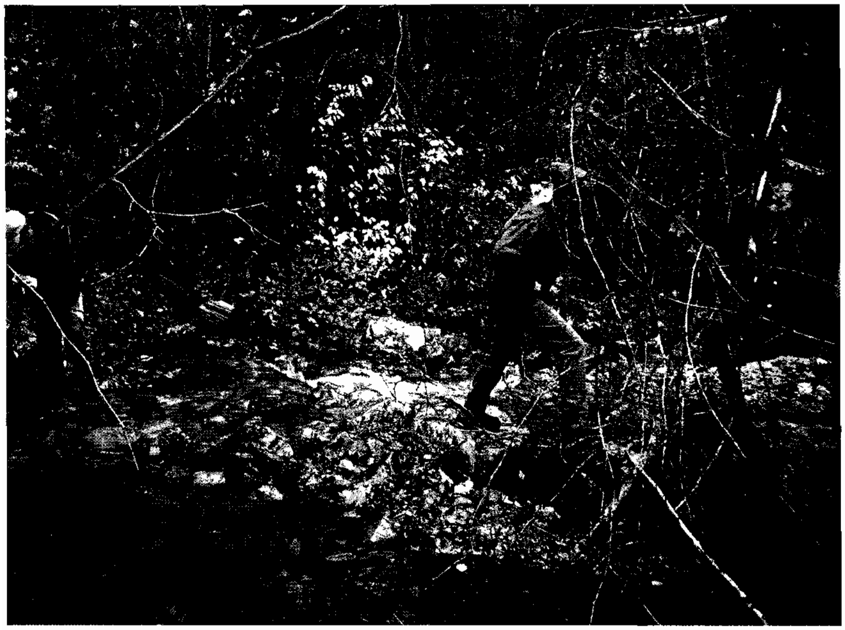
Connor Creek
Crossing #1

Close-up of outlet drop and pool

Looking Upstream

Connor Creek
Crossing #1

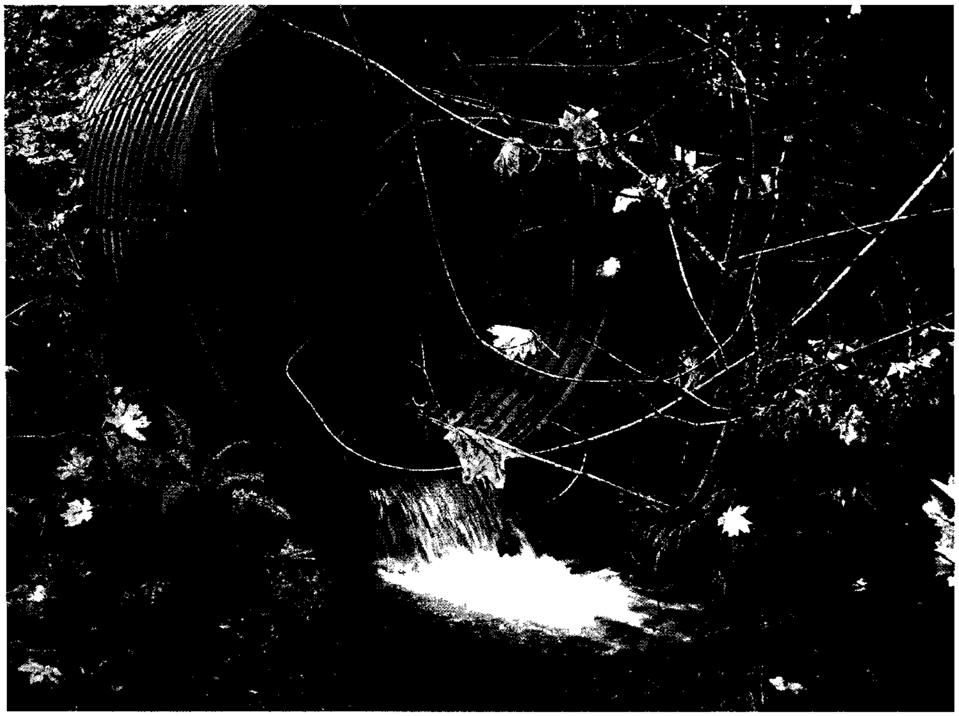
Outlet apron and pool



Connor Creek
Crossing #1

Outlet Pool Control
Boulder Weir

Looking
downstream



Connor Creek
Crossing #2

CMP with baffles
outlet drop

Looking upstream

Connor Creek
Crossing #2

Outlet with road
deck

Looking upstream

Connor Creek
Crossing #2

Upstream
channel

Looking
upstream

Appendix B

Hydrologic Calculations

Location: CONNOR CREEK, TRINITY COUNTY

Magnitude and Frequency Method

No.	Crossing	Area (acres) A	Basin max elevation (ft)	Crossing elevation (ft)	Area (mi^2) A	Precip (in/yr) P	Elev (ft/1000) H	North Coast flood flow Q (cfs) See below for M&F equations Q_{100}	Q_{50}	Q_{25}	Q_{10}
1	***Conner #1***	3146	1480	525	4.916	37	1.0025	***1224.7***	***1096.6***	***909.3***	***750.8***
2	***Conner #2***	3146	1480	545	4.916	37	1.0125	***1224.7***	***1095.7***	***907.7***	***748.7***

Rational Method

No.	Crossing	$T_c = 60((11.9 \times L^3)/H)$^0.385 Channel length (to top of basin) (mi) L	Altitude Index (ft) H	Concentration time (min) Tc	Runoff coefficient C	Area A	Rainfall Intensity (in/hr) DDF for Weaverville I_{100}	I_{50}	I_{25}	I_{10}	Q=CiA Q_{100}	Q_{50}	Q_{25}	Q_{10}
1	***Conner #1***	3.96	955	*54*	0.3	3146	1.10	1.00	0.85	0.70	***1038.2***	***943.8***	***802.2***	***660.7***
2	***Conner #2***	3.73	935	*51*	0.3	3146	1.10	1.00	0.85	0.70	***1038.2***	***943.8***	***802.2***	***660.7***

Magnitude & Frequency North Coast

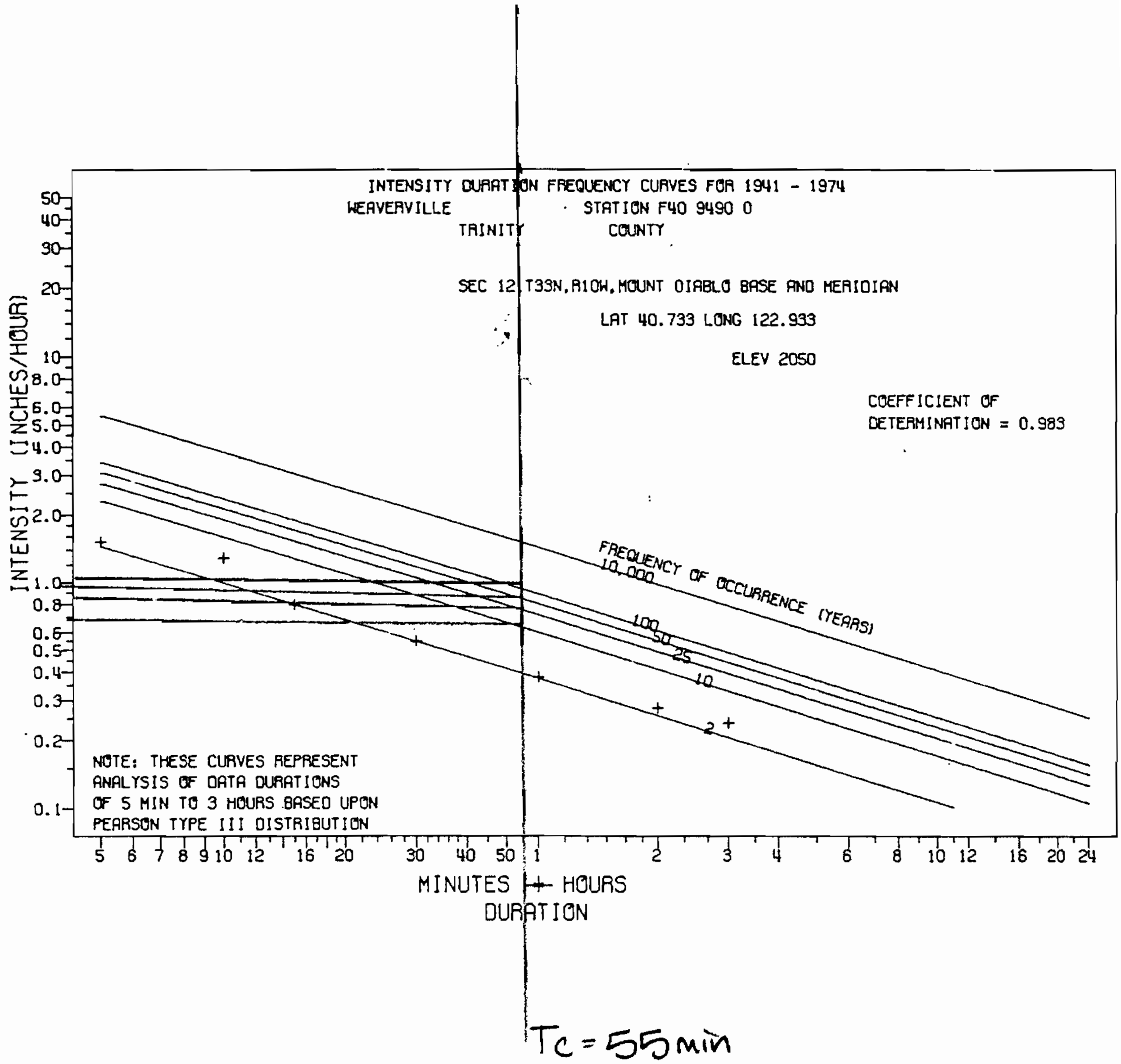
$Q_{100} = 9.23\,(A)^{0.87}\,(P)^{0.97}$

$Q_{50} = 8.57\,(A)^{0.87}\,(P)^{0.96}\,(H)^{-0.08}$

$Q_{25} = 7.64\,(A)^{0.87}\,(P)^{0.94}\,(H)^{-0.17}$

$Q_{10} = 6.21\,(A)^{0.88}\,(P)^{0.93}\,(H)^{-0.27}$

Template prepared by:
Michael Wopat
California Geological Survey
Redding, CA 96002
June 14, 2001
Modified by:
Allison Kelly
SHN Engineering
February 17, 2007



RI	i	Rational Method Q
100-YR	1.1 in/hr	1038
50-YR	1.0 in/hr	944
25-YR	0.85 in/hr	802
10-YR	0.7 in/hr	661

Appendix C

Fish Passage Flows Worksheet

Hydrologic Region	Stream Name	Road Name	Drainage Area ($mi.^2$)	Conclusion from Filter Output	Lower Passage Flow (cfs) Q50% or 3 cfs	Upper Passage Flow (cfs) Q1%	%Passable
I	Conner Creek#1	Conner Creek Rd.	4.61	RED	3.0	57.4	0%
I	Conner Creek#2	Red Hill Rd.	4.58	GRAY	3.0	57.1	#REF!

Stream Name	Road Name	Lower Limit barrier<Q (cfs)	Upper Limit barrier>Q (cfs)	Lower Limit barrier<Q (cfs)	Upper Limit barrier>Q (cfs)	Lower Passage Flow (cfs) Q90% or 2 cfs	Upper Passage Flow (cfs) Q5%	% Passable
Conner Creek#1	Conner Creek Rd.	-	-	-	-	2.0	25.0	0%
Conner Creek#2	Red Hill Rd.	0.0	None	12.7	37.0	2.0	24.8	0%

Stream Name	Road Name	Lower Passage Flow (cfs) Q95% or 1 cfs	Upper Passage Flow (cfs) Q10%	% Passable	Comments	Recommendations from interpreting model output
Conner Creek#1	Conner Creek Rd.	1	15.4	0%	Boulder weir after outlet pool creates a 2 ft+ jump thus making this crossing red. Fish Xing was not used because the site contains baffels.	Full replacement recommended due to conditions below outlet pool. Replace with an open arch or a bridge with a 17 ft width. Could investigat maintaining existing structure possibly with 4-5 jump pool weirs at the outlet.
Conner Creek#2	Red Hill Rd.	1	15.3	0%	Assumed Q1 % = active channel flow in outlet pool. Roughness was assumed n=.04 for ramp baffels, based on roughnesses reported in table 5.1 of the NMFS draft culvert research report. Problem may be increase in channel profile at inlet.	Interim recommendation would be to add a notched beam in culvert outlet to increase depth, reduce velocities and improve leaping conditions. To provide juvenile fish passage, full replacement is recommended with an open arch or bridge with an 18 ft span.

Worksheet created by Ross Taylor and Associates (no date) and provided to SHN by Trinity County Natural Resources Division

Appendix D

Preliminary Construction Cost Estimate Worksheet

Conner Creek - 506057
Engineer's Estimate
3/13/2007

Item #	Item Description	Quantity	Unit	Unit Price	Extended Price
	Crossing #1				
	Replacement				
1	Temporary Bridge	1	LS	$ 20,200.00	$ 20,200.00
	Clearing	1	LS	$ 2,200.00	$ 2,200.00
	Foundation	1	LS	$ 3,000.00	$ 3,000.00
	Bridge	1	LS	$ 10,000.00	$ 10,000.00
	Approaches	1	LS	$ 5,000.00	$ 5,000.00
2	Demolition	1	LS	$ 6,300.00	$ 6,300.00
3	Temporary Diversion	1	LS	$ 4,000.00	$ 4,000.00
4	Traffic Control	1	LS	$ 3,000.00	$ 3,000.00
5	Pipe Arch	22.5	LF	$ 1,763.56	$ 39,680.00
	Excavation	100	CY	$ 6.00	$ 600.00
	Footings	10	CY	$ 700.00	$ 7,000.00
	Pipe Arch	22.5	LF	$ 800.00	$ 18,000.00
	Headwalls	17	CY	$ 800.00	$ 13,600.00
	Backfill	120	CY	$ 4.00	$ 480.00
6	Grade Channel	1	LS	$ 2,200.00	$ 2,200.00
7	Class 2 Aggregate Base	25	Ton	$ 25.00	$ 625.00
8	HACP	14	Ton	$ 125.00	$ 1,750.00
9	Erosion Control	1	LS	$ 3,000.00	$ 3,000.00
10	Mobilization	**1**	LS	$ 4,000.00	$ 4,000.00
	subtotal				**$ 84,755.00**
	Contingency: 20%				$ 16,951.00
	Construction Management: 15%				$ 12,713.25
	Engineering Final Design: 20%				$ 16,951.00
	Total				**$ 131,370.25**
	Retrofit				
1	Temporary Bridge	1	LS	$ 20,200.00	$ 20,200.00
	Clearing	1	LS	$ 2,200.00	$ 2,200.00
	Foundation	1	LS	$ 3,000.00	$ 3,000.00
	Bridge	1	LS	$ 10,000.00	$ 10,000.00
	Approaches	1	LS	$ 5,000.00	$ 5,000.00
2	Temporary Diversion	1	LS	$ 4,000.00	$ 4,000.00
3	Temporary Shoring	1	LS	$ 3,200.00	$ 3,200.00
4	Traffic Control	1	LS	$ 3,000.00	$ 3,000.00
5	Demolition	340	SF	$ 17.00	$ 5,780.00
6	Excavation	30	CY	$ 155.00	$ 4,650.00
7	Structural Concrete	10	CY	$ 500.00	$ 5,000.00
8	Natural Bottom	10	CY	$ 300.00	$ 3,000.00
9	Grade Channel	1	LS	$ 2,200.00	$ 2,200.00
10	Erosion Control	1	LS	$ 3,000.00	$ 3,000.00
11	Mobilization	1	LS	$ 3,000.00	$ 3,000.00
	subtotal				**$ 57,030.00**
	Contingency: 20%				$ 11,406.00
	Construction Management: 15%				$ 8,554.50
	Engineering Final Design: 20%				$ 11,406.00
	Total				**$ 88,396.50**

Conner Creek - 506057
Engineer's Estimate
3/13/2007

Item #	Item Description	Quantity	Unit	Unit Price	Extended Price
	Crossing #2				
	Replacement				
1	Temporary Bridge	1	LS	$ 23,000.00	$ 23,000.00
	Clearing	1	LS	$ 3,000.00	$ 3,000.00
	Foundation	1	LS	$ 3,000.00	$ 3,000.00
	Bridge	1	LS	$ 10,000.00	$ 10,000.00
	Approaches	1	LS	$ 7,000.00	$ 7,000.00
2	Temporary Diversion	1	LS	$ 6,000.00	$ 6,000.00
3	Traffic Control	1	LS	$ 3,000.00	$ 3,000.00
4	Pipe Arch	66	LF	$ 1,397.76	$ 92,252.00
	Excavation	700	CY	$ 6.00	$ 4,200.00
	Remove Existing Culvert	66	LF	$ 22.00	$ 1,452.00
	Footings	30	CY	$ 700.00	$ 21,000.00
	Pipe Arch	66	LF	$ 700.00	$ 46,200.00
	Headwalls	22	CY	$ 800.00	$ 17,600.00
	Backfill	450	CY	$ 4.00	$ 1,800.00
6	Class 2 Aggregate Base	50	Ton	$ 25.00	$ 1,250.00
7	HACP	27	Ton	$ 125.00	$ 3,375.00
8	Erosion Control	1	LS	$ 4,000.00	$ 4,000.00
	subtotal				**$ 132,877.00**
	Contingency: 20%				$ 26,575.40
	Construction Management: 15%				$ 19,931.55
	Engineering Final Design: 20%				$ 26,575.40
	Total				**$ 205,959.35**
	Retrofit				
1	Temporary Diversion	1	LS	$ 6,000.00	$ 6,000.00
2	Traffic Control	1	LS	$ 5,000.00	$ 5,000.00
3	Concrete Lining	20	CY	$ 400.00	$ 8,000.00
4	Baffles	1	LS	$ 4,000.00	$ 4,000.00
5	Overflow Pipe	61	LF	$ 197.46	$ 12,045.00
	Sawcut	40	LF	$ 3.00	$ 120.00
	Excavation	250	CY	$ 6.00	$ 1,500.00
	Pipe	61	LF	$ 125.00	$ 7,625.00
	Backfill	200	CY	$ 4.00	$ 800.00
	Base Rock	20	Ton	$ 25.00	$ 500.00
	HACP	12	Ton	$ 125.00	$ 1,500.00
6	Boulder Weirs	70	Ton	$ 90.00	$ 6,300.00
7	Erosion Control	1	LS	$ 4,000.00	$ 4,000.00
	subtotal				**$ 45,345.00**
	Contingency: 20%				$ 9,069.00
	Construction Management: 15%				$ 6,801.75
	Engineering Final Design: 20%				$ 9,069.00
	Total				**$ 70,284.75**

Appendix E

HEC-RAS Results

Alternative #1-a

Plan: Replacement Connor Creek Connor #1 RS: 219.27 Culv Group: Culvert #1 Profile: 50 yr

Q Culv Group (cfs)	1020.00	**Culv Full Len (ft)**	22.14
# Barrels	1	**Culv Vel US (ft/s)**	9.87
Q Barrel (cfs)	1020.00	**Culv Vel DS (ft/s)**	9.87
E.G. US. (ft)	99.22	**Culv Inv El Up (ft)**	89.90
W.S. US. (ft)	97.58	**Culv Inv El Dn (ft)**	88.57
E.G. DS (ft)	96.48	**Culv Frctn Ls (ft)**	0.54
W.S. DS (ft)	96.11	**Culv Exit Loss (ft)**	1.14
Delta EG (ft)	2.73	**Culv Entr Loss (ft)**	0.76
Delta WS (ft)	1.46	**Q Weir (cfs)**	
E.G. IC (ft)	97.81	**Weir Sta Lft (ft)**	
E.G. OC (ft)	98.73	**Weir Sta Rgt (ft)**	
Culvert Control	Inlet	**Weir Submerg**	
Culv WS Inlet (ft)	96.65	**Weir Max Depth (ft)**	
Culv WS Outlet (ft)	95.32	**Weir Avg Depth (ft)**	
Culv Nml Depth (ft)	3.04	**Weir Flow Area (sq ft)**	
Culv Crt Depth (ft)	4.34	**Min El Weir Flow (ft)**	99.89

Errors Warnings and Notes

Warning:	During subcritical analysis, the water surface upstream of culvert went to critical depth.
Warning:	During the supercritical analysis, the program could not balance the energy equation during the
	forewater calculations inside of the culvert. The program assumed critical depth at the outlet
	and continued on.
Warning:	The inlet is submerged and the outlet computations indicate that the culvert would flow full over
	all or part of its length. The program would normally default to the outlet answer. However, the
	user has requested that the inlet answer be used.
Note:	During the supercritical calculations a hydraulic jump occurred inside of the culvert.
Note:	During the supercritical calculations a hydraulic jump occurred at the inlet of (going into) the
	culvert.

Plan: Replacement Connor Creek Connor #1 RS: 219.27 Culv Group: Culvert #1 Profile: 100 yr

Q Culv Group (cfs)	1131.00	**Culv Full Len (ft)**	22.14
# Barrels	1	**Culv Vel US (ft/s)**	10.94
Q Barrel (cfs)	1131.00	**Culv Vel DS (ft/s)**	10.94
E.G. US. (ft)	98.89	**Culv Inv El Up (ft)**	89.90
W.S. US. (ft)	97.86	**Culv Inv El Dn (ft)**	88.57
E.G. DS (ft)	96.72	**Culv Frctn Ls (ft)**	0.35
W.S. DS (ft)	96.30	**Culv Exit Loss (ft)**	1.44
Delta EG (ft)	2.17	**Culv Entr Loss (ft)**	0.93
Delta WS (ft)	1.56	**Q Weir (cfs)**	
E.G. IC (ft)	98.89	**Weir Sta Lft (ft)**	
E.G. OC (ft)	99.52	**Weir Sta Rgt (ft)**	
Culvert Control	Inlet	**Weir Submerg**	
Culv WS Inlet (ft)	96.65	**Weir Max Depth (ft)**	
Culv WS Outlet (ft)	95.32	**Weir Avg Depth (ft)**	
Culv Nml Depth (ft)	3.28	**Weir Flow Area (sq ft)**	
Culv Crt Depth (ft)	4.63	**Min El Weir Flow (ft)**	99.89

Errors Warnings and Notes

Warning:	During subcritical analysis, the water surface upstream of culvert went to critical depth.
Warning:	During the supercritical analysis, the program could not balance the energy equation during the
	forewater calculations inside of the culvert. The program assumed critical depth at the outlet
	and continued on.
Warning:	The inlet is submerged and the outlet computations indicate that the culvert would flow full over

Plan: Replacement Connor Creek Connor #1 RS: 219.27 Culv Group: Culvert #1 Profile: adult-Low Pass

Q Culv Group (cfs)	3.00	Culv Full Len (ft)	
# Barrels	1	Culv Vel US (ft/s)	0.24
Q Barrel (cfs)	3.00	Culv Vel DS (ft/s)	0.08
E.G. US. (ft)	89.83	Culv Inv El Up (ft)	89.90
W.S. US. (ft)	92.77	Culv Inv El Dn (ft)	88.57
E.G. DS (ft)	90.54	Culv Frctn Ls (ft)	0.00
W.S. DS (ft)	90.54	Culv Exit Loss (ft)	
Delta EG (ft)	0.71	Culv Entr Loss (ft)	
Delta WS (ft)	2.22	Q Weir (cfs)	
E.G. IC (ft)	89.83	Weir Sta Lft (ft)	
E.G. OC (ft)	90.54	Weir Sta Rgt (ft)	
Culvert Control	Inlet	Weir Submerg	
Culv WS Inlet (ft)	90.54	Weir Max Depth (ft)	
Culv WS Outlet (ft)	90.54	Weir Avg Depth (ft)	
Culv Nml Depth (ft)	0.08	Weir Flow Area (sq ft)	
Culv Crt Depth (ft)	0.09	Min El Weir Flow (ft)	99.89

Errors Warnings and Notes

Warning:	During subcritical analysis, the water surface upstream of culvert went to critical depth.
Warning:	During the supercritical analysis, the program could not balance the energy equation during the
	forewater calculations inside of the culvert. The program assumed critical depth at the outlet
	and continued on.
Note:	During the supercritical calculations a hydraulic jump occurred inside of the culvert.

Plan: Replacement Connor Creek Connor #1 RS: 219.27 Culv Group: Culvert #1 Profile: adult-Upper Pass

Q Culv Group (cfs)	57.00	Culv Full Len (ft)	
# Barrels	1	Culv Vel US (ft/s)	1.76
Q Barrel (cfs)	57.00	Culv Vel DS (ft/s)	1.00
E.G. US. (ft)	90.66	Culv Inv El Up (ft)	89.90
W.S. US. (ft)	93.58	Culv Inv El Dn (ft)	88.57
E.G. DS (ft)	91.61	Culv Frctn Ls (ft)	0.01
W.S. DS (ft)	91.60	Culv Exit Loss (ft)	0.00
Delta EG (ft)	0.95	Culv Entr Loss (ft)	
Delta WS (ft)	1.98	Q Weir (cfs)	
E.G. IC (ft)	90.66	Weir Sta Lft (ft)	
E.G. OC (ft)	91.65	Weir Sta Rgt (ft)	
Culvert Control	Inlet	Weir Submerg	
Culv WS Inlet (ft)	91.58	Weir Max Depth (ft)	
Culv WS Outlet (ft)	91.60	Weir Avg Depth (ft)	
Culv Nml Depth (ft)	0.48	Weir Flow Area (sq ft)	
Culv Crt Depth (ft)	0.64	Min El Weir Flow (ft)	99.89

Errors Warnings and Notes

Warning:	During subcritical analysis, the water surface upstream of culvert went to critical depth.
Warning:	During the supercritical analysis, the program could not balance the energy equation during the
	forewater calculations inside of the culvert. The program assumed critical depth at the outlet
	and continued on.
Note:	During the supercritical calculations a hydraulic jump occurred inside of the culvert.

Plan: Replacement Connor Creek Connor #1 RS: 219.27 Culv Group: Culvert #1 Profile: juven-low pass

Q Culv Group (cfs)	1.00	Culv Full Len (ft)	
# Barrels	1	Culv Vel US (ft/s)	0.11
Q Barrel (cfs)	1.00	Culv Vel DS (ft/s)	0.03
E.G. US. (ft)	89.76	Culv Inv El Up (ft)	89.90
W.S. US. (ft)	92.65	Culv Inv El Dn (ft)	88.57
E.G. DS (ft)	90.36	Culv Frctn Ls (ft)	0.00
W.S. DS (ft)	90.36	Culv Exit Loss (ft)	
Delta EG (ft)	0.60	Culv Entr Loss (ft)	
Delta WS (ft)	2.29	Q Weir (cfs)	
E.G. IC (ft)	89.76	Weir Sta Lft (ft)	
E.G. OC (ft)	90.36	Weir Sta Rgt (ft)	
Culvert Control	Inlet	Weir Submerg	
Culv WS Inlet (ft)	90.36	Weir Max Depth (ft)	
Culv WS Outlet (ft)	90.36	Weir Avg Depth (ft)	
Culv Nml Depth (ft)	0.04	Weir Flow Area (sq ft)	
Culv Crt Depth (ft)	0.04	Min El Weir Flow (ft)	99.89

Errors Warnings and Notes

Warning:	During subcritical analysis, the water surface upstream of culvert went to critical depth.
Warning:	During the supercritical analysis, the program could not balance the energy equation during the
	forewater calculations inside of the culvert. The program assumed critical depth at the outlet
	and continued on.
Note:	During the supercritical calculations a hydraulic jump occurred inside of the culvert.

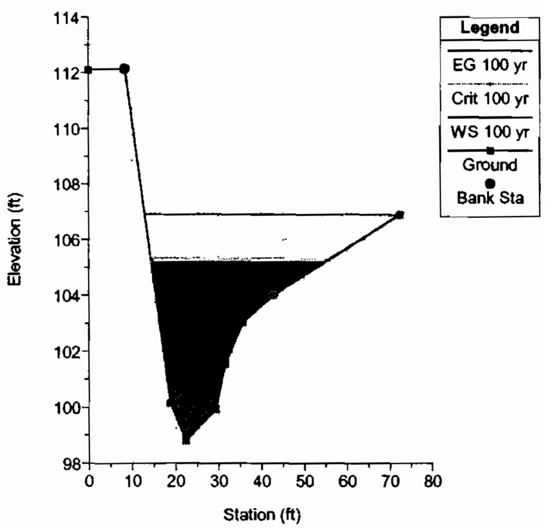
Plan: Replacement Connor Creek Connor #1 RS: 219.27 Culv Group: Culvert #1 Profile: juven-upper pass

Q Culv Group (cfs)	15.00	Culv Full Len (ft)	
# Barrels	1	Culv Vel US (ft/s)	0.75
Q Barrel (cfs)	15.00	Culv Vel DS (ft/s)	0.33
E.G. US. (ft)	90.09	Culv Inv El Up (ft)	89.90
W.S. US. (ft)	93.05	Culv Inv El Dn (ft)	88.57
E.G. DS (ft)	90.93	Culv Frctn Ls (ft)	0.00
W.S. DS (ft)	90.93	Culv Exit Loss (ft)	0.00
Delta EG (ft)	0.84	Culv Entr Loss (ft)	
Delta WS (ft)	2.12	Q Weir (cfs)	
E.G. IC (ft)	90.09	Weir Sta Lft (ft)	
E.G. OC (ft)	90.94	Weir Sta Rgt (ft)	
Culvert Control	Inlet	Weir Submerg	
Culv WS Inlet (ft)	90.92	Weir Max Depth (ft)	
Culv WS Outlet (ft)	90.93	Weir Avg Depth (ft)	
Culv Nml Depth (ft)	0.22	Weir Flow Area (sq ft)	
Culv Crt Depth (ft)	0.26	Min El Weir Flow (ft)	99.89

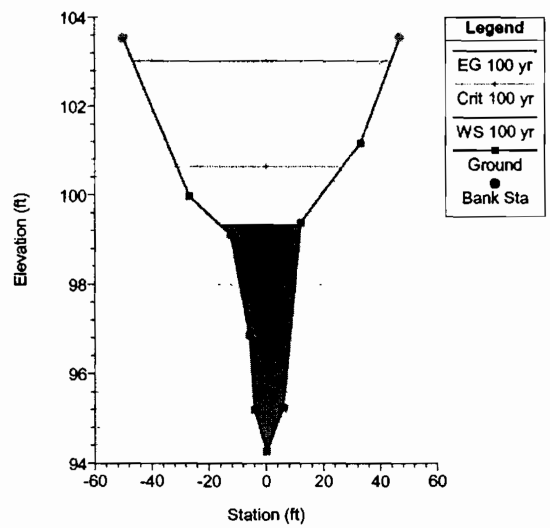
Errors Warnings and Notes

Warning:	During subcritical analysis, the water surface upstream of culvert went to critical depth.
Warning:	During the supercritical analysis, the program could not balance the energy equation during the
	forewater calculations inside of the culvert. The program assumed critical depth at the outlet
	and continued on.
Note:	During the supercritical calculations a hydraulic jump occurred inside of the culvert.

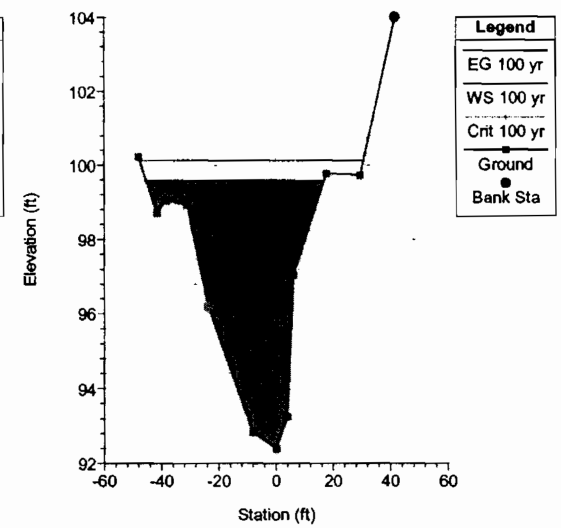
Connor Creek Plan: Plan 07 3/13/2007
River = Connor Creek Reach = Connor #1 RS = 379.48



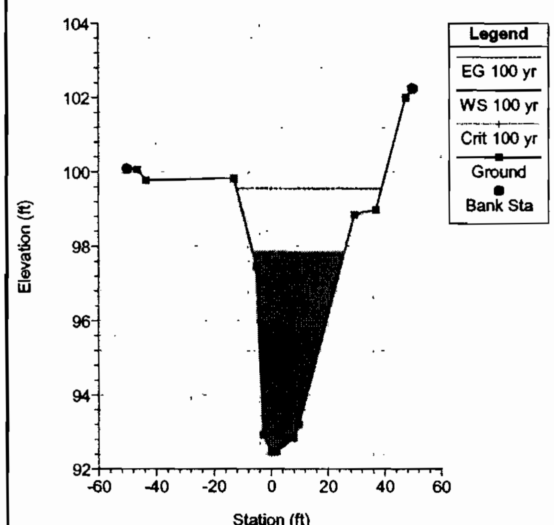
Connor Creek Plan: Plan 07 3/13/2007
River = Connor Creek Reach = Connor #1 RS = 293.15



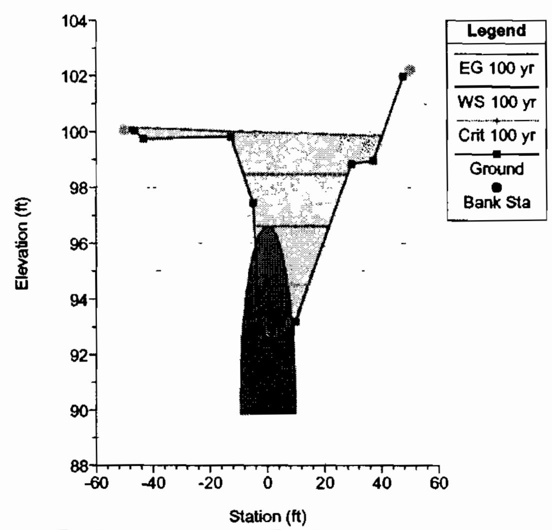
Connor Creek Plan: Plan 07 3/13/2007
River = Connor Creek Reach = Connor #1 RS = 279.61



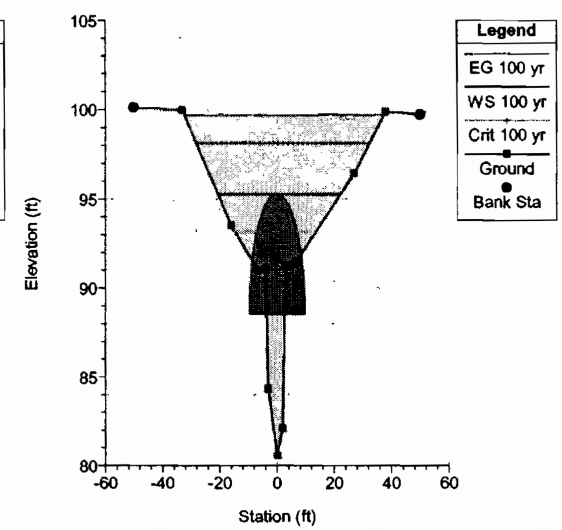
Connor Creek Plan: Plan 07 3/13/2007
River = Connor Creek Reach = Connor #1 RS = 232.73



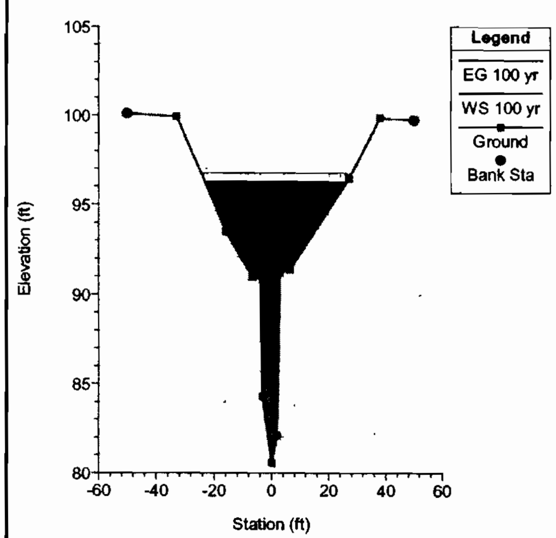
Connor Creek Plan: Plan 07 3/13/2007
River = Connor Creek Reach = Connor #1 RS = 219.27 Culv



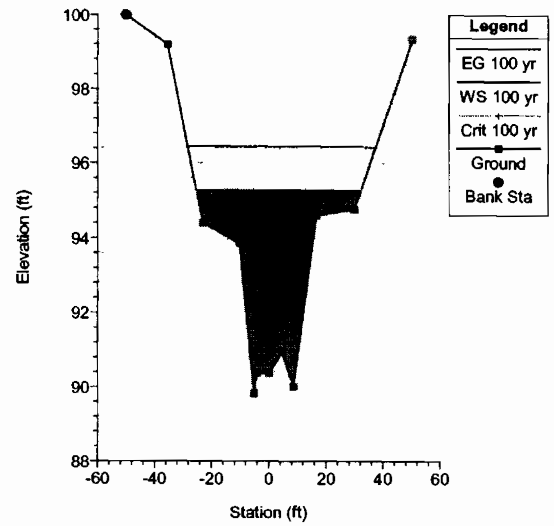
Connor Creek Plan: Plan 07 3/13/2007
River = Connor Creek Reach = Connor #1 RS = 219.27 Culv



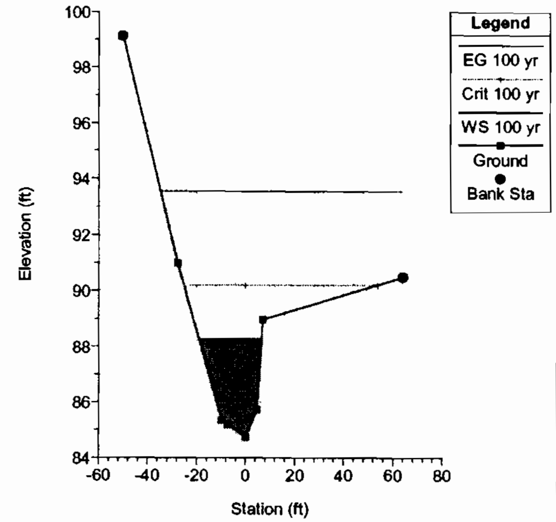
Connor Creek Plan: Plan 07 3/13/2007
River = Connor Creek Reach = Connor #1 RS = 209



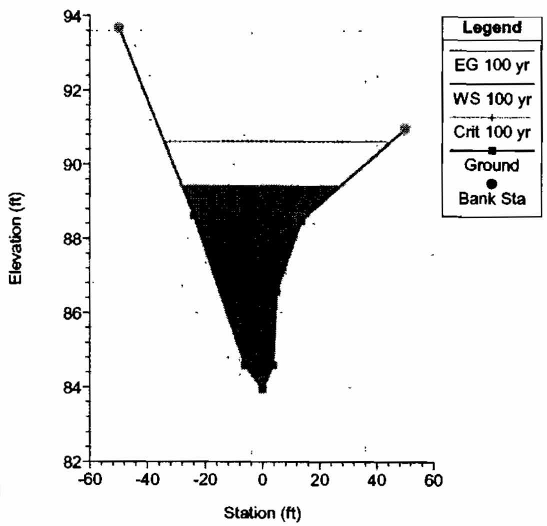
Connor Creek Plan: Plan 07 3/13/2007
River = Connor Creek Reach = Connor #1 RS = 192.18



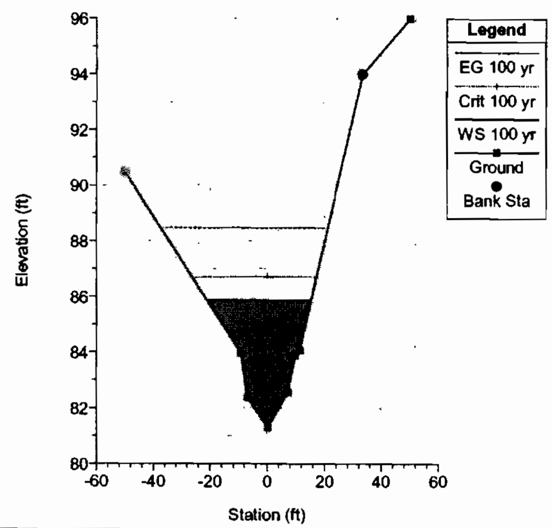
Connor Creek Plan: Plan 07 3/13/2007
River = Connor Creek Reach = Connor #1 RS = 146.55



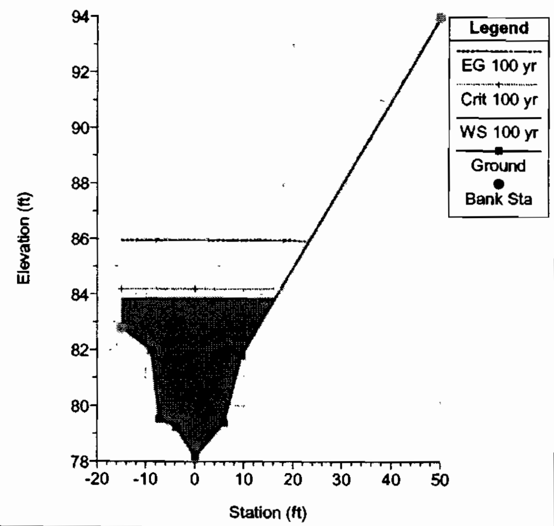
Connor Creek Plan: Plan 07 3/13/2007
River = Connor Creek Reach = Connor #1 RS = 99.32



Connor Creek Plan: Plan 07 3/13/2007
River = Connor Creek Reach = Connor #1 RS = 50.67



Connor Creek Plan: Plan 07 3/13/2007
River = Connor Creek Reach = Connor #1 RS = 0.61



Alternative 1-b

Plan: Retrofit   Connor Creek   Connor #1 RS: 219.27   Culv Group: Culvert #1   Profile: 50 yr

Q Culv Group (cfs)	1020.00	**Culv Full Len (ft)**	
# Barrels	1	**Culv Vel US (ft/s)**	13.19
Q Barrel (cfs)	1020.00	**Culv Vel DS (ft/s)**	17.05
E.G. US. (ft)	99.44	**Culv Inv El Up (ft)**	89.90
W.S. US. (ft)	98.84	**Culv Inv El Dn (ft)**	88.57
E.G. DS (ft)	96.48	**Culv Frctn Ls (ft)**	0.74
W.S. DS (ft)	96.11	**Culv Exit Loss (ft)**	1.78
Delta EG (ft)	2.96	**Culv Entr Loss (ft)**	0.43
Delta WS (ft)	2.73	**Q Weir (cfs)**	
E.G. IC (ft)	99.44	**Weir Sta Lft (ft)**	
E.G. OC (ft)	100.36	**Weir Sta Rgt (ft)**	
Culvert Control	Inlet	**Weir Submerg**	
Culv WS Inlet (ft)	96.31	**Weir Max Depth (ft)**	
Culv WS Outlet (ft)	93.75	**Weir Avg Depth (ft)**	
Culv Nml Depth (ft)	4.73	**Weir Flow Area (sq ft)**	
Culv Crt Depth (ft)	6.41	**Min El Weir Flow (ft)**	99.89

Errors Warnings and Notes

Note:	During the supercritical calculations a hydraulic jump occurred at the outlet of (leaving) the
	culvert.
Warning:	During the supercritical analysis, the program could not converge on a supercritical answer in
	the downstream cross section. The program used the solution with the least error.
Note:	The flow in the culvert is entirely supercritical.

Plan: Retrofit   Connor Creek   Connor #1 RS: 219.27   Culv Group: Culvert #1   Profile: 100 yr

Q Culv Group (cfs)	1114.77	**Culv Full Len (ft)**	
# Barrels	1	**Culv Vel US (ft/s)**	13.59
Q Barrel (cfs)	1114.77	**Culv Vel DS (ft/s)**	17.50
E.G. US. (ft)	100.19	**Culv Inv El Up (ft)**	89.90
W.S. US. (ft)	99.73	**Culv Inv El Dn (ft)**	88.57
E.G. DS (ft)	96.72	**Culv Frctn Ls (ft)**	0.72
W.S. DS (ft)	96.30	**Culv Exit Loss (ft)**	2.06
Delta EG (ft)	3.47	**Culv Entr Loss (ft)**	0.69
Delta WS (ft)	3.42	**Q Weir (cfs)**	16.23
E.G. IC (ft)	100.19	**Weir Sta Lft (ft)**	-47.41
E.G. OC (ft)	100.94	**Weir Sta Rgt (ft)**	41.09
Culvert Control	Inlet	**Weir Submerg**	0.00
Culv WS Inlet (ft)	96.64	**Weir Max Depth (ft)**	0.31
Culv WS Outlet (ft)	94.02	**Weir Avg Depth (ft)**	0.16
Culv Nml Depth (ft)	4.94	**Weir Flow Area (sq ft)**	14.09
Culv Crt Depth (ft)	6.74	**Min El Weir Flow (ft)**	99.89

Errors Warnings and Notes

Warning:	The flow through the culvert is supercritical. However, since there is flow over the road (weir
	flow), the program cannot determine if the downstream cross section should be subcritical or
	supercritical. The program used the downstream subcritical answer, even though it may not be
	valid.
Warning:	During the supercritical analysis, the program could not converge on a supercritical answer in
	the downstream cross section. The program used the solution with the least error.
Warning:	During the culvert outlet computations, the program could not balance the culvert/weir flow.
	The reported outlet energy grade answer may not be valid.
Note:	The flow in the culvert is entirely supercritical.

Alternative 1-b

Plan: Retrofit Connor Creek Connor #1 RS: 219.27 Culv Group: Culvert #1 Profile: adult-Low Pass

Q Culv Group (cfs)	3.00	**Culv Full Len (ft)**	
# Barrels	1	**Culv Vel US (ft/s)**	1.89
Q Barrel (cfs)	3.00	**Culv Vel DS (ft/s)**	0.22
E.G. US. (ft)	91.26	**Culv Inv El Up (ft)**	89.90
W.S. US. (ft)	91.19	**Culv Inv El Dn (ft)**	88.57
E.G. DS (ft)	90.54	**Culv Frctn Ls (ft)**	0.52
W.S. DS (ft)	90.54	**Culv Exit Loss (ft)**	0.00
Delta EG (ft)	0.72	**Culv Entr Loss (ft)**	
Delta WS (ft)	0.65	**Q Weir (cfs)**	
E.G. IC (ft)	90.84	**Weir Sta Lft (ft)**	
E.G. OC (ft)	91.09	**Weir Sta Rgt (ft)**	
Culvert Control	Inlet	**Weir Submerg**	
Culv WS Inlet (ft)	91.01	**Weir Max Depth (ft)**	
Culv WS Outlet (ft)	90.54	**Weir Avg Depth (ft)**	
Culv Nml Depth (ft)	1.11	**Weir Flow Area (sq ft)**	
Culv Crt Depth (ft)	1.11	**Min El Weir Flow (ft)**	99.89

Errors Warnings and Notes

Warning:	During subcritical analysis, the water surface upstream of culvert went to critical depth.
Note:	During the supercritical analysis, the water surface at the inlet was within 0.01 feet of normal
	depth. Therefore, the outlet will be at normal depth.
Note:	During the supercritical calculations a hydraulic jump occurred inside of the culvert.
Note:	During the supercritical calculations a hydraulic jump occurred at the inlet of (going into) the
	culvert.

Plan: Retrofit Connor Creek Connor #1 RS: 219.27 Culv Group: Culvert #1 Profile: adult-Upper Pass

Q Culv Group (cfs)	57.00	**Culv Full Len (ft)**	
# Barrels	1	**Culv Vel US (ft/s)**	5.04
Q Barrel (cfs)	57.00	**Culv Vel DS (ft/s)**	1.96
E.G. US. (ft)	92.45	**Culv Inv El Up (ft)**	89.90
W.S. US. (ft)	91.99	**Culv Inv El Dn (ft)**	88.57
E.G. DS (ft)	91.61	**Culv Frctn Ls (ft)**	0.43
W.S. DS (ft)	91.60	**Culv Exit Loss (ft)**	0.05
Delta EG (ft)	0.83	**Culv Entr Loss (ft)**	
Delta WS (ft)	0.39	**Q Weir (cfs)**	
E.G. IC (ft)	91.89	**Weir Sta Lft (ft)**	
E.G. OC (ft)	92.28	**Weir Sta Rgt (ft)**	
Culvert Control	Inlet	**Weir Submerg**	
Culv WS Inlet (ft)	91.69	**Weir Max Depth (ft)**	
Culv WS Outlet (ft)	91.60	**Weir Avg Depth (ft)**	
Culv Nml Depth (ft)	1.65	**Weir Flow Area (sq ft)**	
Culv Crt Depth (ft)	1.79	**Min El Weir Flow (ft)**	99.89

Errors Warnings and Notes

Warning:	During subcritical analysis, the water surface upstream of culvert went to critical depth.
Note:	During supercritical analysis, the culvert direct step method went to normal depth. The program
	then assumed normal depth at the outlet.
Note:	During the supercritical calculations a hydraulic jump occurred inside of the culvert.
Note:	During the supercritical calculations a hydraulic jump occurred at the inlet of (going into) the
	culvert.

Plan: Retrofit Connor Creek Connor #1 RS: 219.27 Culv Group: Culvert #1 Profile: juven-low pass

Q Culv Group (cfs)	1.00	Culv Full Len (ft)	
# Barrels	1	Culv Vel US (ft/s)	1.31
Q Barrel (cfs)	1.00	Culv Vel DS (ft/s)	0.09
E.G. US. (ft)	91.16	Culv Inv El Up (ft)	89.90
W.S. US. (ft)	91.12	Culv Inv El Dn (ft)	88.57
E.G. DS (ft)	90.36	Culv Frctn Ls (ft)	0.62
W.S. DS (ft)	90.36	Culv Exit Loss (ft)	0.00
Delta EG (ft)	0.80	Culv Entr Loss (ft)	
Delta WS (ft)	0.76	Q Weir (cfs)	
E.G. IC (ft)	90.75	Weir Sta Lft (ft)	
E.G. OC (ft)	90.99	Weir Sta Rgt (ft)	
Culvert Control	Inlet	Weir Submerg	
Culv WS Inlet (ft)	90.95	Weir Max Depth (ft)	
Culv WS Outlet (ft)	90.36	Weir Avg Depth (ft)	
Culv Nml Depth (ft)	1.06	Weir Flow Area (sq ft)	
Culv Crt Depth (ft)	1.05	Min El Weir Flow (ft)	99.89

Errors Warnings and Notes

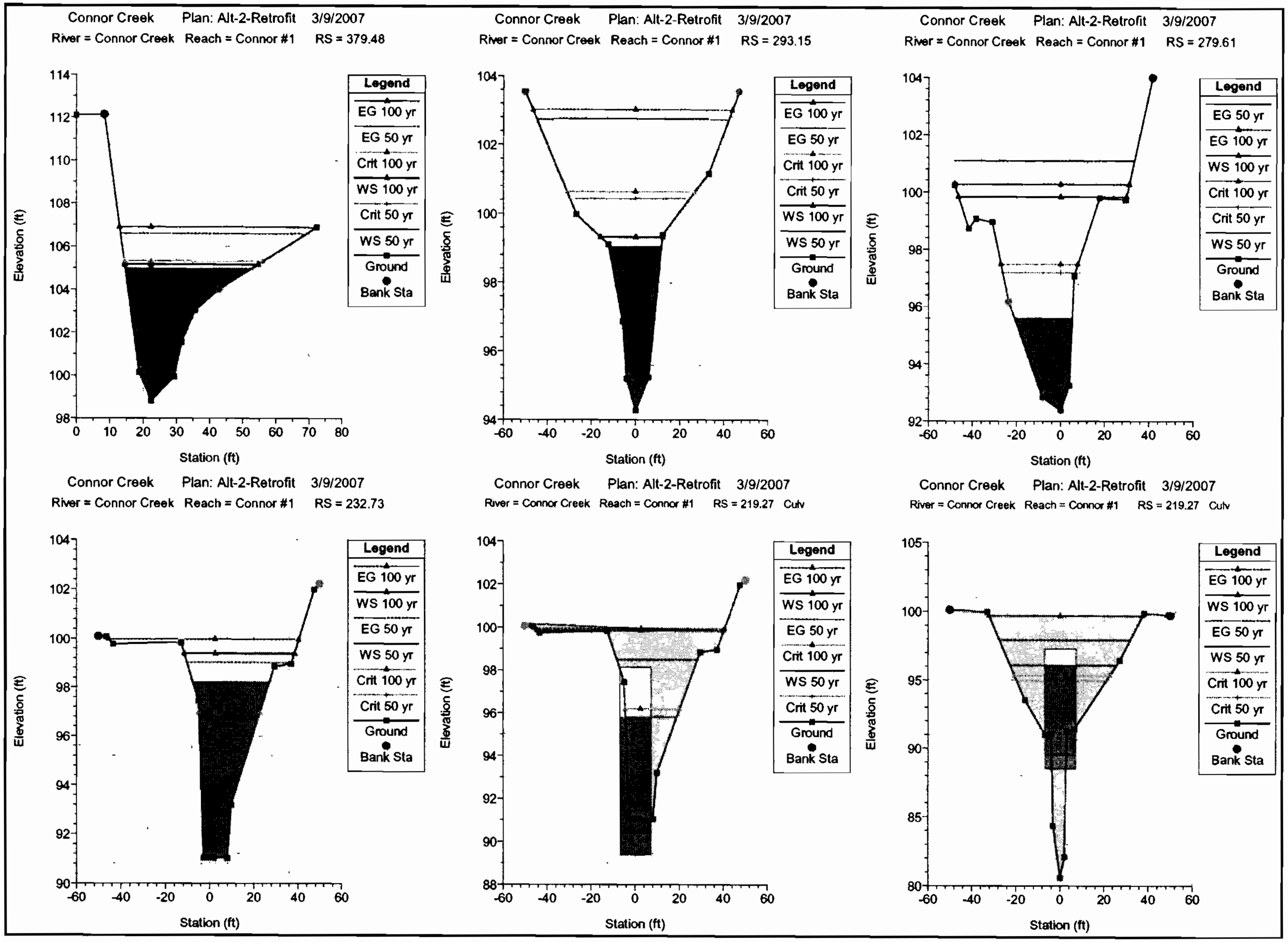
Warning:	During subcritical analysis, the water surface upstream of culvert went to critical depth.
Note:	During the supercritical calculations a hydraulic jump occurred at the inlet of (going into) the
	culvert.

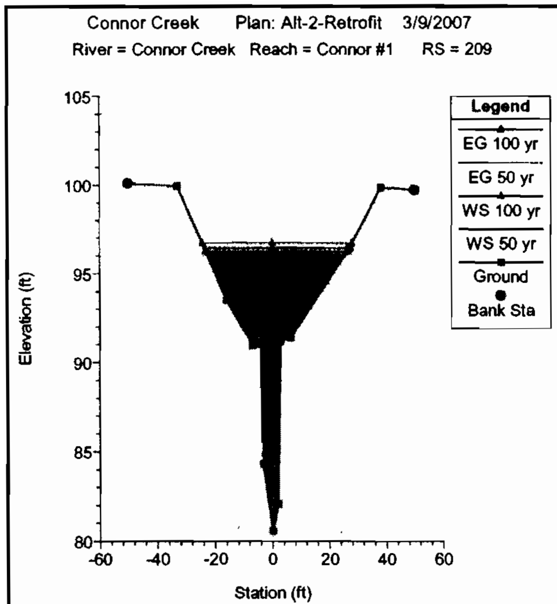
Plan: Retrofit Connor Creek Connor #1 RS: 219.27 Culv Group: Culvert #1 Profile: juven-upper pass

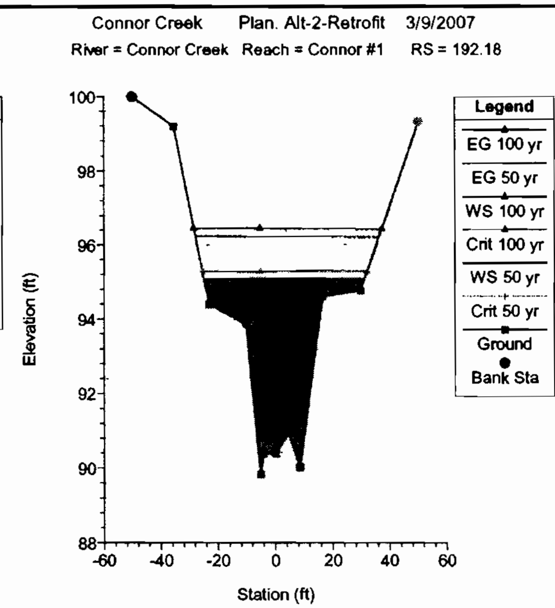
Q Culv Group (cfs)	15.00	Culv Full Len (ft)	
# Barrels	1	Culv Vel US (ft/s)	3.23
Q Barrel (cfs)	15.00	Culv Vel DS (ft/s)	0.77
E.G. US. (ft)	91.64	Culv Inv El Up (ft)	89.90
W.S. US. (ft)	91.45	Culv Inv El Dn (ft)	88.57
E.G. DS (ft)	90.93	Culv Frctn Ls (ft)	0.45
W.S. DS (ft)	90.93	Culv Exit Loss (ft)	0.01
Delta EG (ft)	0.71	Culv Entr Loss (ft)	
Delta WS (ft)	0.52	Q Weir (cfs)	
E.G. IC (ft)	91.16	Weir Sta Lft (ft)	
E.G. OC (ft)	91.47	Weir Sta Rgt (ft)	
Culvert Control	Inlet	Weir Submerg	
Culv WS Inlet (ft)	91.22	Weir Max Depth (ft)	
Culv WS Outlet (ft)	90.93	Weir Avg Depth (ft)	
Culv Nml Depth (ft)	1.29	Weir Flow Area (sq ft)	
Culv Crt Depth (ft)	1.32	Min El Weir Flow (ft)	99.89

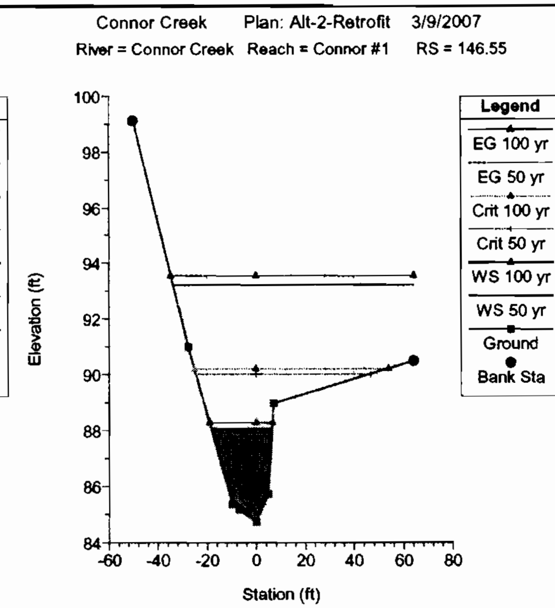
Errors Warnings and Notes

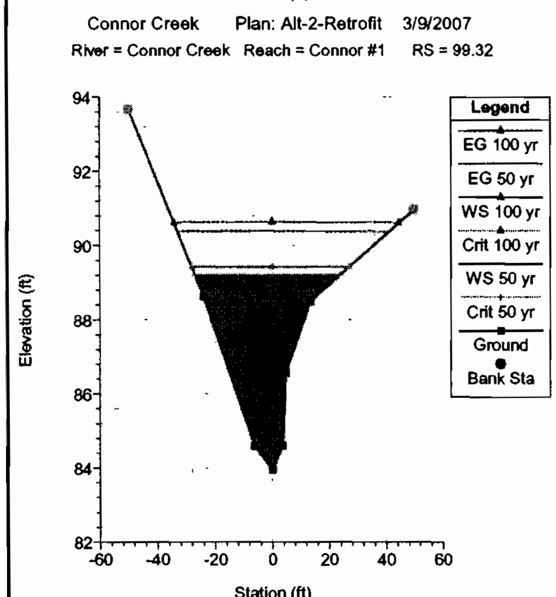
Warning:	During subcritical analysis, the water surface upstream of culvert went to critical depth.
Note:	During supercritical analysis, the culvert direct step method went to normal depth. The program
	then assumed normal depth at the outlet.
Note:	During the supercritical calculations a hydraulic jump occurred inside of the culvert.
Note:	During the supercritical calculations a hydraulic jump occurred at the inlet of (going into) the
	culvert.

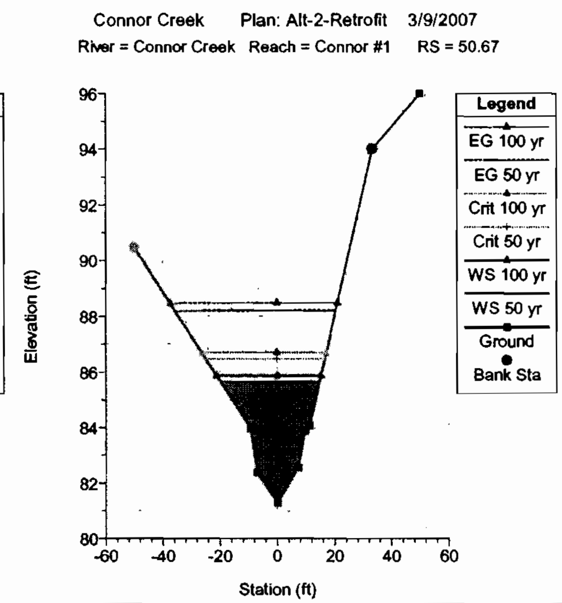

Connor Creek Plan: Alt-2-Retrofit 3/9/2007
River = Connor Creek Reach = Connor #1 RS = 379.48
Legend
EG 100 yr
EG 50 yr
Crit 100 yr
WS 100 yr
Crit 50 yr
WS 50 yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
Connor Creek Plan: Alt-2-Retrofit 3/9/2007
River = Connor Creek Reach = Connor #1 RS = 293.15
Legend
EG 100 yr
EG 50 yr
Crit 100 yr
Crit 50 yr
WS 100 yr
WS 50 yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
Connor Creek Plan: Alt-2-Retrofit 3/9/2007
River = Connor Creek Reach = Connor #1 RS = 279.61
Legend
EG 50 yr
EG 100 yr
WS 100 yr
Crit 100 yr
Crit 50 yr
WS 50 yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
Connor Creek Plan: Alt-2-Retrofit 3/9/2007
River = Connor Creek Reach = Connor #1 RS = 232.73
Legend
EG 100 yr
WS 100 yr
EG 50 yr
WS 50 yr
Crit 100 yr
Crit 50 yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
Connor Creek Plan: Alt-2-Retrofit 3/9/2007
River = Connor Creek Reach = Connor #1 RS = 219.27 Culv
Legend
EG 100 yr
WS 100 yr
EG 50 yr
Crit 100 yr
WS 50 yr
Crit 50 yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
Connor Creek Plan: Alt-2-Retrofit 3/9/2007
River = Connor Creek Reach = Connor #1 RS = 219.27 Culv
Legend
EG 100 yr
WS 100 yr
EG 50 yr
WS 50 yr
Crit 100 yr
Crit 50 yr
Ground
Bank Sta
Elevation (ft)
Station (ft)

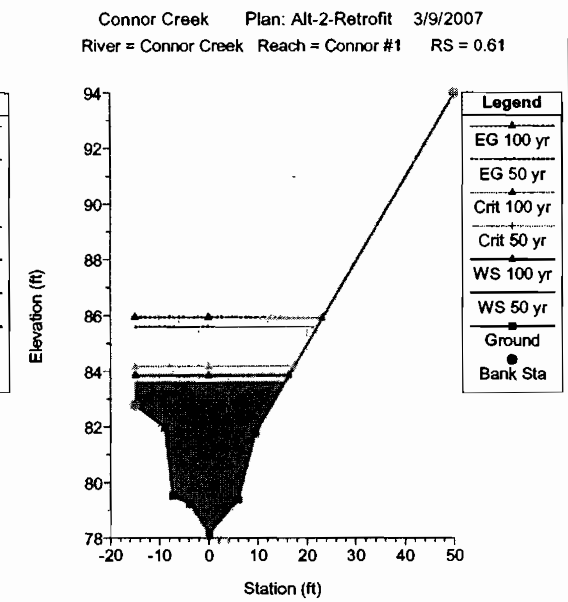

Connor Creek Plan: Alt-2-Retrofit 3/9/2007
River = Connor Creek Reach = Connor #1 RS = 209
Elevation (ft)
Station (ft)
Legend
EG 100 yr
EG 50 yr
WS 100 yr
WS 50 yr
Ground
Bank Sta


Connor Creek Plan. Alt-2-Retrofit 3/9/2007
River = Connor Creek Reach = Connor #1 RS = 192.18
Elevation (ft)
Station (ft)
Legend
EG 100 yr
EG 50 yr
WS 100 yr
Crit 100 yr
WS 50 yr
Crit 50 yr
Ground
Bank Sta


Connor Creek Plan: Alt-2-Retrofit 3/9/2007
River = Connor Creek Reach = Connor #1 RS = 146.55
Elevation (ft)
Station (ft)
Legend
EG 100 yr
EG 50 yr
Crit 100 yr
Crit 50 yr
WS 100 yr
WS 50 yr
Ground
Bank Sta


Connor Creek Plan: Alt-2-Retrofit 3/9/2007
River = Connor Creek Reach = Connor #1 RS = 99.32
Elevation (ft)
Station (ft)
Legend
EG 100 yr
EG 50 yr
WS 100 yr
Crit 100 yr
WS 50 yr
Crit 50 yr
Ground
Bank Sta


Connor Creek Plan: Alt-2-Retrofit 3/9/2007
River = Connor Creek Reach = Connor #1 RS = 50.67
Elevation (ft)
Station (ft)
Legend
EG 100 yr
EG 50 yr
Crit 100 yr
Crit 50 yr
WS 100 yr
WS 50 yr
Ground
Bank Sta


Connor Creek Plan: Alt-2-Retrofit 3/9/2007
River = Connor Creek Reach = Connor #1 RS = 0.61
Elevation (ft)
Station (ft)
Legend
EG 100 yr
EG 50 yr
Crit 100 yr
Crit 50 yr
WS 100 yr
WS 50 yr
Ground
Bank Sta

Alternative #2-a

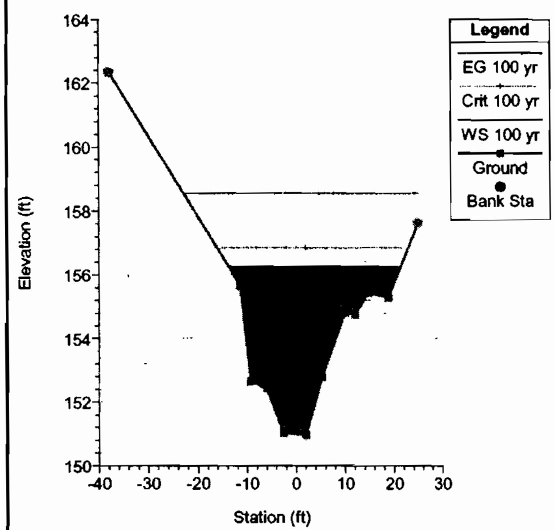
Plan: Replacement Connor Creek Connor #2 RS: 235.28 Culv Group: Culvert #2 Profile: 50 yr

Q Culv Group (cfs)	1020.00	Culv Full Len (ft)	
# Barrels	1	Culv Vel US (ft/s)	13.69
Q Barrel (cfs)	1020.00	Culv Vel DS (ft/s)	9.38
E.G. US. (ft)	152.70	Culv Inv El Up (ft)	142.91
W.S. US. (ft)	151.40	Culv Inv El Dn (ft)	140.56
E.G. DS (ft)	148.94	Culv Frctn Ls (ft)	1.23
W.S. DS (ft)	147.52	Culv Exit Loss (ft)	0.00
Delta EG (ft)	3.76	Culv Entr Loss (ft)	2.53
Delta WS (ft)	3.88	Q Weir (cfs)	
E.G. IC (ft)		Weir Sta Lft (ft)	
E.G. OC (ft)		Weir Sta Rgt (ft)	
Culvert Control	Inlet	Weir Submerg	
Culv WS Inlet (ft)	147.26	Weir Max Depth (ft)	
Culv WS Outlet (ft)	147.58	Weir Avg Depth (ft)	
Culv Nml Depth (ft)	4.18	Weir Flow Area (sq ft)	
Culv Crt Depth (ft)	4.62	Min El Weir Flow (ft)	157.24

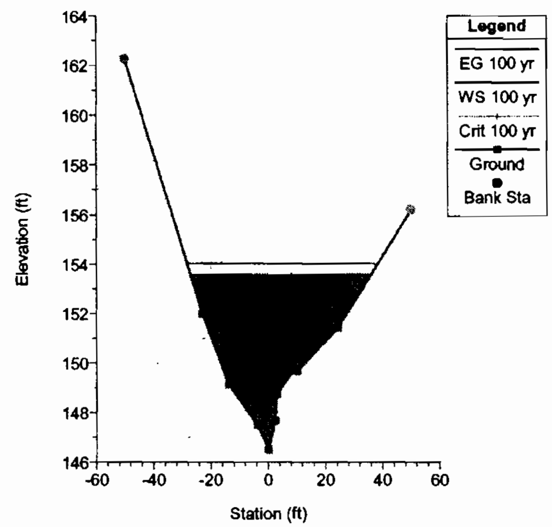
Plan: Replacement Connor Creek Connor #2 RS: 235.28 Culv Group: Culvert #2 Profile: 100 yr

Q Culv Group (cfs)	1131.00	Culv Full Len (ft)	
# Barrels	1	Culv Vel US (ft/s)	13.62
Q Barrel (cfs)	1131.00	Culv Vel DS (ft/s)	10.25
E.G. US. (ft)	152.97	Culv Inv El Up (ft)	142.91
W.S. US. (ft)	151.60	Culv Inv El Dn (ft)	140.56
E.G. DS (ft)	149.24	Culv Frctn Ls (ft)	1.32
W.S. DS (ft)	147.76	Culv Exit Loss (ft)	0.15
Delta EG (ft)	3.73	Culv Entr Loss (ft)	2.26
Delta WS (ft)	3.85	Q Weir (cfs)	
E.G. IC (ft)		Weir Sta Lft (ft)	
E.G. OC (ft)		Weir Sta Rgt (ft)	
Culvert Control	Inlet	Weir Submerg	
Culv WS Inlet (ft)	147.83	Weir Max Depth (ft)	
Culv WS Outlet (ft)	147.76	Weir Avg Depth (ft)	
Culv Nml Depth (ft)	4.53	Weir Flow Area (sq ft)	
Culv Crt Depth (ft)	4.92	Min El Weir Flow (ft)	157.24

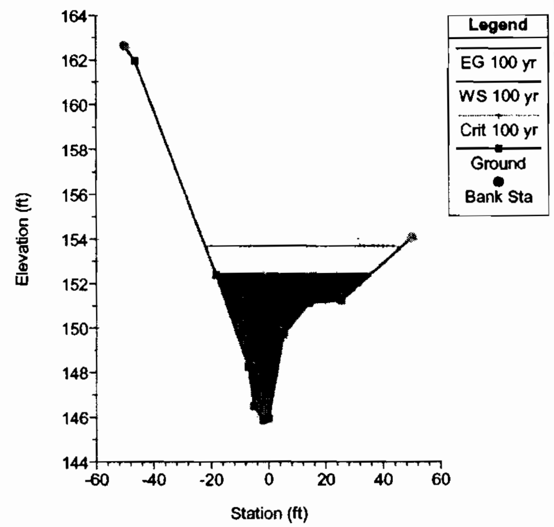
Connor Creek Plan: Alt-1-Replacement 3/12/2007
River = Connor Creek Reach = Connor #2 RS = 350



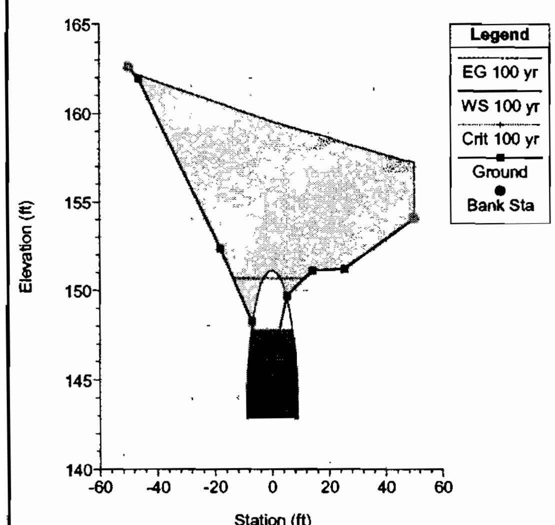
Connor Creek Plan: Alt-1-Replacement 3/12/2007
River = Connor Creek Reach = Connor #2 RS = 292.34



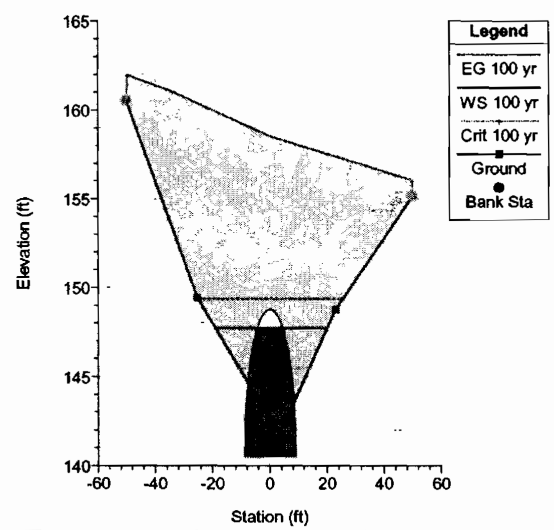
Connor Creek Plan: Alt-1-Replacement 3/12/2007
River = Connor Creek Reach = Connor #2 RS = 267



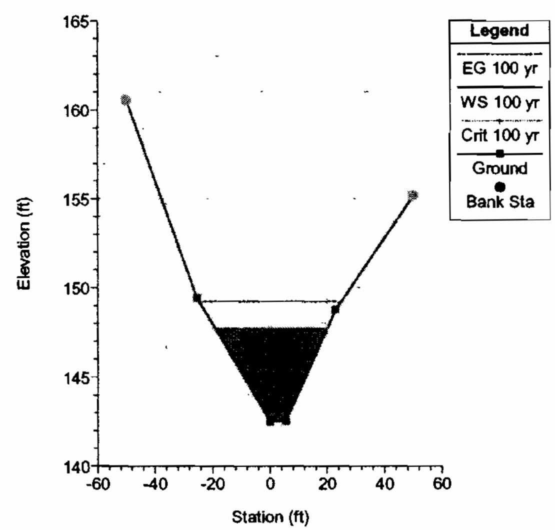
Connor Creek Plan: Alt-1-Replacement 3/12/2007
River = Connor Creek Reach = Connor #2 RS = 235.28 Culv

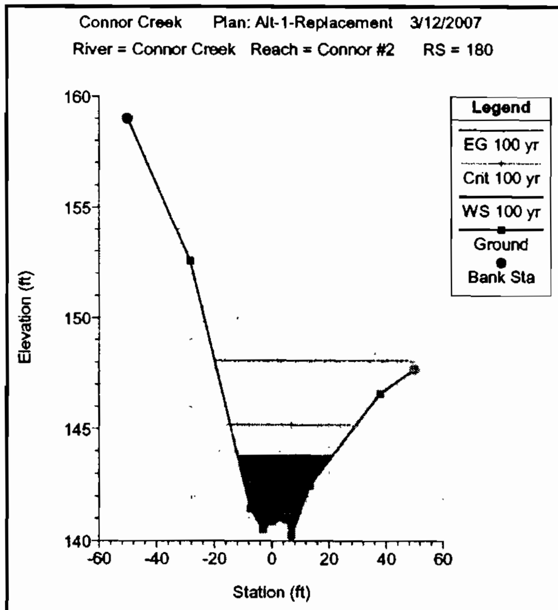


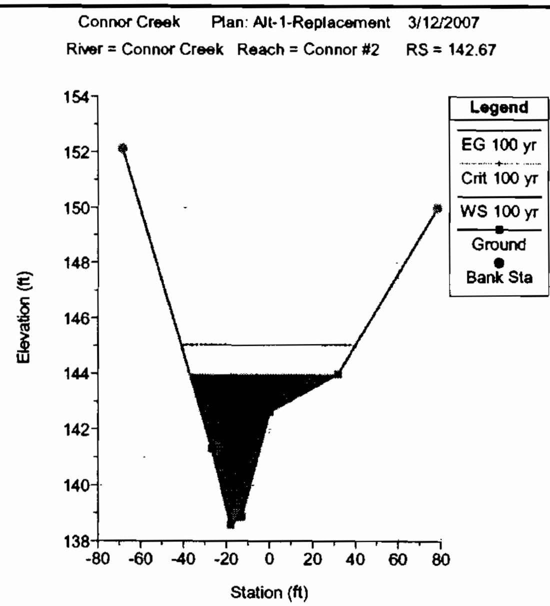
Connor Creek Plan: Alt-1-Replacement 3/12/2007
River = Connor Creek Reach = Connor #2 RS = 235.28 Culv

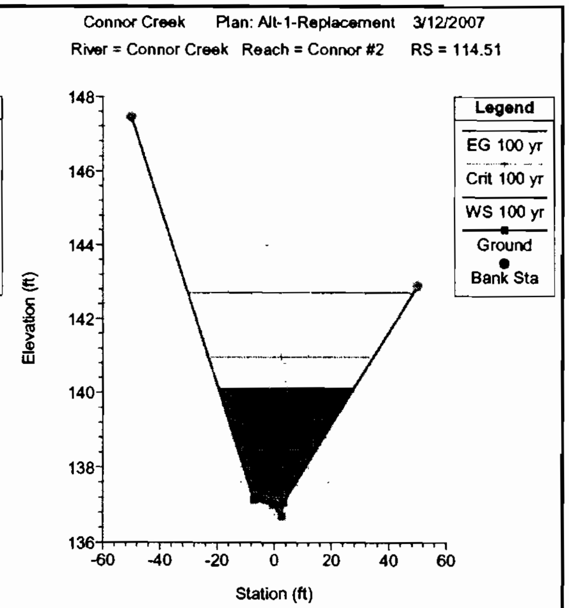


Connor Creek Plan: Alt-1-Replacement 3/12/2007
River = Connor Creek Reach = Connor #2 RS = 201.87




Connor Creek Plan: Alt-1-Replacement 3/12/2007
River = Connor Creek Reach = Connor #2 RS = 180
Legend
EG 100 yr
Crit 100 yr
WS 100 yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
160
155
150
145
140
-60
-40
-20
0
20
40
60


Connor Creek Plan: Alt-1-Replacement 3/12/2007
River = Connor Creek Reach = Connor #2 RS = 142.67
Legend
EG 100 yr
Crit 100 yr
WS 100 yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
154
152
150
148
146
144
142
140
138
-80
-60
-40
-20
0
20
40
60
80


Connor Creek Plan: Alt-1-Replacement 3/12/2007
River = Connor Creek Reach = Connor #2 RS = 114.51
Legend
EG 100 yr
Crit 100 yr
WS 100 yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
148
146
144
142
140
138
136
-60
-40
-20
0
20
40
60

Plan: Replacement Connor Creek Connor #2 RS: 235.28 Culv Group: Culvert #2 Profile: adult-Low Pass

Q Culv Group (cfs)	3.00	Culv Full Len (ft)	
# Barrels	1	Culv Vel US (ft/s)	1.55
Q Barrel (cfs)	3.00	Culv Vel DS (ft/s)	0.07
E.G. US. (ft)	142.90	Culv Inv El Up (ft)	142.91
W.S. US. (ft)	146.26	Culv Inv El Dn (ft)	140.56
E.G. DS (ft)	142.86	Culv Frctn Ls (ft)	0.19
W.S. DS (ft)	142.77	Culv Exit Loss (ft)	0.00
Delta EG (ft)	0.04	Culv Entr Loss (ft)	
Delta WS (ft)	3.49	Q Weir (cfs)	
E.G. IC (ft)	142.90	Weir Sta Lft (ft)	
E.G. OC (ft)	143.09	Weir Sta Rgt (ft)	
Culvert Control	Inlet	Weir Submerg	
Culv WS Inlet (ft)	143.02	Weir Max Depth (ft)	
Culv WS Outlet (ft)	142.86	Weir Avg Depth (ft)	
Culv Nml Depth (ft)	0.11	Weir Flow Area (sq ft)	
Culv Crt Depth (ft)	0.10	Min El Weir Flow (ft)	157.24

Errors Warnings and Notes

Warning:	During subcritical analysis, the water surface upstream of culvert went to critical depth.

Plan: Replacement Connor Creek Connor #2 RS: 235.28 Culv Group: Culvert #2 Profile: adult-Upper Pass

Q Culv Group (cfs)	57.00	Culv Full Len (ft)	
# Barrels	1	Culv Vel US (ft/s)	13.03
Q Barrel (cfs)	57.00	Culv Vel DS (ft/s)	0.91
E.G. US. (ft)	148.08	Culv Inv El Up (ft)	142.91
W.S. US. (ft)	147.51	Culv Inv El Dn (ft)	140.56
E.G. DS (ft)	144.17	Culv Frctn Ls (ft)	1.62
W.S. DS (ft)	143.74	Culv Exit Loss (ft)	
Delta EG (ft)	3.92	Culv Entr Loss (ft)	2.29
Delta WS (ft)	3.77	Q Weir (cfs)	
E.G. IC (ft)		Weir Sta Lft (ft)	
E.G. OC (ft)		Weir Sta Rgt (ft)	
Culvert Control	Inlet	Weir Submerg	
Culv WS Inlet (ft)	143.15	Weir Max Depth (ft)	
Culv WS Outlet (ft)	144.15	Weir Avg Depth (ft)	
Culv Nml Depth (ft)	0.65	Weir Flow Area (sq ft)	
Culv Crt Depth (ft)	0.68	Min El Weir Flow (ft)	157.24

Errors Warnings and Notes

Warning:	During the supercritical analysis, the program could not balance the energy equation during the
	forewater calculations inside of the culvert. The program assumed critical depth at the outlet
	and continued on.
Note:	During supercritical analysis, the culvert direct step method went to normal depth. The program
	then assumed normal depth at the outlet.
Note:	During the supercritical calculations a hydraulic jump occurred inside of the culvert.

Plan: Replacement Connor Creek Connor #2 RS: 235.28 Culv Group: Culvert #2 Profile: juven-low pass

Q Culv Group (cfs)	1.00	Culv Full Len (ft)	
# Barrels	1	Culv Vel US (ft/s)	1.20
Q Barrel (cfs)	1.00	Culv Vel DS (ft/s)	0.03
E.G. US. (ft)	142.83	Culv Inv El Up (ft)	142.91
W.S. US. (ft)	146.10	Culv Inv El Dn (ft)	140.56
E.G. DS (ft)	142.72	Culv Frctn Ls (ft)	0.26

Plan: Replacement Connor Creek Connor #2 RS: 235.28 Culv Group: Culvert #2 Profile: juven-low pass (Continued)

W.S. DS (ft)	142.66	Culv Exit Loss (ft)	
Delta EG (ft)	0.11	Culv Entr Loss (ft)	
Delta WS (ft)	3.44	Q Weir (cfs)	
E.G. IC (ft)	142.83	Weir Sta Lft (ft)	
E.G. OC (ft)	143.00	Weir Sta Rgt (ft)	
Culvert Control	Inlet	Weir Submerg	
Culv WS Inlet (ft)	142.96	Weir Max Depth (ft)	
Culv WS Outlet (ft)	142.72	Weir Avg Depth (ft)	
Culv Nml Depth (ft)	0.06	Weir Flow Area (sq ft)	
Culv Crt Depth (ft)	0.05	Min El Weir Flow (ft)	157.24

Errors Warnings and Notes

Warning:	During subcritical analysis, the water surface upstream of culvert went to critical depth.

Plan: Replacement Connor Creek Connor #2 RS: 235.28 Culv Group: Culvert #2 Profile: juven-upper pass

Q Culv Group (cfs)	15.00	Culv Full Len (ft)	
# Barrels	1	Culv Vel US (ft/s)	11.69
Q Barrel (cfs)	15.00	Culv Vel DS (ft/s)	0.31
E.G. US. (ft)	146.99	Culv Inv El Up (ft)	142.91
W.S. US. (ft)	146.71	Culv Inv El Dn (ft)	140.56
E.G. DS (ft)	143.34	Culv Frctn Ls (ft)	1.77
W.S. DS (ft)	143.12	Culv Exit Loss (ft)	0.00
Delta EG (ft)	3.66	Culv Entr Loss (ft)	1.89
Delta WS (ft)	3.60	Q Weir (cfs)	
E.G. IC (ft)		Weir Sta Lft (ft)	
E.G. OC (ft)		Weir Sta Rgt (ft)	
Culvert Control	Inlet	Weir Submerg	
Culv WS Inlet (ft)	142.98	Weir Max Depth (ft)	
Culv WS Outlet (ft)	143.33	Weir Avg Depth (ft)	
Culv Nml Depth (ft)	0.29	Weir Flow Area (sq ft)	
Culv Crt Depth (ft)	0.28	Min El Weir Flow (ft)	157.24

Errors Warnings and Notes

Note:	During supercritical analysis, the culvert direct step method went to critical depth. The program
	then assumed critical depth at the outlet.
Note:	During the supercritical calculations a hydraulic jump occurred inside of the culvert.

Plan: Retrofit Connor Creek Connor #2 RS: 235.28 Culv Group: Culvert #2 Profile: 50 yr

Q Culv Group (cfs)	790.96	Culv Full Len (ft)	
# Barrels	1	Culv Vel US (ft/s)	14.02
Q Barrel (cfs)	790.96	Culv Vel DS (ft/s)	14.66
E.G. US. (ft)	157.16	Culv Inv El Up (ft)	145.41
W.S. US. (ft)	157.09	Culv Inv El Dn (ft)	143.06
E.G. DS (ft)	149.71	Culv Frctn Ls (ft)	2.33
W.S. DS (ft)	149.20	Culv Exit Loss (ft)	3.34
Delta EG (ft)	7.46	Culv Entr Loss (ft)	1.79
Delta WS (ft)	7.89	Q Weir (cfs)	
E.G. IC (ft)	157.16	Weir Sta Lft (ft)	
E.G. OC (ft)	158.12	Weir Sta Rgt (ft)	
Culvert Control	Inlet	Weir Submerg	
Culv WS Inlet (ft)	152.32	Weir Max Depth (ft)	
Culv WS Outlet (ft)	149.70	Weir Avg Depth (ft)	
Culv Nml Depth (ft)	6.64	Weir Flow Area (sq ft)	
Culv Crt Depth (ft)	6.91	Min El Weir Flow (ft)	157.24

Errors Warnings and Notes

Warning:	At least one culvert in the culvert group has supercritical flow at the outlet. However, since
	more than one culvert in the culvert group has flow, the program cannot determine if the
	downstream cross section should be subcritical or supercritical flow. The program used the
	downstream subcritical answer, even though it may not be valid.
Warning:	During the supercritical analysis, the program could not converge on a supercritical answer in
	the downstream cross section. The program used the solution with the least error.
Note:	During supercritical analysis, the culvert direct step method went to normal depth. The program
	then assumed normal depth at the outlet.
Note:	The flow in the culvert is entirely supercritical.

Plan: Retrofit Connor Creek Connor #2 RS: 235.28 Culv Group: Culvert #2 Profile: 100 yr

Q Culv Group (cfs)	862.65	Culv Full Len (ft)	
# Barrels	1	Culv Vel US (ft/s)	14.58
Q Barrel (cfs)	862.65	Culv Vel DS (ft/s)	14.98
E.G. US. (ft)	157.94	Culv Inv El Up (ft)	145.41
W.S. US. (ft)	157.87	Culv Inv El Dn (ft)	143.06
E.G. DS (ft)	149.93	Culv Frctn Ls (ft)	2.34
W.S. DS (ft)	149.36	Culv Exit Loss (ft)	3.65
Delta EG (ft)	8.01	Culv Entr Loss (ft)	2.01
Delta WS (ft)	8.51	Q Weir (cfs)	8.17
E.G. IC (ft)	157.94	Weir Sta Lft (ft)	35.10
E.G. OC (ft)	158.89	Weir Sta Rgt (ft)	50.00
Culvert Control	Inlet	Weir Submerg	0.00
Culv WS Inlet (ft)	152.62	Weir Max Depth (ft)	0.70
Culv WS Outlet (ft)	150.09	Weir Avg Depth (ft)	0.35
Culv Nml Depth (ft)	7.03	Weir Flow Area (sq ft)	5.23
Culv Crt Depth (ft)	7.21	Min El Weir Flow (ft)	157.24

Errors Warnings and Notes

Warning:	The flow through the culvert is supercritical. However, since there is flow over the road (weir
	flow), the program cannot determine if the downstream cross section should be subcritical or
	supercritical. The program used the downstream subcritical answer, even though it may not be
	valid.
Warning:	During the supercritical analysis, the program could not converge on a supercritical answer in
	the downstream cross section. The program used the solution with the least error.

Alternative 2-b

Plan: Retrofit Connor Creek Connor #2 RS: 235.28 Culv Group: Culvert #2 Profile: adult-Low Pass

Q Culv Group (cfs)	3.00	**Culv Full Len (ft)**	
# Barrels	1	**Culv Vel US (ft/s)**	2.11
Q Barrel (cfs)	3.00	**Culv Vel DS (ft/s)**	2.64
E.G. US. (ft)	146.08	**Culv Inv El Up (ft)**	145.41
W.S. US. (ft)	146.26	**Culv Inv El Dn (ft)**	143.06
E.G. DS (ft)	142.86	**Culv Frctn Ls (ft)**	2.36
W.S. DS (ft)	142.77	**Culv Exit Loss (ft)**	1.04
Delta EG (ft)	3.22	**Culv Entr Loss (ft)**	
Delta WS (ft)	3.49	**Q Weir (cfs)**	
E.G. IC (ft)	146.08	**Weir Sta Lft (ft)**	
E.G. OC (ft)	146.33	**Weir Sta Rgt (ft)**	
Culvert Control	Inlet	**Weir Submerg**	
Culv WS Inlet (ft)	146.20	**Weir Max Depth (ft)**	
Culv WS Outlet (ft)	143.80	**Weir Avg Depth (ft)**	
Culv Nml Depth (ft)	0.79	**Weir Flow Area (sq ft)**	
Culv Crt Depth (ft)	0.74	**Min El Weir Flow (ft)**	157.24

Errors Warnings and Notes

Warning:	During subcritical analysis, the water surface upstream of culvert went to critical depth.

Plan: Retrofit Connor Creek Connor #2 RS: 235.28 Culv Group: Culvert #2 Profile: adult-Upper Pass

Q Culv Group (cfs)	57.00	**Culv Full Len (ft)**	
# Barrels	1	**Culv Vel US (ft/s)**	6.14
Q Barrel (cfs)	57.00	**Culv Vel DS (ft/s)**	6.29
E.G. US. (ft)	148.08	**Culv Inv El Up (ft)**	145.41
W.S. US. (ft)	147.51	**Culv Inv El Dn (ft)**	143.06
E.G. DS (ft)	144.17	**Culv Frctn Ls (ft)**	2.35
W.S. DS (ft)	143.74	**Culv Exit Loss (ft)**	1.43
Delta EG (ft)	3.92	**Culv Entr Loss (ft)**	
Delta WS (ft)	3.77	**Q Weir (cfs)**	
E.G. IC (ft)	147.81	**Weir Sta Lft (ft)**	
E.G. OC (ft)	148.47	**Weir Sta Rgt (ft)**	
Culvert Control	Inlet	**Weir Submerg**	
Culv WS Inlet (ft)	147.36	**Weir Max Depth (ft)**	
Culv WS Outlet (ft)	144.98	**Weir Avg Depth (ft)**	
Culv Nml Depth (ft)	1.92	**Weir Flow Area (sq ft)**	
Culv Crt Depth (ft)	1.95	**Min El Weir Flow (ft)**	157.24

Errors Warnings and Notes

Warning:	During subcritical analysis, the water surface upstream of culvert went to critical depth.
Warning:	During the supercritical analysis, the program could not converge on a supercritical answer in
	the downstream cross section. The program used the solution with the least error.
Note:	During supercritical analysis, the culvert direct step method went to normal depth. The program
	then assumed normal depth at the outlet.
Note:	The flow in the culvert is entirely supercritical.
Note:	During the supercritical calculations a hydraulic jump occurred at the inlet of (going into) the
	culvert.

Plan: Retrofit Connor Creek Connor #2 RS: 235.28 Culv Group: Culvert #2 Profile: juven-low pass

Q Culv Group (cfs)	1.00	**Culv Full Len (ft)**	
# Barrels	1	**Culv Vel US (ft/s)**	1.42
Q Barrel (cfs)	1.00	**Culv Vel DS (ft/s)**	1.88
E.G. US. (ft)	145.91	**Culv Inv El Up (ft)**	145.41

Plan: Retrofit Connor Creek Connor #2 RS: 235.28 Culv Group: Culvert #2 Profile: juven-low pass (Continued)

W.S. US. (ft)	146.10	Culv Inv El Dn (ft)	143.06
E.G. DS (ft)	142.72	Culv Frctn Ls (ft)	2.36
W.S. DS (ft)	142.66	Culv Exit Loss (ft)	1.02
Delta EG (ft)	3.19	Culv Entr Loss (ft)	
Delta WS (ft)	3.44	Q Weir (cfs)	
E.G. IC (ft)	145.91	Weir Sta Lft (ft)	
E.G. OC (ft)	146.12	Weir Sta Rgt (ft)	
Culvert Control	Inlet	Weir Submerg	
Culv WS Inlet (ft)	146.06	Weir Max Depth (ft)	
Culv WS Outlet (ft)	143.68	Weir Avg Depth (ft)	
Culv Nml Depth (ft)	0.65	Weir Flow Area (sq ft)	
Culv Crt Depth (ft)	0.62	Min El Weir Flow (ft)	157.24

Errors Warnings and Notes

Warning:	During subcritical analysis, the water surface upstream of culvert went to critical depth.

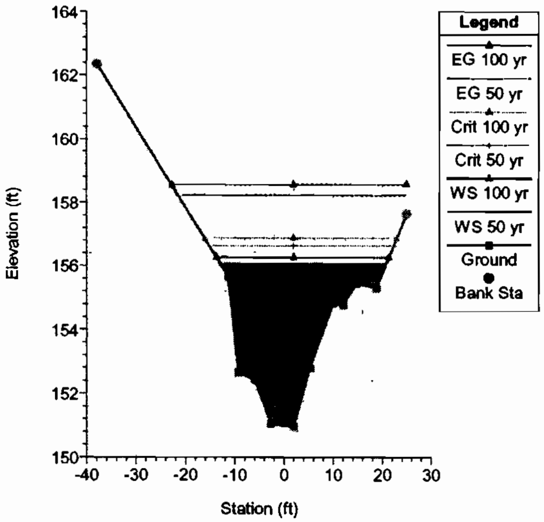
Plan: Retrofit Connor Creek Connor #2 RS: 235.28 Culv Group: Culvert #2 Profile: juven-upper pass

Q Culv Group (cfs)	15.00	Culv Full Len (ft)	
# Barrels	1	Culv Vel US (ft/s)	3.89
Q Barrel (cfs)	15.00	Culv Vel DS (ft/s)	4.23
E.G. US. (ft)	146.99	Culv Inv El Up (ft)	145.41
W.S. US. (ft)	146.71	Culv Inv El Dn (ft)	143.06
E.G. DS (ft)	143.34	Culv Frctn Ls (ft)	2.36
W.S. DS (ft)	143.12	Culv Exit Loss (ft)	1.15
Delta EG (ft)	3.66	Culv Entr Loss (ft)	
Delta WS (ft)	3.60	Q Weir (cfs)	
E.G. IC (ft)	146.67	Weir Sta Lft (ft)	
E.G. OC (ft)	147.05	Weir Sta Rgt (ft)	
Culvert Control	Inlet	Weir Submerg	
Culv WS Inlet (ft)	146.61	Weir Max Depth (ft)	
Culv WS Outlet (ft)	144.21	Weir Avg Depth (ft)	
Culv Nml Depth (ft)	1.20	Weir Flow Area (sq ft)	
Culv Crt Depth (ft)	1.15	Min El Weir Flow (ft)	157.24

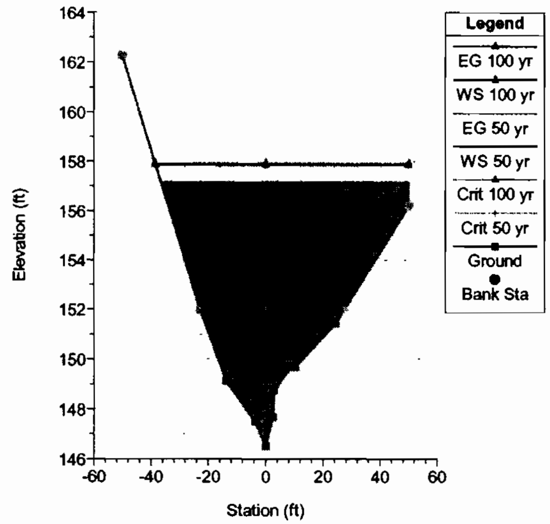
Errors Warnings and Notes

Warning:	During subcritical analysis, the water surface upstream of culvert went to critical depth.
Note:	During the supercritical calculations a hydraulic jump occurred at the inlet of (going into) the
	culvert.

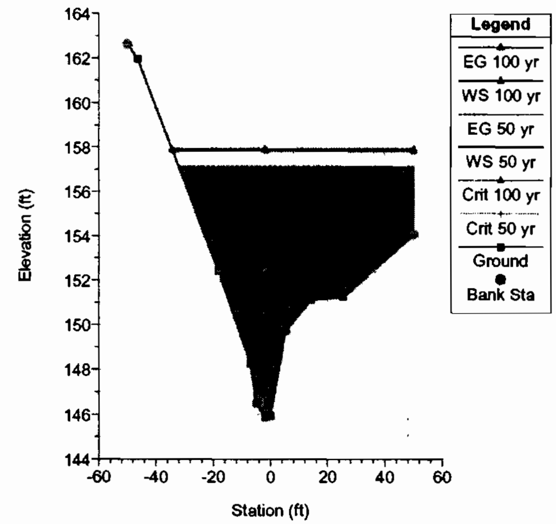
Connor Creek Plan: Alt-2-Retrofit 3/9/2007
River = Connor Creek Reach = Connor #2 RS = 350



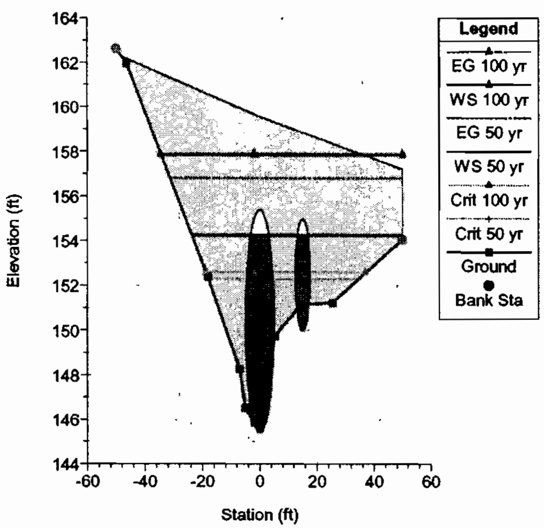
Connor Creek Plan: Alt-2-Retrofit 3/9/2007
River = Connor Creek Reach = Connor #2 RS = 292.34



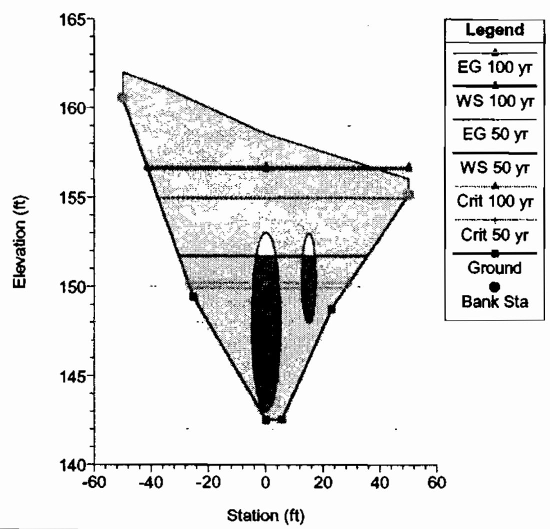
Connor Creek Plan: Alt-2-Retrofit 3/9/2007
River = Connor Creek Reach = Connor #2 RS = 267



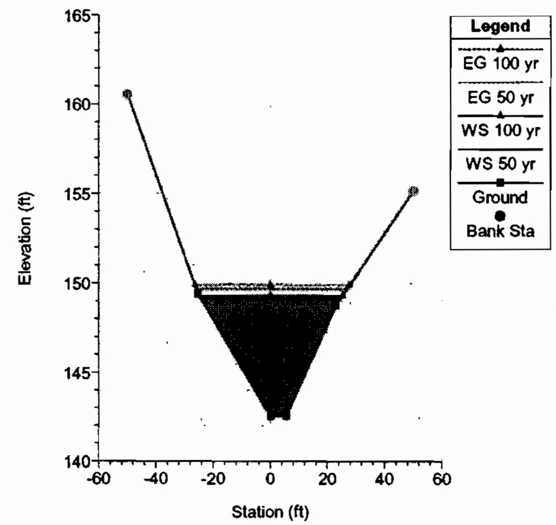
Connor Creek Plan: Alt-2-Retrofit 3/9/2007
River = Connor Creek Reach = Connor #2 RS = 235.28 Culv

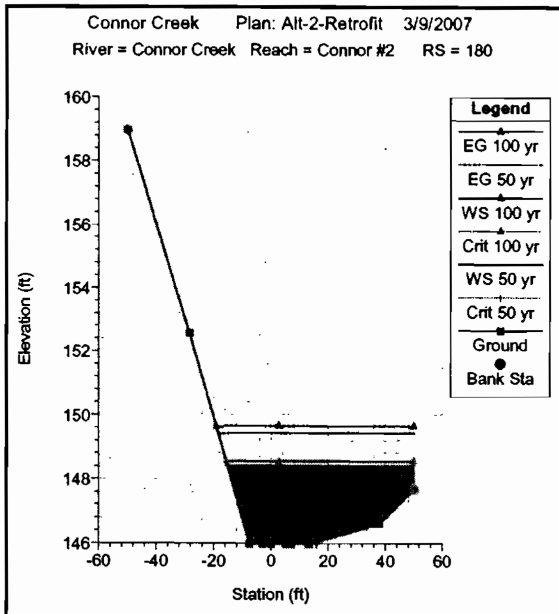


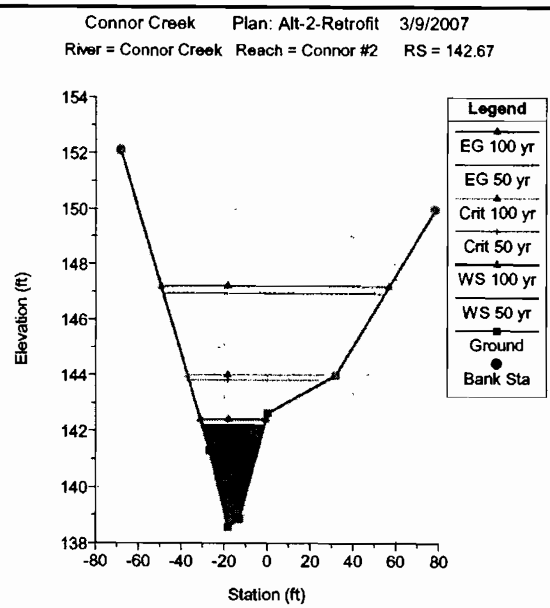
Connor Creek Plan: Alt-2-Retrofit 3/9/2007
River = Connor Creek Reach = Connor #2 RS = 235.28 Culv

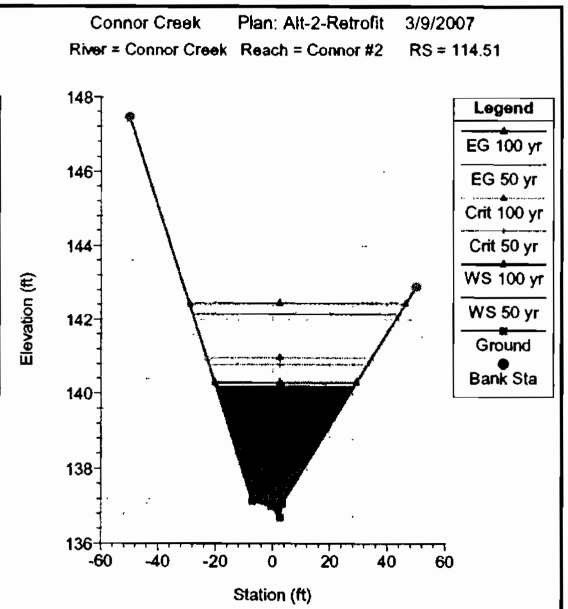


Connor Creek Plan: Alt-2-Retrofit 3/9/2007
River = Connor Creek Reach = Connor #2 RS = 201.87




Connor Creek Plan: Alt-2-Retrofit 3/9/2007
River = Connor Creek Reach = Connor #2 RS = 180
Legend
EG 100 yr
EG 50 yr
WS 100 yr
Crit 100 yr
WS 50 yr
Crit 50 yr
Ground
Bank Sta
Elevation (ft)
Station (ft)


Connor Creek Plan: Alt-2-Retrofit 3/9/2007
River = Connor Creek Reach = Connor #2 RS = 142.67
Legend
EG 100 yr
EG 50 yr
Crit 100 yr
Crit 50 yr
WS 100 yr
WS 50 yr
Ground
Bank Sta
Elevation (ft)
Station (ft)


Connor Creek Plan: Alt-2-Retrofit 3/9/2007
River = Connor Creek Reach = Connor #2 RS = 114.51
Legend
EG 100 yr
EG 50 yr
Crit 100 yr
Crit 50 yr
WS 100 yr
WS 50 yr
Ground
Bank Sta
Elevation (ft)
Station (ft)

Appendix F

FishXing Results

Alternative #1-b

Crossing Installation Data

Culvert Type: 14.3 X 8.75 ft Box
Material: Concrete
Installation: Embedded
Countersunk Depth: 1 ft
Natural Bottom Roughness Coefficient: 0.035
Culvert Length: 22.14 ft
Culvert Slope: 6.01%
Culvert Roughness Coefficient: 0.013
Natural Bottom Roughness Coefficient: 0.035
Inlet Invert Elevation: 89.9 ft
Outlet Invert Elevation: 88.57 ft
Inlet Headloss Coefficient (Ke): 0.5

Design Flows

Low Passage Flow: 1 cfs
High Passage Flow: 15 cfs

Biological Data

Fish Length: 0 cm
Minimum Water Depth: 0.5 ft
Prolonged Swimming Speed: 0.8 ft/s
Prolonged Time to Exhaustion: 30 min
Prolonged Notes:
Oncorhynchus kisutch
Coho salmon
Length: 4.07 to 18.1 cm
Temp: 8 to 12 Deg C
Fish Metrics Calculated

Burst Swimming Speed: 10.8 ft/s
Burst Time to Exhaustion: 10 s
Burst Notes:
Oncorhynchus kisutch
Coho salmon
Length: 35.6 to 61 cm
Temp: 10 to 19 Deg C
Swim Time: 2.6 - 13 s
Fish Metrics Calculated

Max Outlet Drop: 1 ft
Velocity Reduction Factors:
Inlet: 1.00
Barrel: 1.00
Outlet: 1.00

Table 1. Culvert Summary for 1.00 cfs.

Summary for Q = 1.00 cfs	
Normal Depth (ft)	0.05
Critical Depth (ft)	0.05
Headwater Depth (ft)	0.42
HW/D	0.05
Inlet Velocity (ft/s)	0.14
Tailwater Depth (ft)	1.92
Outlet Water Surface Drop...	0.00
Prolonged Swim Time (min)	0.50
Burst Swim Time (s)	0.00
Barrier Code	Depth

Table 1. Culvert Profiles for 1.00 cfs.

	Profiles for Q = 1.00 cfs				
Dist Down Culvert (ft)	Depth (ft)	Velocity Average (ft/s)	Velocity Occupied (ft/s)	Swim Mode	Barrier Type
0	0.42	0.00	0.00	Prolonged	Depth
3	0.60	0.14	0.14	Prolonged	
4	0.78	0.09	0.08	Prolonged	
5	0.84	0.08	0.08	Prolonged	
6	0.90	0.08	0.07	Prolonged	
7	0.96	0.07	0.07	Prolonged	
8	1.02	0.07	0.06	Prolonged	
9	1.08	0.06	0.06	Prolonged	
10	1.14	0.06	0.06	Prolonged	
11	1.20	0.06	0.05	Prolonged	
12	1.26	0.06	0.05	Prolonged	
13	1.32	0.05	0.05	Prolonged	
14	1.38	0.05	0.05	Prolonged	
15	1.44	0.05	0.04	Prolonged	
16	1.50	0.05	0.04	Prolonged	
17	1.56	0.04	0.04	Prolonged	
18	1.62	0.04	0.04	Prolonged	
19	1.68	0.04	0.04	Prolonged	
20	1.74	0.04	0.04	Prolonged	
21	1.80	0.04	0.03	Prolonged	
22	1.86	0.04	0.03	Prolonged	
	1.92	0.04	0.03		

Table 2. Culvert Profiles for 15 cfs.

	Profiles for Q = 15.00 cfs				
Dist Down Culvert (ft)	**Depth (ft)**	**Velocity Average (ft/s)**	**Velocity Occupied (ft/s)**	**Swim Mode**	**Barrier Type**
0	0.57	0.00	0.00	Burst	
3	0.45	2.83	2.83	Burst	Depth
4	0.76	1.38	1.37	Burst	
5	0.82	1.27	1.27	Burst	
6	0.89	1.18	1.16	Burst	
7	0.95	1.11	1.10	Burst	
8	1.01	1.04	1.03	Burst	
9	1.07	0.98	0.97	Burst	
10	1.13	0.93	0.92	Burst	
11	1.19	0.88	0.87	Burst	
12	1.25	0.84	0.83	Burst	
13	1.32	0.80	0.79	Prolonged	
14	1.38	0.76	0.76	Prolonged	
15	1.44	0.73	0.73	Prolonged	
16	1.50	0.70	0.70	Prolonged	
17	1.56	0.67	0.67	Prolonged	
18	1.62	0.65	0.64	Prolonged	
19	1.68	0.62	0.62	Prolonged	
20	1.74	0.60	0.60	Prolonged	
21	1.80	0.58	0.58	Prolonged	
22	1.86	0.56	0.56	Prolonged	
	1.92	0.55	0.54		

Table 1. Culvert Profiles for 3.00 cfs.

	Profiles for Q = 3.00 cfs				
Dist Down Culvert (ft)	**Depth (ft)**	**Velocity Average (ft/s)**	**Velocity Occupied (ft/s)**	**Swim Mode**	**Barrier Type**
0	0.42	0.00	0.00	Prolonged	Depth
3	0.60	0.43	0.43	Prolonged	Depth
4	0.78	0.27	0.26	Prolonged	Depth
5	0.84	0.25	0.25	Prolonged	Depth
6	0.90	0.23	0.23	Prolonged	Depth
7	0.96	0.22	0.21	Prolonged	Depth
8	1.02	0.21	0.20	Prolonged	
9	1.08	0.19	0.19	Prolonged	
10	1.14	0.18	0.18	Prolonged	
11	1.20	0.18	0.17	Prolonged	
12	1.26	0.17	0.16	Prolonged	
13	1.32	0.16	0.15	Prolonged	
14	1.38	0.15	0.15	Prolonged	
15	1.44	0.15	0.14	Prolonged	
16	1.50	0.14	0.13	Prolonged	
17	1.56	0.13	0.13	Prolonged	
18	1.62	0.13	0.12	Prolonged	
19	1.68	0.12	0.12	Prolonged	
20	1.74	0.12	0.12	Prolonged	
21	1.80	0.12	0.11	Prolonged	
22	1.86	0.11	0.11	Prolonged	
	1.92	0.11	0.10		

Table 2. Culvert Profiles for 57 cfs.

	Profiles for Q = 57.00 cfs				
Dist Down Culvert (ft)	Depth (ft)	Velocity Average (ft/s)	Velocity Occupied (ft/s)	Swim Mode	Barrier Type
0	1.40	0.00	0.00	Burst	
3	0.61	7.97	7.96	Burst	Depth
4	0.60	6.62	6.61	Burst	Depth
5	0.59	6.71	6.70	Burst	Depth
6	0.59	6.78	6.77	Burst	Depth
7	0.58	6.83	6.82	Burst	Depth
8	0.58	6.87	6.87	Burst	Depth
9	0.58	6.91	6.90	Burst	Depth
10	0.57	6.93	6.93	Burst	Depth
11	1.09	3.65	3.64	Burst	
12	1.17	3.39	3.39	Burst	
13	1.25	3.19	3.18	Burst	
14	1.32	3.01	3.01	Burst	
15	1.39	2.86	2.85	Burst	
16	1.46	2.72	2.72	Burst	
17	1.53	2.60	2.60	Burst	
18	1.60	2.50	2.49	Burst	
19	1.66	2.40	2.39	Burst	
20	1.73	2.31	2.30	Burst	
21	1.79	2.22	2.22	Burst	
22	1.86	2.15	2.14	Burst	
	1.92	2.08	2.07		

Table 2. Culvert Summary for 15 cfs.

Summary for Q = 15.00 cfs	
Normal Depth (ft)	0.25
Critical Depth (ft)	0.32
Headwater Depth (ft)	0.57
HW/D	0.07
Inlet Velocity (ft/s)	2.83
Tailwater Depth (ft)	1.92
Outlet Water Surface Drop...	0.00
Prolonged Swim Time (min)	1.96
Burst Swim Time (s)	1.36
Barrier Code	Depth

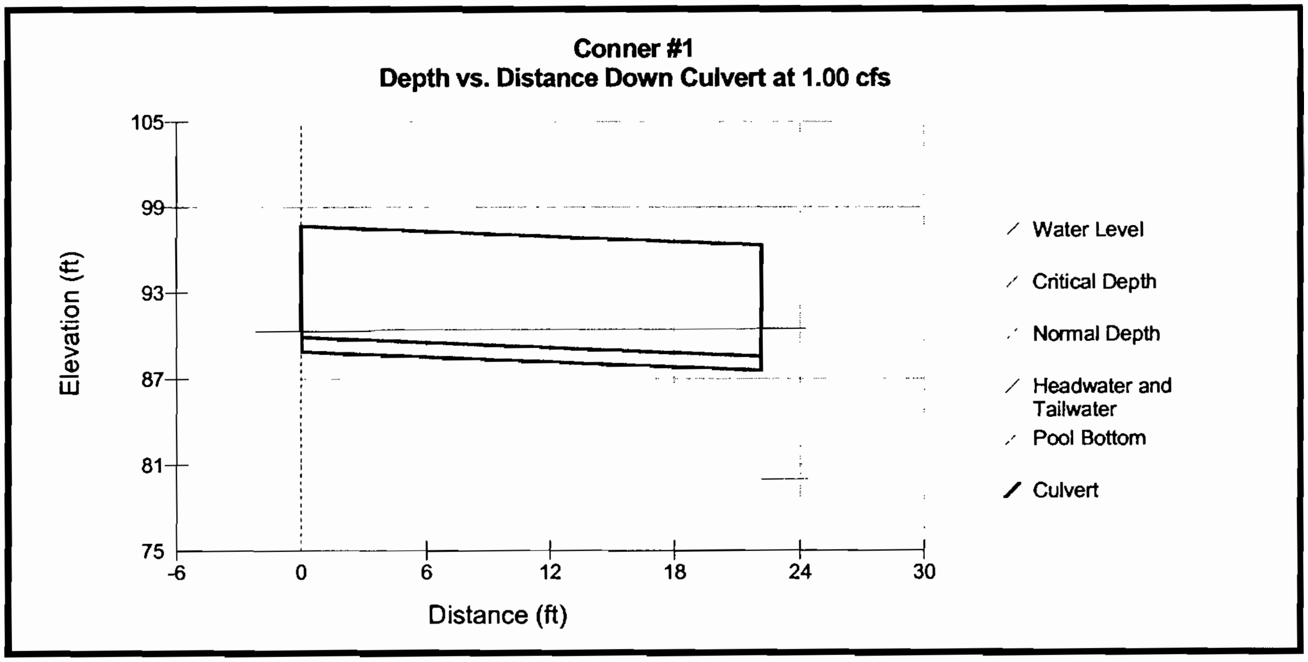


Figure 1. Water Surface Profile at 1 cfs

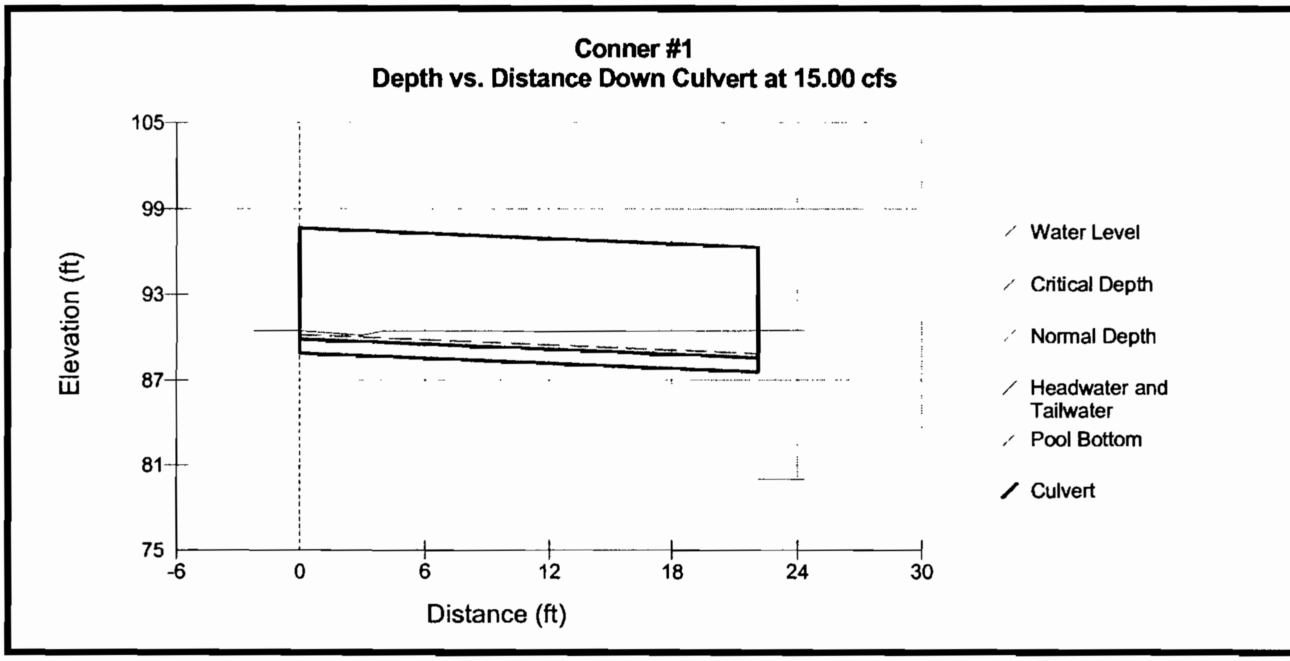


Figure 2. Water Surface Profile at 15 cfs

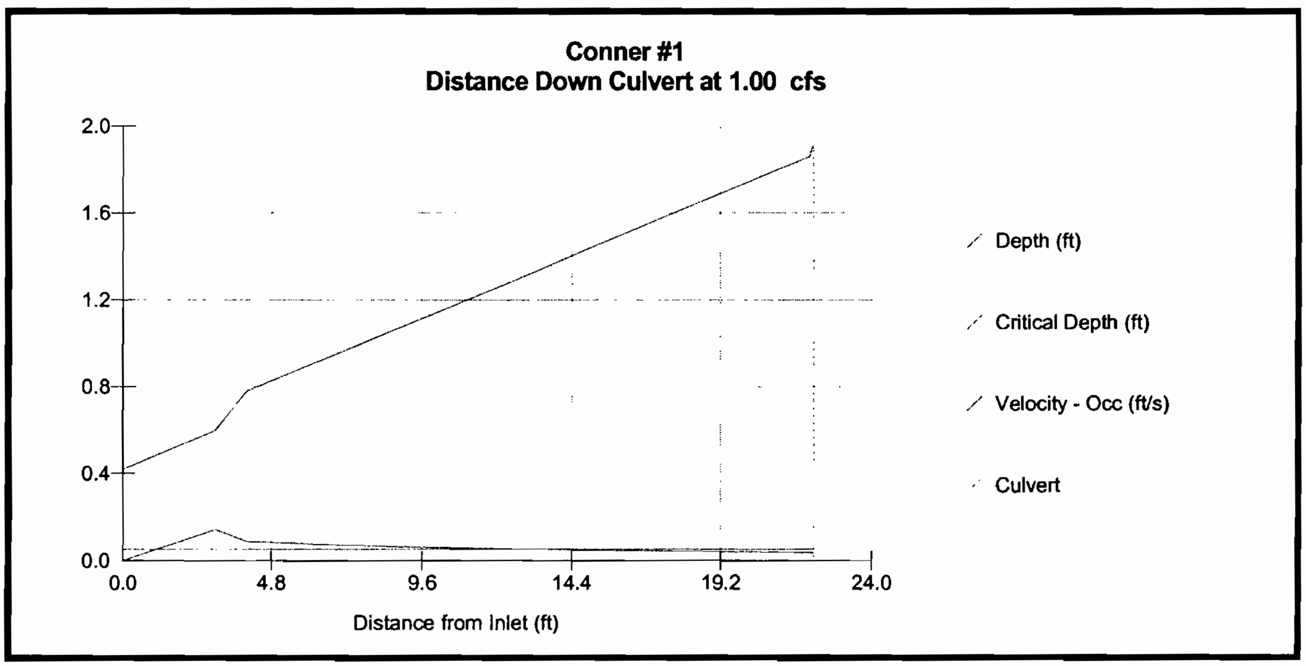


Figure 3. Culvert Profiles at 1 cfs

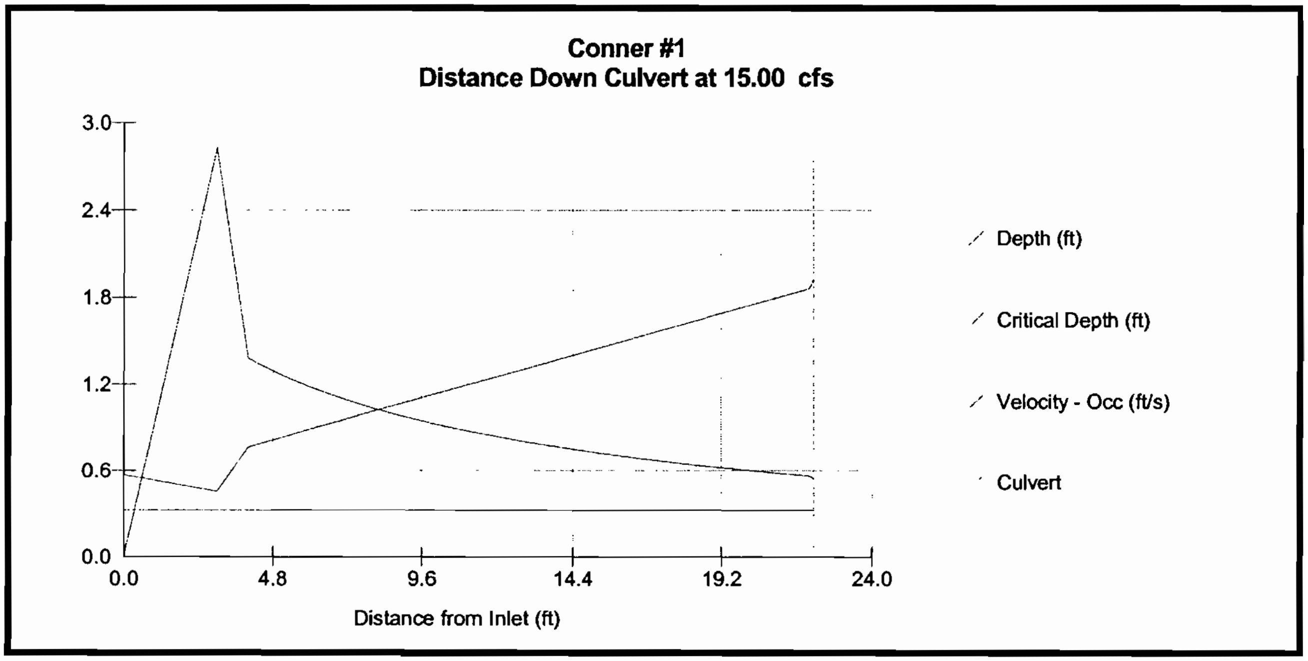


Figure 4. Culvert Profiles at 15 cfs

Table 3. Culvert Rating Table.

Q total (cfs)	Depth Min (ft)	V(occ) Max (ft/s)	Depth TW (ft)	Outlet WS Drop (ft)	Depth Pool (ft)	Barrier Type
0.00	0.59	5.97	1.92	0.00	10.49	NONE
1.00	0.42	0.14	1.92	0.00	10.49	Depth
1.75	0.42	0.25	1.92	0.00	10.49	Depth
2.50	0.42	0.36	1.92	0.00	10.49	Depth
3.25	0.42	0.47	1.92	0.00	10.49	Depth
4.00	0.42	0.57	1.92	0.00	10.49	Depth
4.75	0.43	0.68	1.92	0.00	10.49	Depth
5.50	0.43	0.79	1.92	0.00	10.49	Depth
6.25	0.43	0.90	1.92	0.00	10.49	Depth
7.00	0.44	1.01	1.92	0.00	10.49	Depth
7.75	0.44	1.13	1.92	0.00	10.49	Depth
8.50	0.45	1.24	1.92	0.00	10.49	Depth
9.25	0.46	1.35	1.92	0.00	10.49	Depth
10.00	0.46	1.47	1.92	0.00	10.49	Depth
10.75	0.47	1.90	1.92	0.00	10.49	Depth
11.50	0.48	2.05	1.92	0.00	10.49	Depth
12.25	0.48	2.21	1.92	0.00	10.49	Depth
13.00	0.47	2.37	1.92	0.00	10.49	Depth
13.75	0.47	2.53	1.92	0.00	10.49	Depth
14.50	0.46	2.71	1.92	0.00	10.49	Depth
15.00	0.45	2.83	1.92	0.00	10.49	Depth
15.75	0.44	3.04	1.92	0.00	10.49	Depth
16.50	0.56	2.55	1.92	0.00	10.49	NONE
17.25	0.55	2.69	1.92	0.00	10.49	NONE
18.00	0.54	2.83	1.92	0.00	10.49	NONE
18.75	0.54	2.98	1.92	0.00	10.49	NONE
19.50	0.53	3.14	1.92	0.00	10.49	NONE
20.25	0.52	3.32	1.92	0.00	10.49	NONE
21.00	0.31	5.81	1.92	0.00	10.49	Depth
21.75	0.32	5.89	1.92	0.00	10.49	Depth
22.50	0.32	5.97	1.92	0.00	10.49	Depth

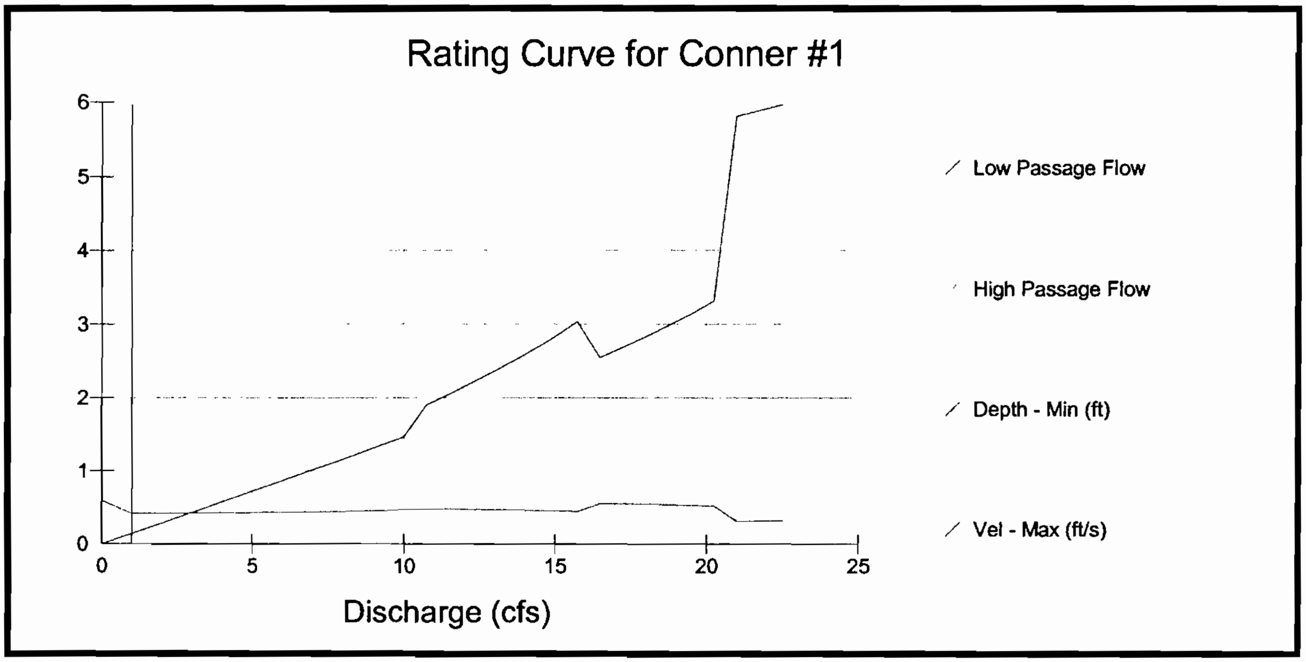


Figure 5. Culvert Rating Curve

Alternative #2-b

Crossing Installation Data

Culvert Type: 10 ft Circular
Material: Annular 6 x 2 inches
Installation: Embedded
Countersunk Depth: 0.5 ft
Natural Bottom Roughness Coefficient: 0.04
Culvert Length: 65.32 ft
Culvert Slope: 3.60%
Culvert Roughness Coefficient: 0.032
Natural Bottom Roughness Coefficient: 0.04
Inlet Invert Elevation: 145.41 ft
Outlet Invert Elevation: 143.06 ft
Inlet Headloss Coefficient (Ke): 0.9

Design Flows

Low Passage Flow: 1 cfs
High Passage Flow: 15 cfs

Biological Data

Fish Length: 0 cm
Minimum Water Depth: 0.5 ft
Prolonged Swimming Speed: 2.5 ft/s
Prolonged Time to Exhaustion: 30 min
Prolonged Notes:
Oncorhynchus kisutch
Coho salmon
Length: 4.07 to 18.1 cm
Temp: 8 to 12 Deg C
Fish Metrics Calculated

Burst Swimming Speed: 16 ft/s
Burst Time to Exhaustion: 1800 s
Burst Notes:
Oncorhynchus kisutch
Coho salmon
Temp: NR Deg C
Speed Range: 10.99 - 21 ft/s

Max Outlet Drop: 1 ft
Velocity Reduction Factors:
Inlet: 1.00
Barrel: 1.00
Outlet: 1.00

Table 1. Culvert Summary for 1.00 cfs.

Summary for Q = 1.00 cfs	
Normal Depth (ft)	0.13
Critical Depth (ft)	0.12
Headwater Depth (ft)	0.64
HW/D	0.07
Inlet Velocity (ft/s)	0.37
Tailwater Depth (ft)	2.94
Outlet Water Surface Drop...	0.00
Prolonged Swim Time (min)	0.46
Burst Swim Time (s)	0.00
Barrier Code	NONE

Table 2. Culvert Summary for 15 cfs.

Summary for Q = 15.00 cfs	
Normal Depth (ft)	0.60
Critical Depth (ft)	0.65
Headwater Depth (ft)	1.19
HW/D	0.13
Inlet Velocity (ft/s)	6.45
Tailwater Depth (ft)	2.94
Outlet Water Surface Drop...	0.00
Prolonged Swim Time (min)	0.56
Burst Swim Time (s)	1.82
Barrier Code	NONE

Table 3. Culvert Profiles for 1.00 cfs.

	Profiles for Q = 1.00 cfs				
Dist Down Culvert (ft)	Depth (ft)	Velocity Average (ft/s)	Velocity Occupied (ft/s)	Swim Mode	Barrier Type
0	0.64	0.00	0.00	Prolonged	NONE
3	0.67	0.37	0.37	Prolonged	
6	0.78	0.23	0.22	Prolonged	
10	0.92	0.19	0.18	Prolonged	
14	1.07	0.16	0.15	Prolonged	
18	1.21	0.13	0.13	Prolonged	
22	1.36	0.12	0.11	Prolonged	
26	1.50	0.10	0.10	Prolonged	
30	1.64	0.09	0.09	Prolonged	
34	1.79	0.08	0.08	Prolonged	
38	1.93	0.08	0.07	Prolonged	
42	2.08	0.07	0.06	Prolonged	
46	2.22	0.06	0.06	Prolonged	
50	2.36	0.06	0.05	Prolonged	
54	2.51	0.05	0.05	Prolonged	
58	2.65	0.05	0.05	Prolonged	
62	2.80	0.05	0.04	Prolonged	
65	2.94	0.04	0.04		

Table 4. Culvert Profiles for 15 cfs.

	Profiles for Q = 15.00 cfs				
Dist Down Culvert (ft)	Depth (ft)	Velocity Average (ft/s)	Velocity Occupied (ft/s)	Swim Mode	Barrier Type
0	1.19	0.00	0.00	Burst	NONE
3	0.60	6.45	6.44	Burst	
6	0.60	4.68	4.67	Burst	
10	0.60	4.68	4.67	Burst	
14	0.60	4.68	4.67	Burst	
18	0.60	4.68	4.67	Burst	
22	1.34	1.78	1.77	Prolonged	
26	1.49	1.56	1.56	Prolonged	
30	1.63	1.39	1.38	Prolonged	
34	1.78	1.25	1.24	Prolonged	
38	1.93	1.13	1.13	Prolonged	
42	2.07	1.03	1.03	Prolonged	
46	2.22	0.95	0.94	Prolonged	
50	2.36	0.88	0.87	Prolonged	
54	2.51	0.81	0.81	Prolonged	
58	2.65	0.76	0.75	Prolonged	
62	2.80	0.71	0.71	Prolonged	
65	2.94	0.67	0.66		

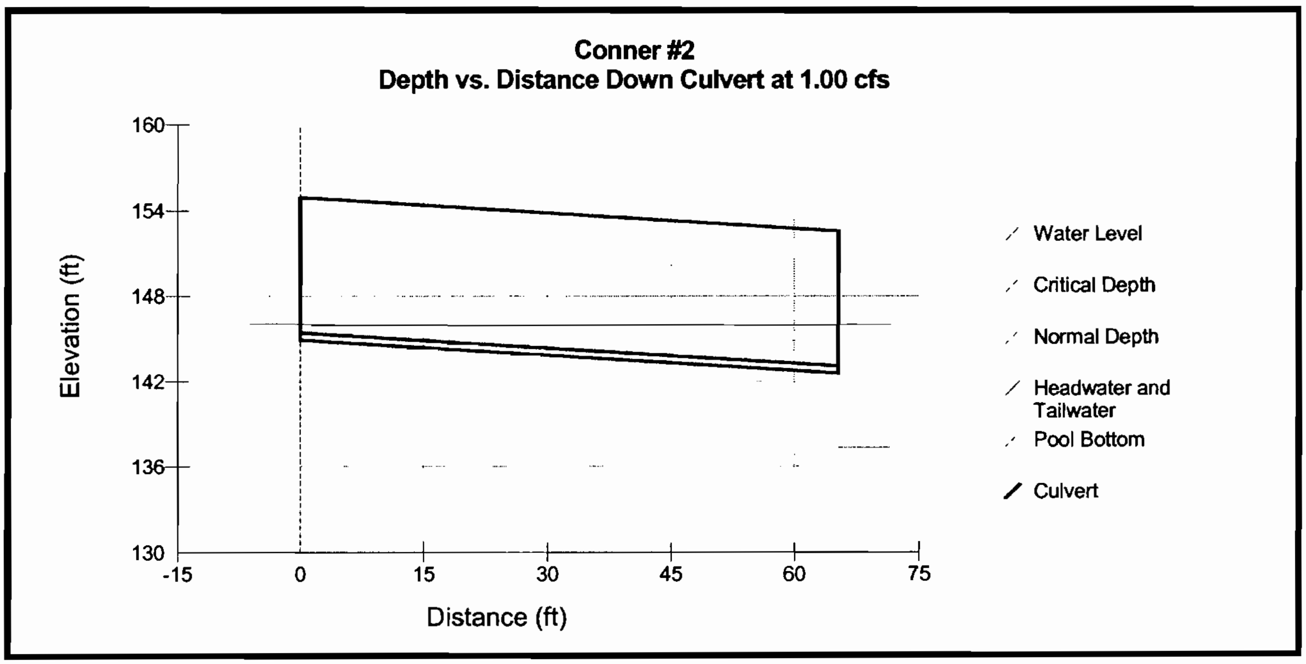


Figure 1. Water Surface Profile at 1 cfs

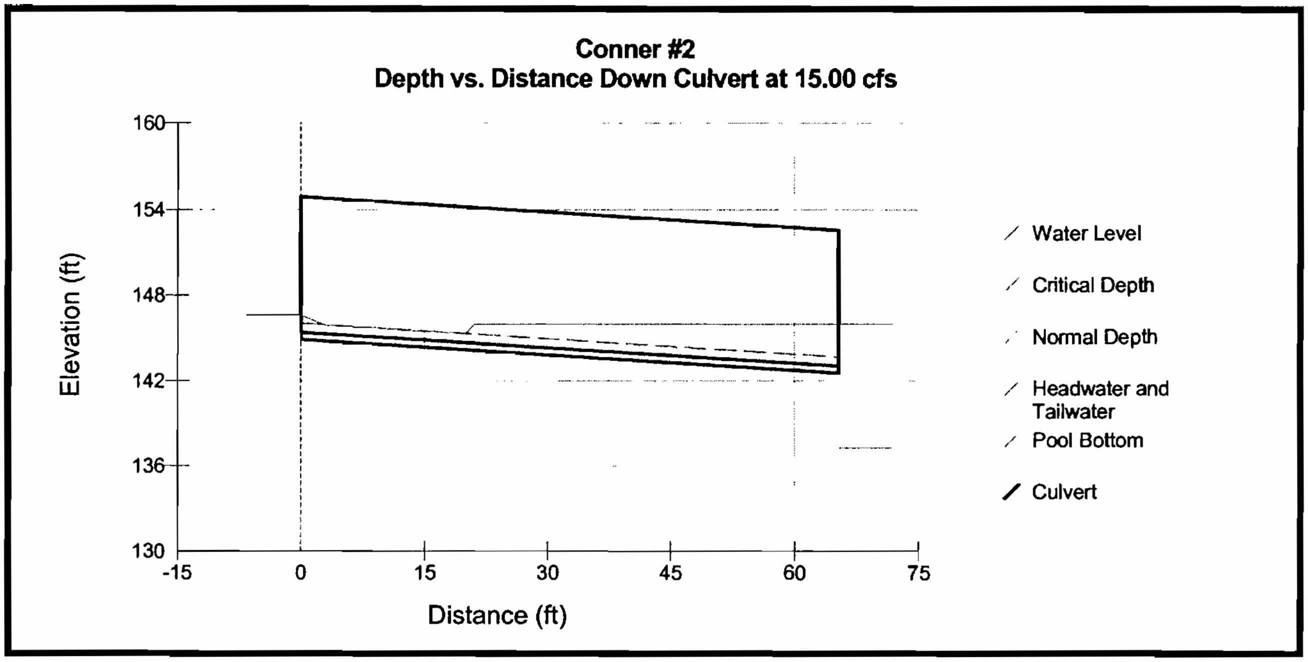


Figure 2. Water Surface Profile at 15 cfs

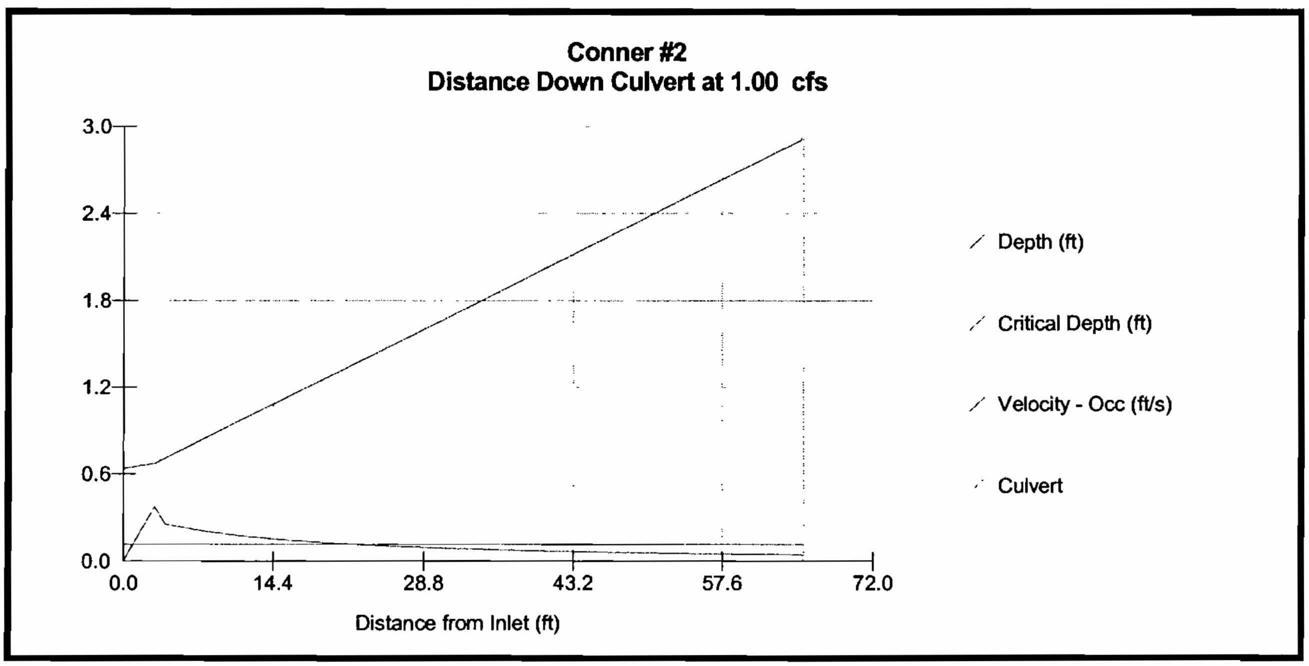


Figure 3. Culvert Profiles at 1 cfs

Table 5. Culvert Rating Table.

Q total (cfs)	Depth Min (ft)	V(occ) Max (ft/s)	Depth TW (ft)	Outlet WS Drop (ft)	Depth Pool (ft)	Barrier Type
0.00	0.59	4.90	2.94	0.00	8.70	NONE
1.00	0.64	0.37	2.94	0.00	8.70	NONE
1.75	0.64	0.66	2.94	0.00	8.70	NONE
2.50	0.65	0.94	2.94	0.00	8.70	NONE
3.25	0.66	1.22	2.94	0.00	8.70	NONE
4.00	0.28	4.02	2.94	0.00	8.70	Depth
4.75	0.31	4.28	2.94	0.00	8.70	Depth
5.50	0.34	4.51	2.94	0.00	8.70	Depth
6.25	0.36	4.72	2.94	0.00	8.70	Depth
7.00	0.39	4.92	2.94	0.00	8.70	Depth
7.75	0.41	5.10	2.94	0.00	8.70	Depth
8.50	0.43	5.28	2.94	0.00	8.70	Depth
9.25	0.45	5.44	2.94	0.00	8.70	Depth
10.00	0.47	5.59	2.94	0.00	8.70	Depth
10.75	0.49	5.73	2.94	0.00	8.70	Depth
11.50	0.51	5.87	2.94	0.00	8.70	NONE
12.25	0.53	6.00	2.94	0.00	8.70	NONE
13.00	0.55	6.13	2.94	0.00	8.70	NONE
13.75	0.57	6.25	2.94	0.00	8.70	NONE
14.50	0.58	6.37	2.94	0.00	8.70	NONE
15.00	0.60	6.45	2.94	0.00	8.70	NONE
15.75	0.61	6.56	2.94	0.00	8.70	NONE
16.50	0.63	6.66	2.94	0.00	8.70	NONE
17.25	0.64	6.77	2.94	0.00	8.70	NONE
18.00	0.66	6.87	2.94	0.00	8.70	NONE
18.75	0.68	6.96	2.94	0.00	8.70	NONE
19.50	0.69	7.05	2.94	0.00	8.70	NONE
20.25	0.70	7.13	2.94	0.00	8.70	NONE
21.00	0.72	7.21	2.94	0.00	8.70	NONE
21.75	0.73	7.29	2.94	0.00	8.70	NONE
22.50	0.75	7.37	2.94	0.00	8.70	NONE

Design Flows

Low Passage Flow: 3 cfs

High Passage Flow: 57 cfs

Table 1. Culvert Summary for 3.00 cfs.

Summary for Q = 3.00 cfs	
Normal Depth (ft)	0.24
Critical Depth (ft)	0.24
Headwater Depth (ft)	0.66
HW/D	0.07
Inlet Velocity (ft/s)	1.13
Tailwater Depth (ft)	2.94
Outlet Water Surface Drop...	0.00
Prolonged Swim Time (min)	0.50
Burst Swim Time (s)	0.00
Barrier Code	Depth

Table 2. Culvert Summary for 57 cfs.

Summary for Q = 57.00 cfs	
Normal Depth (ft)	1.25
Critical Depth (ft)	1.45
Headwater Depth (ft)	2.59
HW/D	0.27
Inlet Velocity (ft/s)	9.66
Tailwater Depth (ft)	2.94
Outlet Water Surface Drop...	0.00
Prolonged Swim Time (min)	0.00
Burst Swim Time (s)	6.72
Barrier Code	NONE

Table 3. Culvert Profiles for 3.00 cfs.

	Profiles for Q = 3.00 cfs				
Dist Down Culvert (ft)	**Depth (ft)**	**Velocity Average (ft/s)**	**Velocity Occupied (ft/s)**	**Swim Mode**	**Barrier Type**
0	0.66	0.00	0.00	Prolonged	Depth
3	0.67	1.13	1.12	Prolonged	Depth
6	0.78	0.68	0.68	Prolonged	Depth
10	0.92	0.56	0.55	Prolonged	Depth
14	1.07	0.47	0.46	Prolonged	
18	1.21	0.40	0.40	Prolonged	
22	1.36	0.35	0.34	Prolonged	
26	1.50	0.31	0.30	Prolonged	
30	1.64	0.28	0.27	Prolonged	
34	1.79	0.25	0.24	Prolonged	
38	1.93	0.23	0.22	Prolonged	
42	2.08	0.21	0.20	Prolonged	
46	2.22	0.19	0.18	Prolonged	
50	2.36	0.18	0.17	Prolonged	
54	2.51	0.16	0.16	Prolonged	
58	2.65	0.15	0.15	Prolonged	
62	2.80	0.14	0.14	Prolonged	
65	2.94	0.13	0.13		

Table 4. Culvert Profiles for 57 cfs.

	Profiles for Q = 57.00 cfs				
Dist Down Culvert (ft)	**Depth (ft)**	**Velocity Average (ft/s)**	**Velocity Occupied (ft/s)**	**Swim Mode**	**Barrier Type**
0	2.59	0.00	0.00	Burst	NONE
3	1.30	9.66	9.66	Burst	
6	1.28	7.16	7.16	Burst	
10	1.25	7.35	7.35	Burst	
14	1.25	7.35	7.35	Burst	
18	1.25	7.35	7.35	Burst	
22	1.25	7.35	7.35	Burst	
26	1.25	7.35	7.35	Burst	
30	1.25	7.35	7.35	Burst	
34	1.25	7.35	7.35	Burst	
38	1.25	7.35	7.35	Burst	
42	1.25	7.35	7.35	Burst	
46	2.16	3.73	3.72	Burst	
50	2.32	3.40	3.40	Burst	
54	2.48	3.13	3.13	Burst	
58	2.64	2.91	2.90	Burst	
62	2.79	2.71	2.71	Burst	
65	2.94	2.54	2.53		

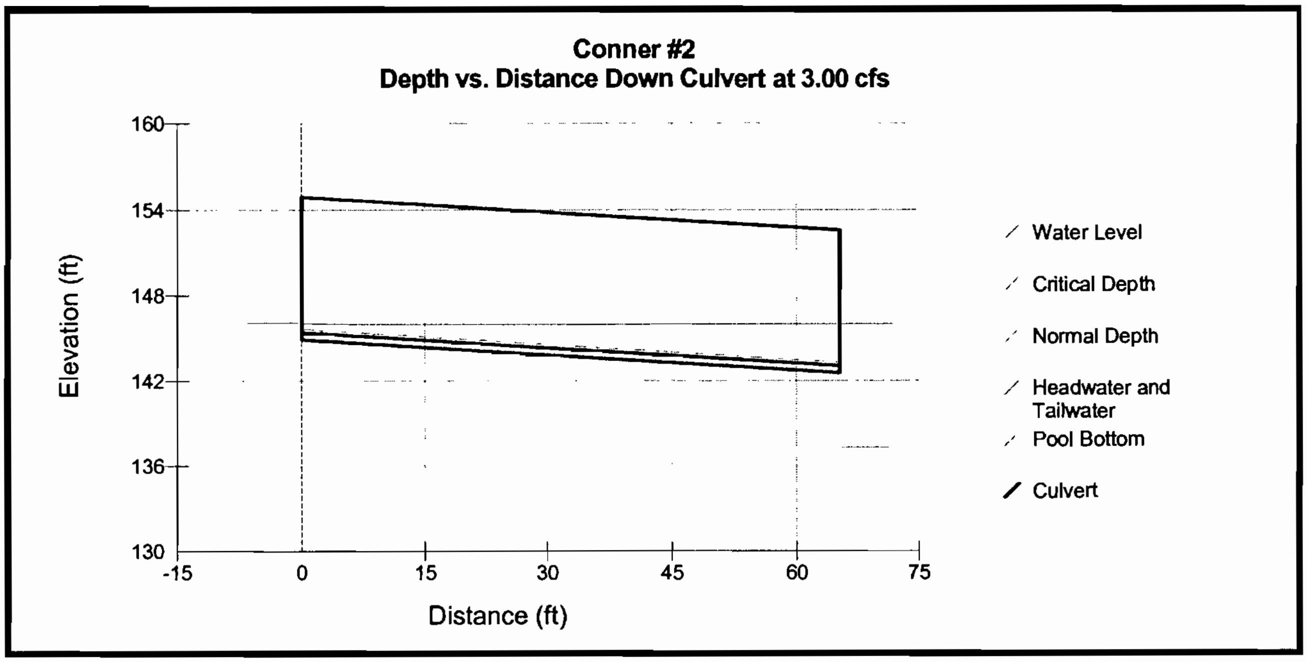


Figure 1. Water Surface Profile at 3 cfs

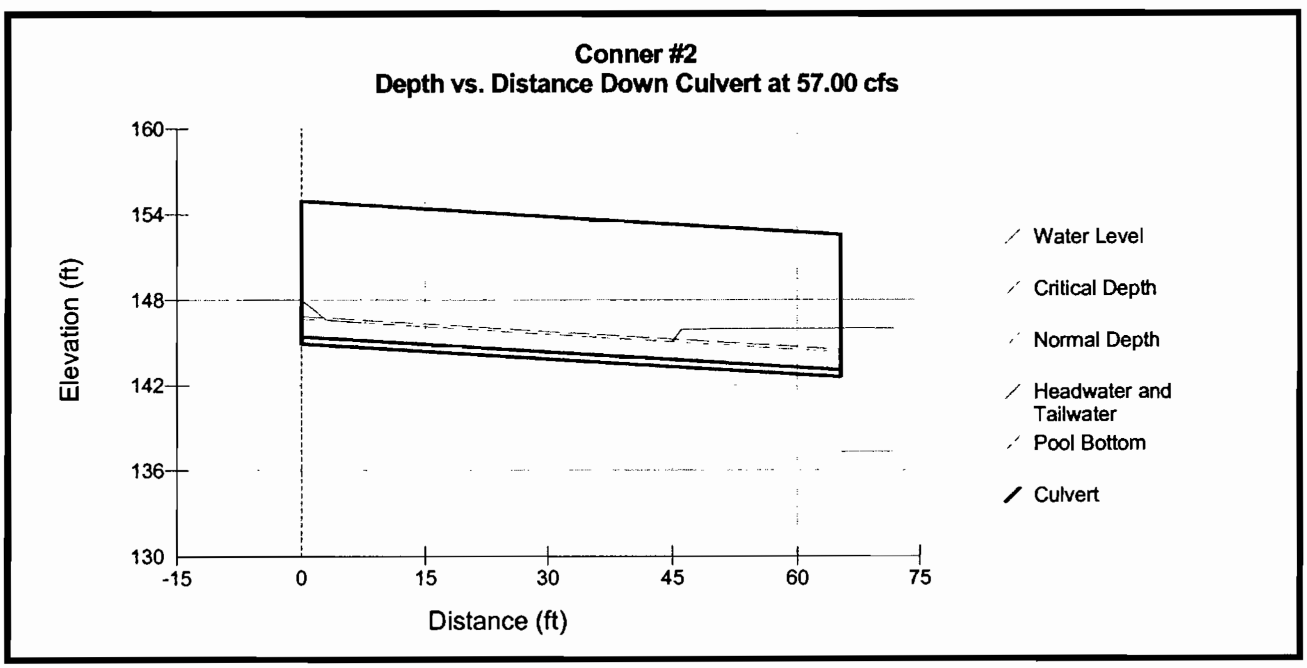


Figure 2. Water Surface Profile at 57 cfs

Table 5. Culvert Rating Table.

Q total (cfs)	Depth Min (ft)	V(occ) Max (ft/s)	Depth TW (ft)	Outlet WS Drop (ft)	Depth Pool (ft)	Barrier Type
0.00	0.59	5.78	2.94	0.00	8.70	Depth
3.00	0.66	1.13	2.94	0.00	8.70	Depth
6.00	0.35	4.66	2.94	0.00	8.70	Depth
9.00	0.45	5.38	2.94	0.00	8.70	Depth
11.00	0.50	5.78	2.94	0.00	8.70	Depth
14.00	0.57	6.29	2.94	0.00	8.70	Depth
17.00	0.64	6.73	2.94	0.00	8.70	Depth
20.00	0.70	7.10	2.94	0.00	8.70	Depth
23.00	0.76	7.42	2.94	0.00	8.70	Depth
26.00	0.81	7.70	2.94	0.00	8.70	Depth
29.00	0.86	7.96	2.94	0.00	8.70	Depth
31.00	0.89	8.12	2.94	0.00	8.70	Depth
34.00	0.94	8.35	2.94	0.00	8.70	Depth
37.00	0.98	8.55	2.94	0.00	8.70	Depth
40.00	1.03	8.75	2.94	0.00	8.70	NONE
43.00	1.07	8.93	2.94	0.00	8.70	NONE
46.00	1.11	9.10	2.94	0.00	8.70	NONE
48.00	1.14	9.21	2.94	0.00	8.70	NONE
51.00	1.17	9.37	2.94	0.00	8.70	NONE
54.00	1.21	9.52	2.94	0.00	8.70	NONE
57.00	1.25	9.66	2.94	0.00	8.70	NONE
60.00	1.28	9.80	2.94	0.00	8.70	NONE
63.00	1.32	9.93	2.94	0.00	8.70	NONE
66.00	1.35	10.06	2.94	0.00	8.70	NONE
68.00	1.38	10.15	2.94	0.00	8.70	NONE
71.00	1.41	10.27	2.94	0.00	8.70	NONE
74.00	1.44	10.38	2.94	0.00	8.70	NONE
77.00	1.47	10.50	2.94	0.00	8.70	NONE
80.00	1.50	10.61	2.94	0.00	8.70	NONE
83.00	1.53	10.71	2.94	0.00	8.70	NONE
85.50	1.56	10.80	2.94	0.00	8.70	NONE

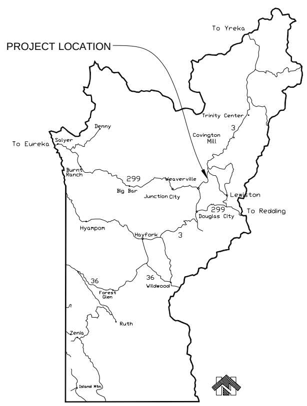
Attachment 6

Little Browns Creek Migration Barrier Removal Project Plans

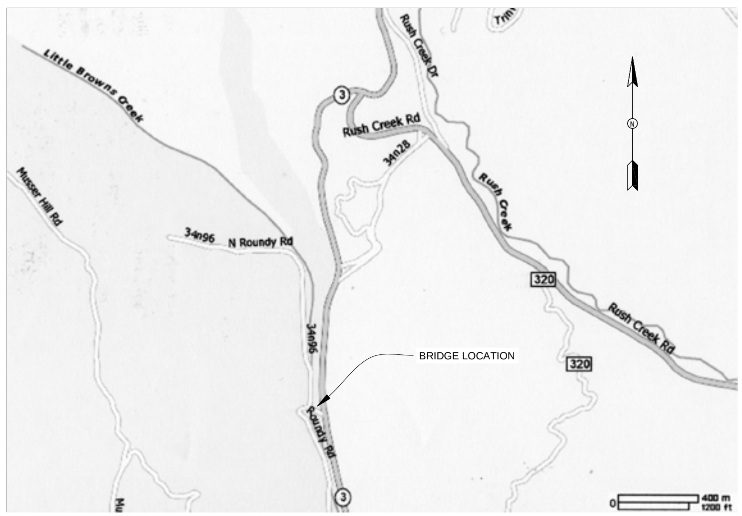
TRINITY COUNTY
DEPARTMENT OF TRANSPORTATION

PLANS FOR BRIDGE CONSTRUCTION AND CHANNEL GRADING AT LITTLE BROWNS CREEK ON ROUNDY ROAD, C.R. #232 NEAR WEAVERVILLE, CALIFORNIA

CONTRACT NO. 07-BRIDGE-232
W.O.# 05-2871



VICINITY MAP
TRINITY COUNTY



LOCATION MAP

INDEX TO SHEETS	
1	TITLE SHEET
2	CREEKBED GRADING PLAN
3	THALWAG PROFILE AND DETAILS
4	ROADWAY LAYOUT AND PROFILE
5	DETOUR PLAN
6	GENERAL PLAN
7	FOUNDATION PLAN
8	ABUT DETAILS
9	DECK REINFORCING PLAN
10	SLAB REINFORCING DETAILS
11	THRIE BEAM BRIDGE RAIL
12	LOG OF TEST BORINGS

REGISTERED PROFESSIONAL ENGINEER
CARL A. BONOMINI
C 26121
CIVIL
STATE OF CALIFORNIA

CARL A. BONOMINI, DIRECTOR
TRINITY COUNTY DEPARTMENT OF TRANSPORTATION

NOTE: THE CONTRACTOR SHALL POSSESS THE CLASS OR CLASSES OF LICENSE AS SPECIFIED IN THE "NOTICE TO CONTRACTORS" ON PAGE 1 OF THE SPECIAL PROVISIONS.

SHEET 1 OF 11

TRINITY COUNTY ROAD DEPARTMENT
BRIDGE PLAN AT LITTLE BROWNS CREEK
ON ROUNDY ROAD, COUNTY ROAD NO. 232

APPV'D BY:		PROJECT NO.: 05-2871	CONTRACT: 07-BRIDGE-232
DESIGN BY:	Andrew Pence	LITTLE BROWN'S CREEK BRIDGE	
SCALE:	1"=20'	REVISION DATES:	
DATE:	12/13/2006	1-22-07	

TITLE PAGE

CARL A. BONDMINI, DIRECTOR
TRINITY COUNTY DEPARTMENT OF TRANSPORTATION

REGISTERED PROFESSIONAL ENGINEER · CARL A. BONDMINI · C 26121 · CIVIL · STATE OF CALIFORNIA

Gradation for Engineered Streambed Material

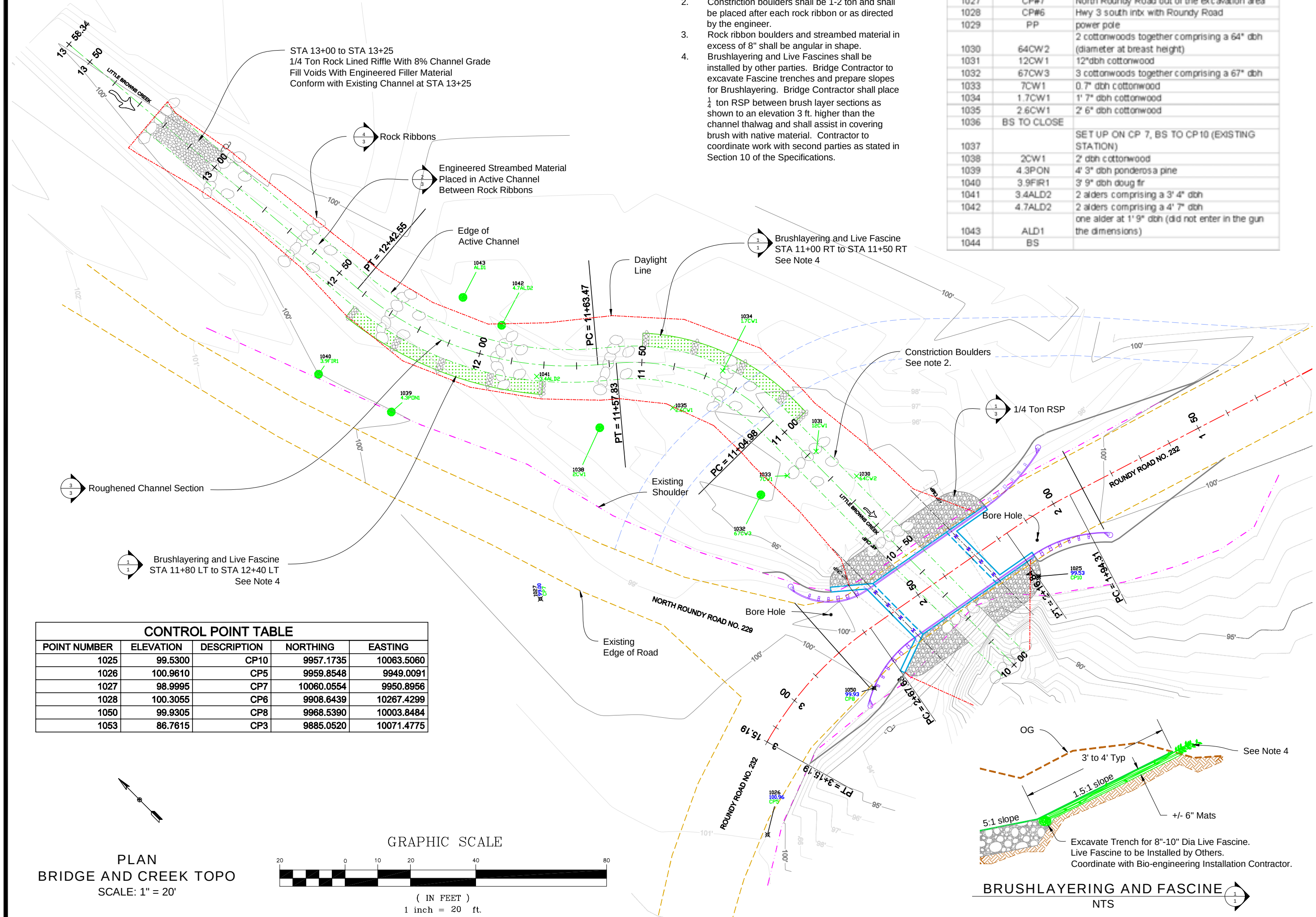
D10	2 mm	(sand and silt)	
D16	1	inches	
D32	4	inches	
D50	8	inches	
D84	21	inches	
D84 designed to be stable to Q100yr (750 cfs)			

NOTES:

1. Trees to be protected during construction are depicted by a ● symbol. Bank slopes around these trees shall be steepened to prevent damage to the trees. Orange construction fencing shall be placed around these trees prior to construction.
2. Constriction boulders shall be 1-2 ton and shall be placed after each rock ribbon or as directed by the engineer.
3. Rock ribbon boulders and streambed material in excess of 8" shall be angular in shape.
4. Brushlayering and Live Fascines shall be installed by other parties. Bridge Contractor to excavate Fascine trenches and prepare slopes for Brushlayering. Bridge Contractor shall place $\frac{1}{4}$ ton RSP between brush layer sections as shown to an elevation 3 ft. higher than the channel thalwag and shall assist in covering brush with native material. Contractor to coordinate work with second parties as stated in Section 10 of the Specifications.

Little Browns Creek Additional Topo Survey: 10-16-2006

Point	Code	
1025	BS from CP#10	shot to new CP#5 from the existing Station that I arbitrarily called CP#10 (south side of road on Hwy side of Outlet area)
1026	CP#5	Roundy Road out of the excavation area
1027	CP#7	North Roundy Road out of the excavation area
1028	CP#6	Hwy 3 south intx with Roundy Road
1029	PP	power pole
1030	64CW2	2 cottonwoods together comprising a 64" dbh (diameter at breast height)
1031	12CW1	12"dbh cottonwood
1032	67CW3	3 cottonwoods together comprising a 67" dbh
1033	7CW1	0.7" dbh cottonwood
1034	1.7CW1	1' 7" dbh cottonwood
1035	2.6CW1	2' 6" dbh cottonwood
1036	BS TO CLOSE	
1037		SET UP ON CP 7, BS TO CP10 (EXISTING STATION)
1038	2CW1	2' dbh cottonwood
1039	4.3PON	4' 3" dbh ponderosa pine
1040	3.9FIR1	3' 9" dbh doug fir
1041	3.4ALD2	2 alders comprising a 3' 4" dbh
1042	4.7ALD2	2 alders comprising a 4' 7" dbh
1043	ALD1	one alder at 1' 9" dbh (did not enter in the gun the dimensions)
1044	BS	



CONTROL POINT TABLE

POINT NUMBER	ELEVATION	DESCRIPTION	NORTHING	EASTING
1025	99.5300	CP10	9957.1735	10063.5060
1026	100.9610	CP5	9959.8548	9949.0091
1027	98.9995	CP7	10060.0554	9950.8956
1028	100.3055	CP6	9908.6439	10267.4299
1050	99.9305	CP8	9968.5390	10003.8484
1053	86.7615	CP3	9885.0520	10071.4775

PLAN
BRIDGE AND CREEK TOPO
SCALE: 1" = 20'

GRAPHIC SCALE
20 0 10 20 40 80
(IN FEET)
1 inch = 20 ft.

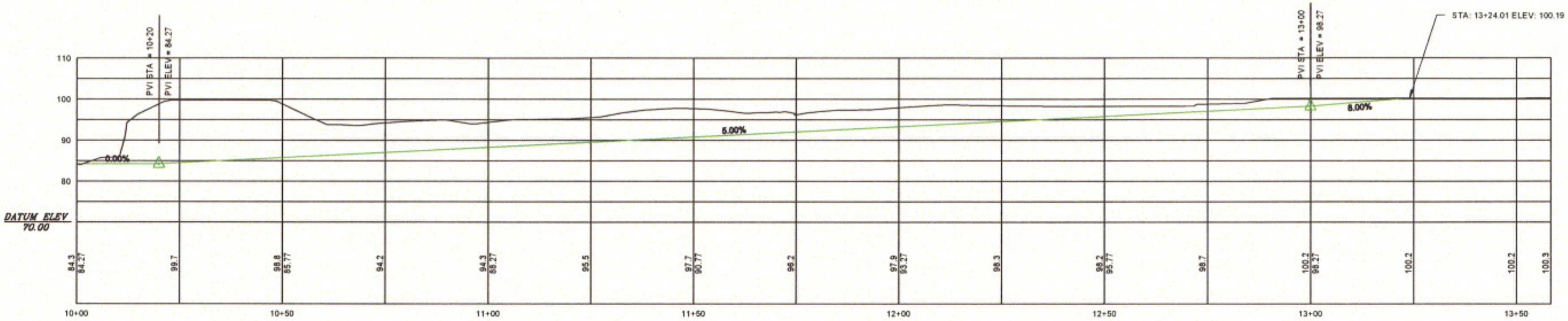
BRUSHLAYERING AND FASCINE
NTS

TRINITY COUNTY ROAD DEPARTMENT
BRIDGE PLAN AT LITTLE BROWNS CREEK
ON ROUNDY ROAD, COUNTY ROAD NO. 232

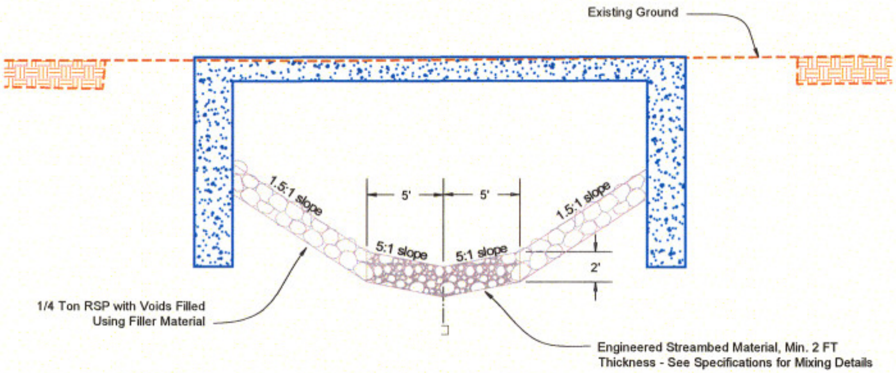
SHEET 2 OF 11

PROJECT NO. 05-2871 · CONTRACT 07-BRIDGE-232
LITTLE BROWN'S CREEK BRIDGE
REVISION DATES: 1-22-07
APPV'D BY:
DESIGN BY: Andrew Pence
SCALE: 1"=20'
DATE: 12/13/2006

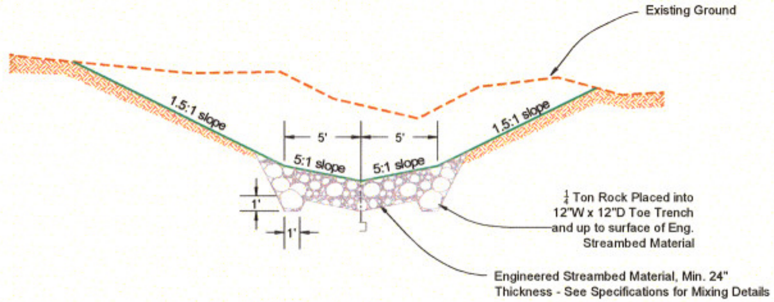
CREEKBED GRADING PLAN



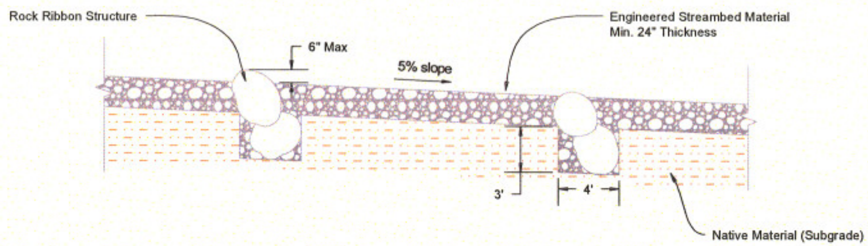
CREEK THALWAG PROFILE
BRIDGE AND CREEK TOPO
SCALE: 1" = 20'



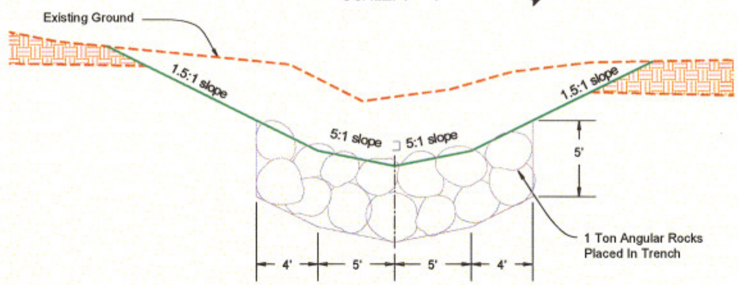
TYPICAL SECTION
CREEK THALWAG UNDER BRIDGE
SCALE: 1" = 6'



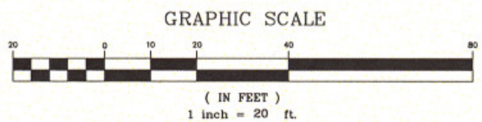
TYPICAL SECTION
CREEK THALWAG
SCALE: 1" = 6'



TYPICAL ROUGHENED CHANNEL PROFILE
SCALE: 1" = 6'



TYPICAL SECTION
ROCK RIBBON
NOT TO SCALE



REGISTERED PROFESSIONAL ENGINEER
CARL A. BONOMINI
C 26121
CIVIL
STATE OF CALIFORNIA

CARL A. BONOMINI, DIRECTOR
TRINITY COUNTY DEPARTMENT OF TRANSPORTATION

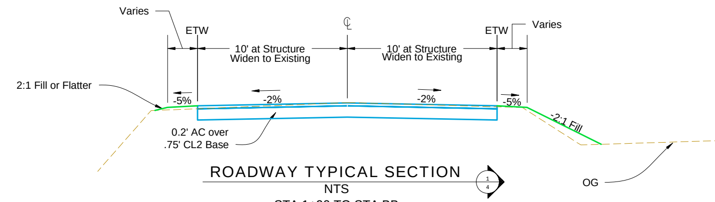
TRINITY COUNTY ROAD DEPARTMENT
BRIDGE PLAN AT LITTLE BROWNS CREEK
ON ROUNDY ROAD, COUNTY ROAD NO. 232

PROJECT NO.	05-2871
CONTRACT	07-BRIDGE-232
	LITTLE BROWN'S CREEK BRIDGE
APPV'D BY:	
DESIGN BY:	Andrew Pence
SCALE	Varies
DATE	12/13/2006
REVISION DATES:	1-22-07

THALWAG PROFILE
AND DETAILS

LINE TABLE						
LINE	LENGTH	BEARING	START NORTHING	START EASTING	END NORTHING	END EASTING
L1	94.31	N72°28'21"W	9939.59	10177.88	9967.99	10087.95
L2	50.85	N79°50'57"W	9973.38	10066.09	9982.34	10016.04

CURVE TABLE			
CURVE	LENGTH	RADIUS	Delta
C1	22.53	175.00	7°22'36"
C2	47.50	105.00	25°55'20"

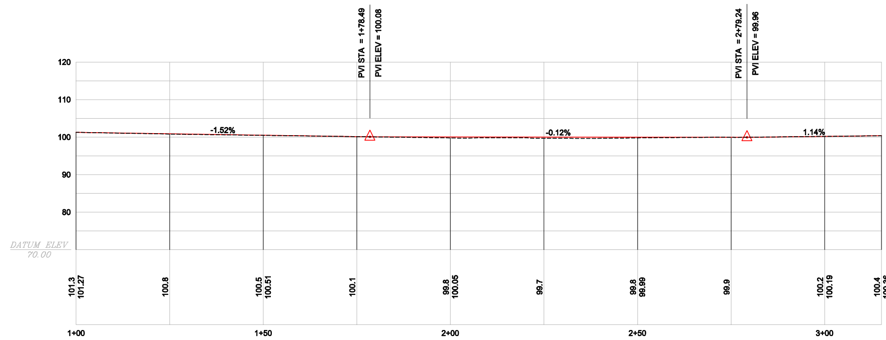


ROADWAY TYPICAL SECTION

NTS

STA 1+90 TO STA BB

STA EB TO STA 2+80

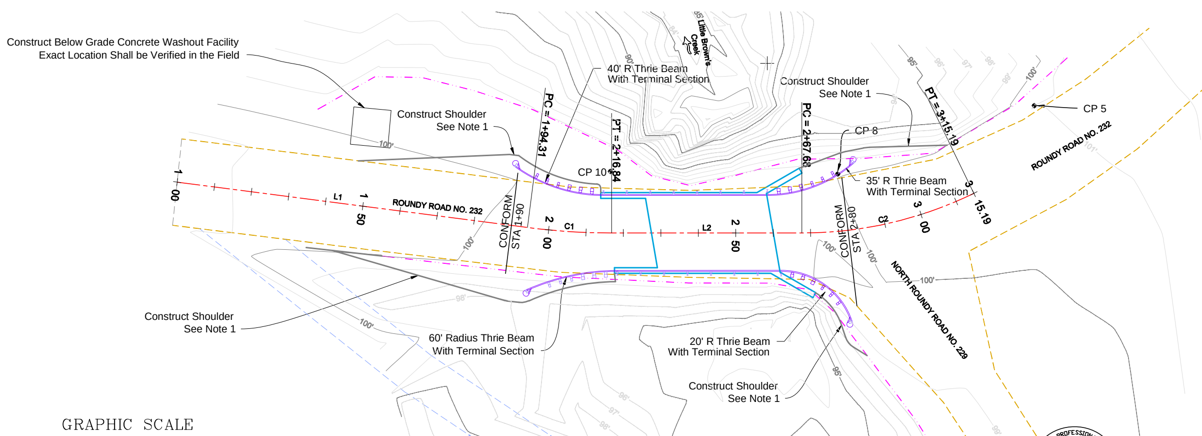


ROADWAY PROFILE

SCALE: 1" = 20'

NOTE

1. Construct shoulder at 5% grade from ETW to min 3' behind face of rail. See Standard Plan A77FA Detail A, A78A, A78B and A78C.



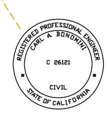
GRAPHIC SCALE

20 0 10 20 40 80

(IN FEET)
1 inch = 20 ft.

ROADWAY PLAN

SCALE: 1" = 20'



CARL A. BONDMINI, DIRECTOR
TRINITY COUNTY DEPARTMENT OF TRANSPORTATION

TRINITY COUNTY ROAD DEPARTMENT

BRIDGE PLAN AT LITTLE BROWNS CREEK
ON ROUNDY ROAD

SHEET 4 OF 11

PROJECT NO: 05-2871 | CONTRACT: 07-BRIDGE-232

LITTLE BROWN'S CREEK BRIDGE

REVISION DATES: 1-22-07

APPROVED BY: | DESIGN BY: Andrew Pence | SCALE: Varies | DATE: 12/13/2006

ROAD LAYOUT AND PROFILE

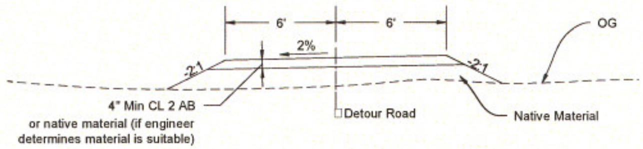
DETOUR LINE TABLE		
LINE	LENGTH	BEARING
L5	82.11	N41°22'44"W
L6	49.11	N45°59'48"W
L7	19.26	N82°53'46"W
L8	4.62	S64°03'27"W

DETOUR CURVE TABLE			
CURVE	LENGTH	RADIUS	Delta
C3	48.30	75.00	36°53'58"
C4	43.26	75.00	33°02'47"

CONSTRUCTION AREA SIGNS					
SIGN	SIZE	NUMBER	DESCRIPTION	MOUNTED ON	LOCATION
C2	4' x 2'-6"	2	ROAD CLOSED	barricade or K-rail	See Plan
C5 (Lt)	4' x 1'-6"	1	DETOUR (ARROW LT)	barricade or K-rail	See Plan
C5 (Rt)	4' x 1'-6"	1	DETOUR (ARROW RT)	barricade or K-rail	See Plan
C23	4' x 4'	1	ROAD WORK AHEAD	4" x 4" WOOD POST	Intersection with HW3

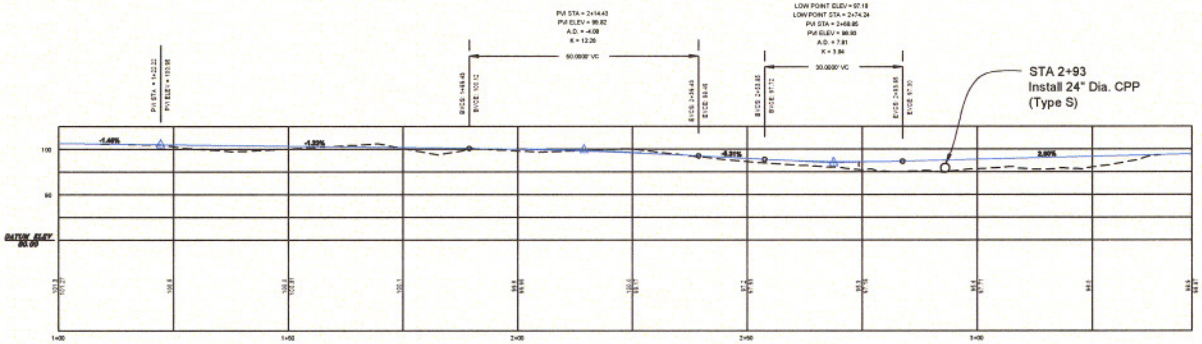
NOTES

1. In the event that flowing water is present, a coffer dam shall be built upstream of the project and running water shall be pumped to a location downstream of the project.
2. Groundwater during excavation shall be pumped to a location that will allow the water to percolate into the soil before entering the stream. Contractor shall be required to construct a settling basin of sufficient size to contain the groundwater. Pump outflow shall not be allowed to re-enter the live channel.



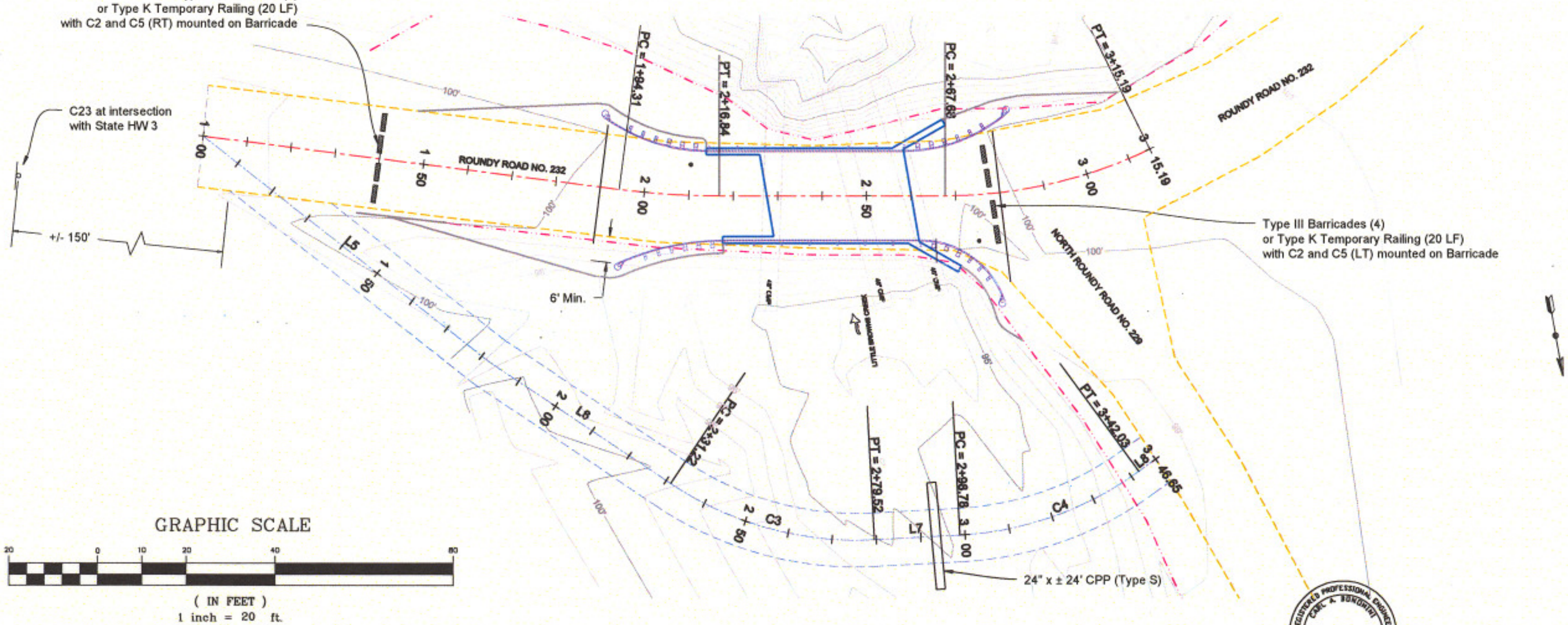
DETOUR ROAD TYPICAL SECTION

NOT TO SCALE



DETOUR PROFILE

SCALE: 1" = 20'



DETOUR AND CONSTRUCTION AREA SIGN PLAN

SCALE: 1" = 20'

REGISTERED PROFESSIONAL ENGINEER CARL A. BONOMINI C 26121 CIVIL STATE OF CALIFORNIA

CARL A. BONOMINI, DIRECTOR
TRINITY COUNTY DEPARTMENT OF TRANSPORTATION

TRINITY COUNTY ROAD DEPARTMENT

BRIDGE PLAN AT LITTLE BROWNS CREEK
ON ROUNDY ROAD

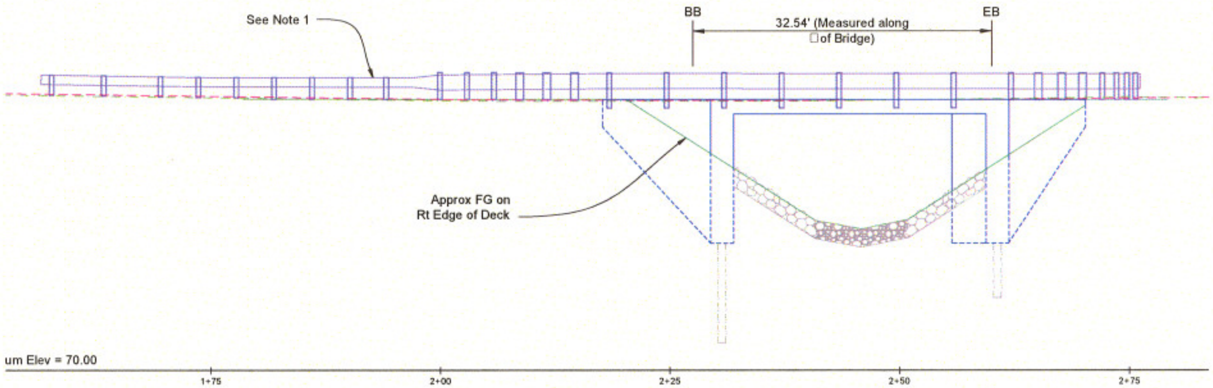
SHEET 5 OF 11

PROJECT NO.: 05-2871 CONTRACT: 07-BRIDGE-232
LITTLE BROWN'S CREEK BRIDGE
REVISION DATES:
APPROVED: Andrew Pence
DESIGN BY:
SCALE: Varies
DATE: 12/13/2006 1-22-07

DETOUR PLAN

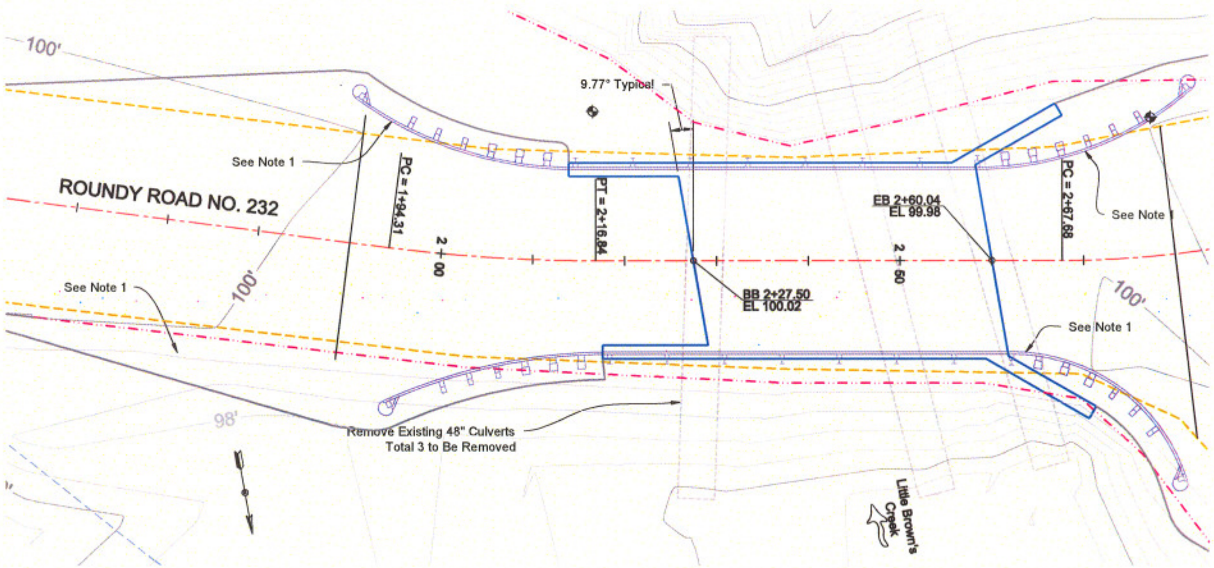
PROFILE GRADE

SCALE: 1" = 10'



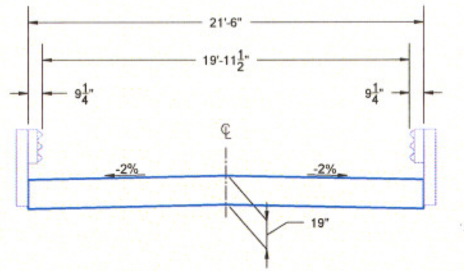
ELEVATION

SCALE: 1" = 10'



PLAN

SCALE: 1" = 10'



TYPICAL SECTION

NOT TO SCALE

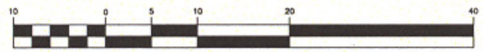
NOTES

1. MBGR. See "Road Layout and Profile" Sheet.
2. See Hydrologic Sumary on "Foundation Plan" Sheet.
3. For General notes see "Slab Reinforcement Details" Sheet.

Legend

- Roadway Centerline
- Existing Culverts to Be Removed
- Existing Shoulder
- Existing Edge of Road
- Approx OG at ⎕ in Elevation View
- Approx OG along Lt Edge of Deck
- Approx OG along Rt Edge of Deck
- H-Pile
- FG at CL

GRAPHIC SCALE



(IN FEET)
1 inch = 10 ft.

REGISTERED PROFESSIONAL ENGINEER
CARL A. BONOMINI
C 26121
CIVIL
STATE OF CALIFORNIA

CARL A. BONOMINI, DIRECTOR
TRINITY COUNTY DEPARTMENT OF TRANSPORTATION

SHEET 6 OF 11

TRINITY COUNTY ROAD DEPARTMENT

BRIDGE PLAN AT LITTLE BROWNS CREEK
ON ROUNDY ROAD

PROJECT NO.	05-2871
CONTRACT	07-BRIDGE-232
	LITTLE BROWN'S CREEK BRIDGE
	REVISION DATES:
APPVD BY	
DESIGN BY	Andrew Pence
SCALE	Varies
DATE	12/13/2006
	1-22-07

GENERAL PLAN

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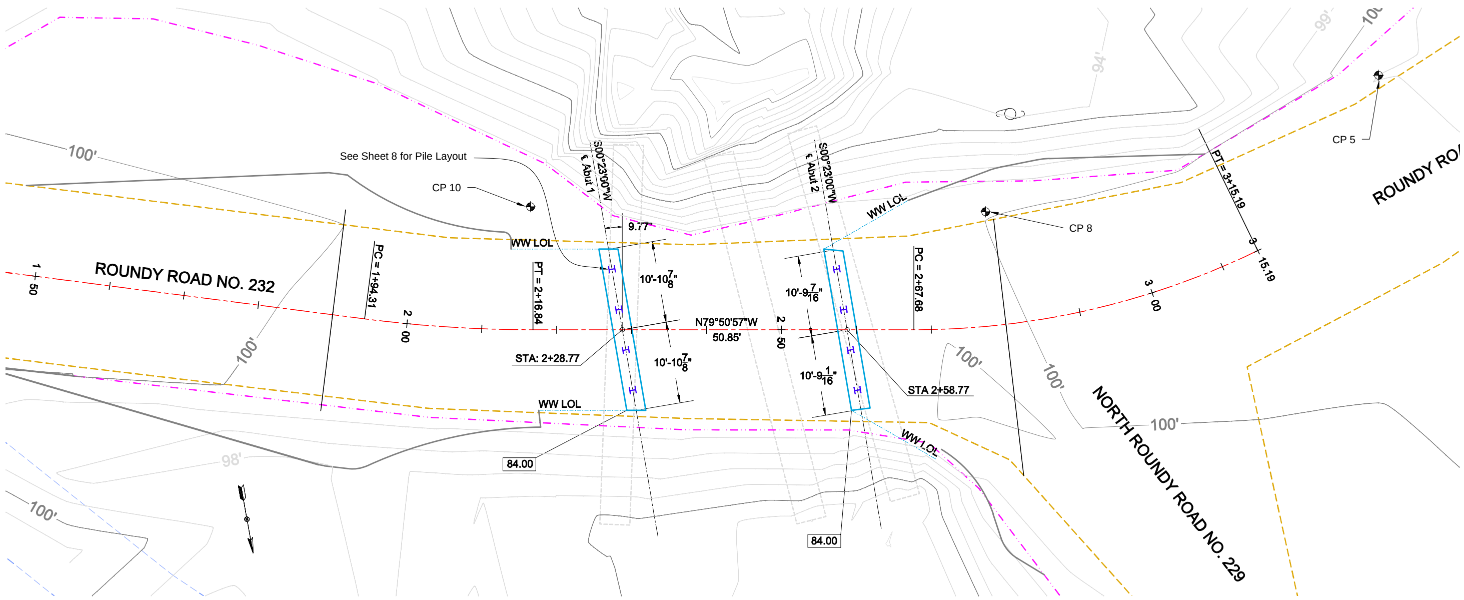


FOUNDATION PLAN

SCALE: 1" = 10'

Legend

84.00	Indicates Bottom of Footing Elevation
H	Indicates Vertical Steel Pile
	Indicates New Construction
	Indicates Existing Culverts to be Removed
	Existing Shoulder
	Existing Edge of Road
	Abutment CL
	Roadway CL

PILE DATA TABLE

Location / Pile Type	Design Loading (Service)	Nominal Resistance		Design Tip Elevation	Specified Tip Elevation
		Compression	Tension		
Abut 1 / HP 10 x 57	45 Ton	90 Ton	0	73.0 (1)	73.0
Abut 2 / HP 10 x 57	45 Ton	90 Ton	0	78.0 (1)	78.0

Design tip elevation is controlled by the following conditions: (1) Axial Compression

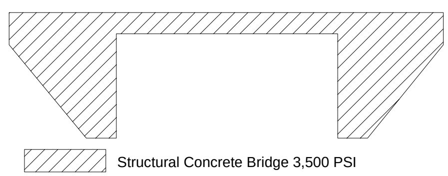
CONTROL POINT TABLE

POINT NUMBER	ELEVATION	DESCRIPTION	NORTHING	EASTING
1025	99.5300	CP10	9957.1735	10063.5060
1026	100.9610	CP5	9959.8548	9949.0091
1027	98.9995	CP7	10060.0554	9950.8956
1028	100.3055	CP6	9908.6439	10267.4299
1050	99.9305	CP8	9968.5390	10003.8484
1053	86.7615	CP3	9885.0520	10071.4775

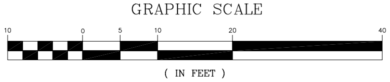
HYDROLOGIC SUMMARY

Drainage Area 1.98 Sq. Miles

	Design Flood	Base Flood	Overtopping Flood
Frequency (Years)	50	100	500 +
Discharge (CFS)	600	743	2025



CONCRETE STRENGTH
AND TYPE LIMITS DIAGRAM
NOT TO SCALE



CARL A. BONDMINI, DIRECTOR
TRINITY COUNTY DEPARTMENT OF TRANSPORTATION

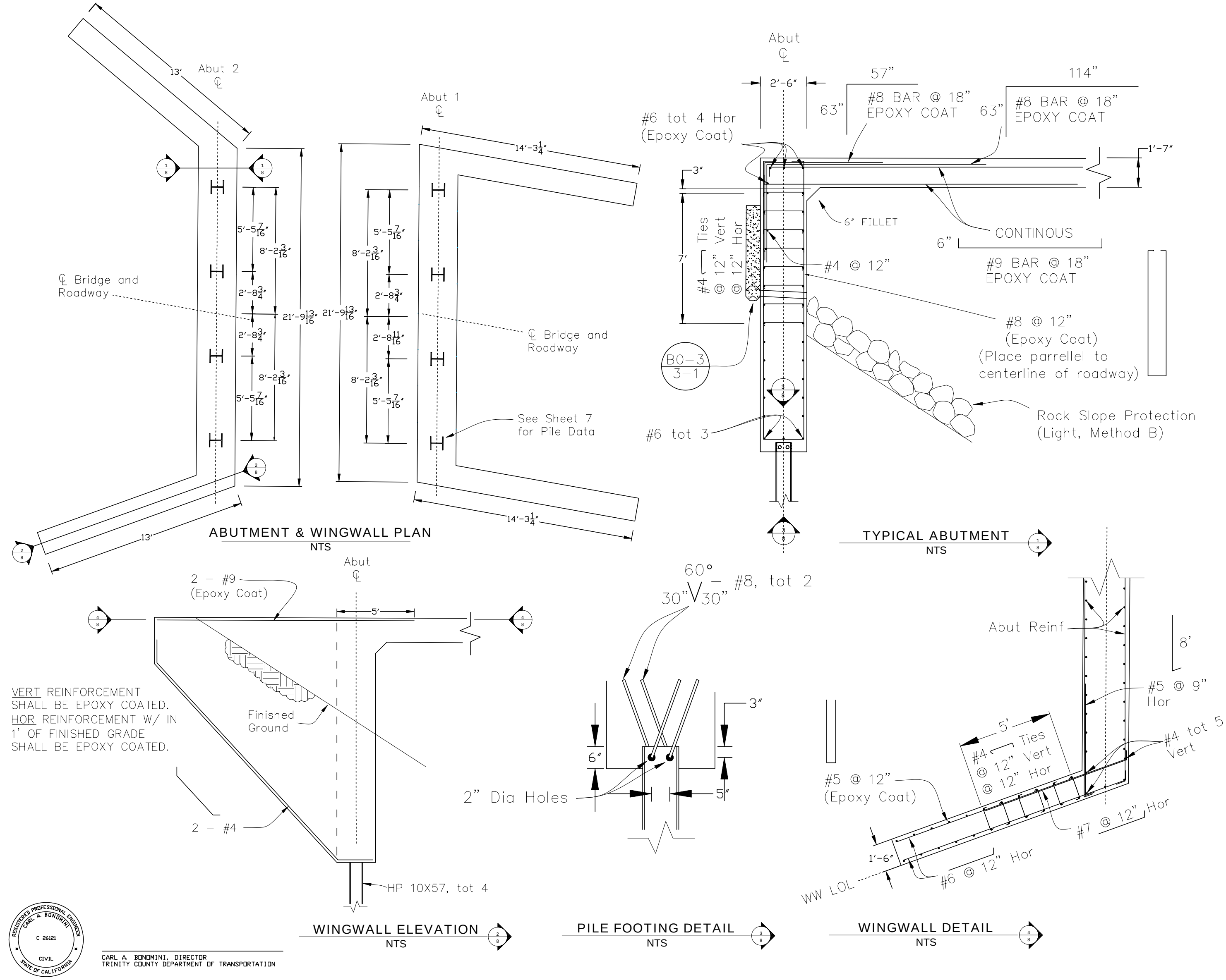
SHEET 7 OF 11

TRINITY COUNTY ROAD DEPARTMENT

BRIDGE PLAN AT LITTLE BROWNS CREEK
ON ROUNDY ROAD

PROJECT NO.: 05-2871
CONTRACT: 07-BRIDGE-232
LITTLE BROWN'S CREEK BRIDGE
REVISION DATES:
1-22-07
APPR'D BY:
DESIGN BY: Andrew Pence
SCALE: Varies
DATE: 12/13/2006

FOUNDATION PLAN



TRINITY COUNTY ROAD DEPARTMENT

BRIDGE PLAN AT LITTLE BROWNS CREEK
ON ROUNDY ROAD, COUNTY ROAD NO. 232

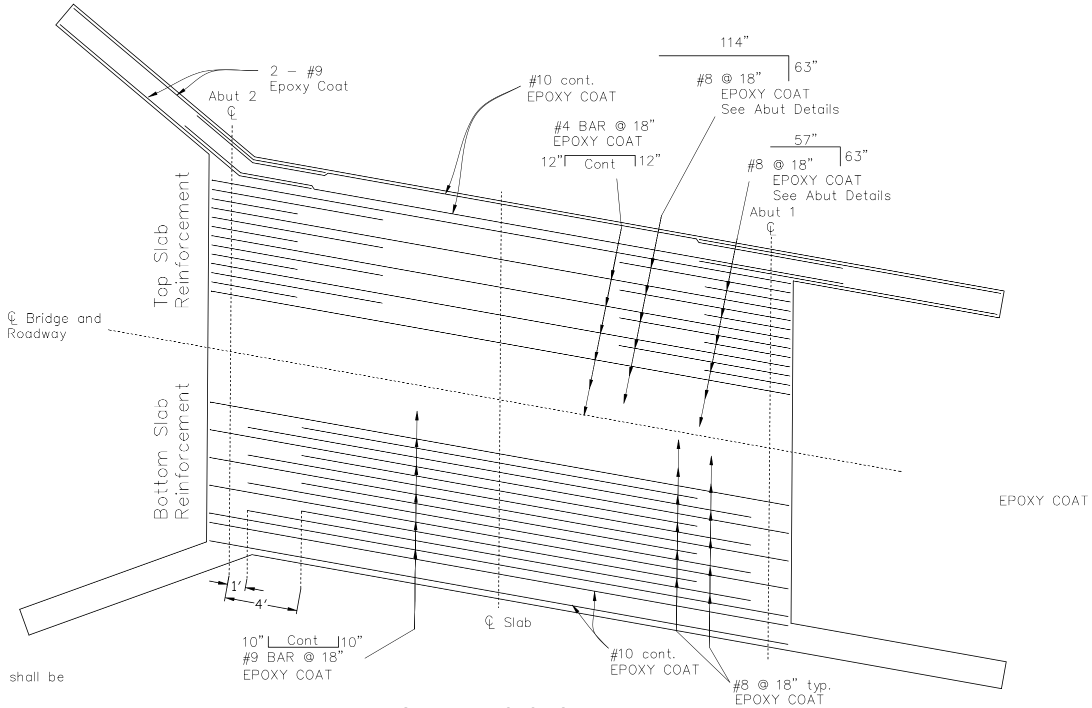
SHEET 8 OF 11

APPV'D BY:	Randy Cessna
DESIGN BY:	NTS
SCALE:	NTS
DATE:	2/20/2007
PROJECT NO.	05-2871
CONTRACT	07-BRIDGE-232

LITTLE BROWN'S CREEK BRIDGE

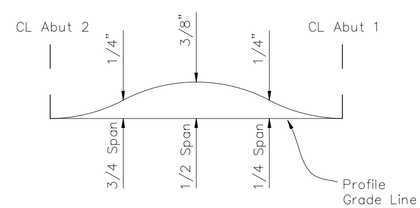
REVISION DATES: 1-22-07

ABUTMENT DETAILS



NOTE
All slab reinforcement shall be epoxy coated.

SLAB REINFORCING PLAN
NTS



CAMBER DIAGRAM
NTS

GRAPHIC SCALE
(IN FEET)
1 inch = 4 ft.

CARL A. BONOMINI, DIRECTOR
TRINITY COUNTY DEPARTMENT OF TRANSPORTATION

SHEET 9 OF 11

TRINITY COUNTY ROAD DEPARTMENT
BRIDGE PLAN AT LITTLE BROWNS CREEK
ON ROUNDY ROAD, COUNTY ROAD NO. 232

APPV'D BY:	
DESIGN BY:	Randy Cessna
SCALE:	NTS
DATE:	2/20/2007
PROJECT NO.:	05-2871
CONTRACT:	07-BRIDGE-232
	LITTLE BROWN'S CREEK BRIDGE
REVISION DATES:	1-22-07

DECK REINFORCING PLAN

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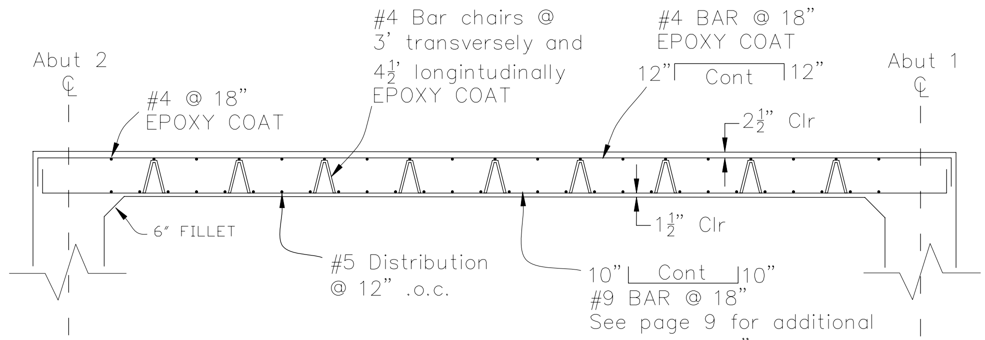
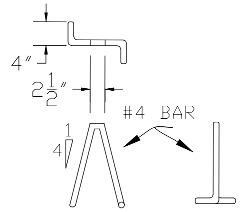


LONGITUDINAL SECTION
NTS

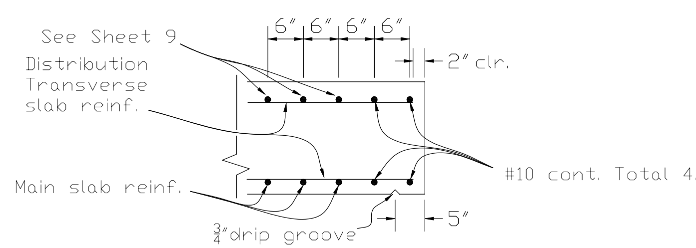
BAR SPLICE LENGTH								
Bar Size	#4	#5	#6	#7	#8	#9	#10	#11
All bars, except top bars in spans over 24'	1'-11"	2'-4"	2'-10"	3'-3"	3'-9"	5'-8"	6'-4"	7'-1"
Top bars in spans over 24'	1'-11"	2'-4"	2'-10"	4'-5"	5'-0"	6'-5"	8'-1"	10'-0"

REINFORCEMENT NOTES:
Splices in top main bars to be located near center of span.
Splices in bottom main bars to be located near bent.
Spacing of all transverse bars is measured along ℄ roadway.
Skew 0° to 20° : Place all transverse bars parallel to bent.
Skew over 20° : Place transverse slab bars perpendicular to ℄ bridge.

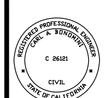
GENERAL NOTE
LOAD FACTOR DESIGN
BRIDGE DESIGN SPECIFICATIONS
(1983 AASHTO with Interims and Revisions by CALTRANS)
DEAD LOAD: Includes 35 psf for future wearing surface.
LIVE LOADING: HS20-44 and alternative and permit design load.
REINFORCED CONCRETE: fy = 60,000 psi
f'c = 3,250 psi
n = 9



BAR CHAIR DETAIL
NTS



EDGE OF SLAB DETAIL
NTS



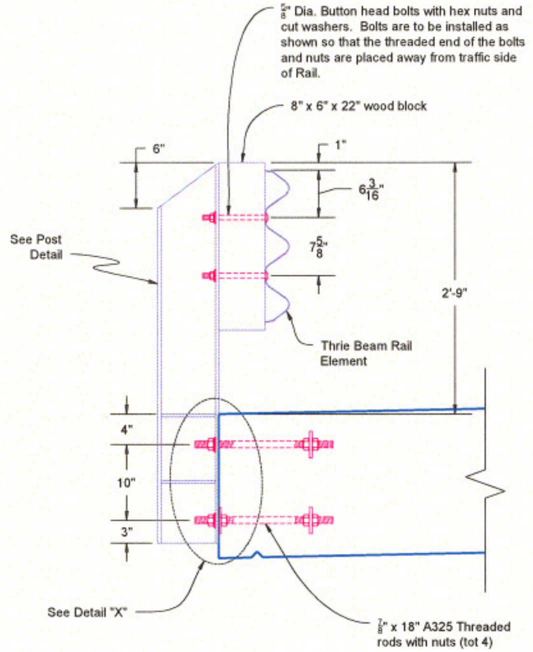
CARL A. BONOMINI, DIRECTOR
TRINITY COUNTY DEPARTMENT OF TRANSPORTATION

SHEET 10 OF 11

TRINITY COUNTY ROAD DEPARTMENT
BRIDGE PLAN AT LITTLE BROWNS CREEK
ON ROUNDY ROAD, COUNTY ROAD NO. 232

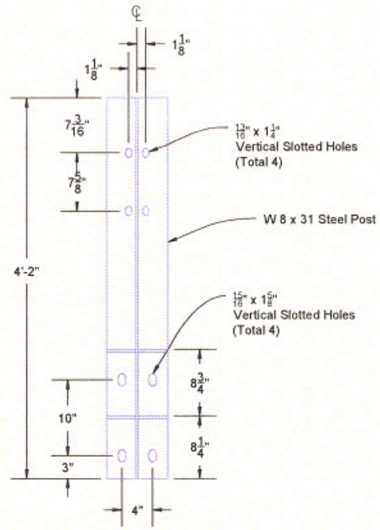
APPR'D BY: Randy Cessna | PROJECT NO. 05-2871 | CONTRACT 07-BRIDGE-232
DESIGN BY: LITTLE BROWN'S CREEK BRIDGE
SCALE: NTS | REVISION DATES:
DATE: 2/20/2007 | 1-22-07

SLAB REINFORCING DETAILS



RAIL POST SECTION

SCALE: 1" = 1'

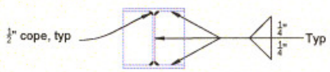


POST DETAIL

SCALE: 1" = 1'

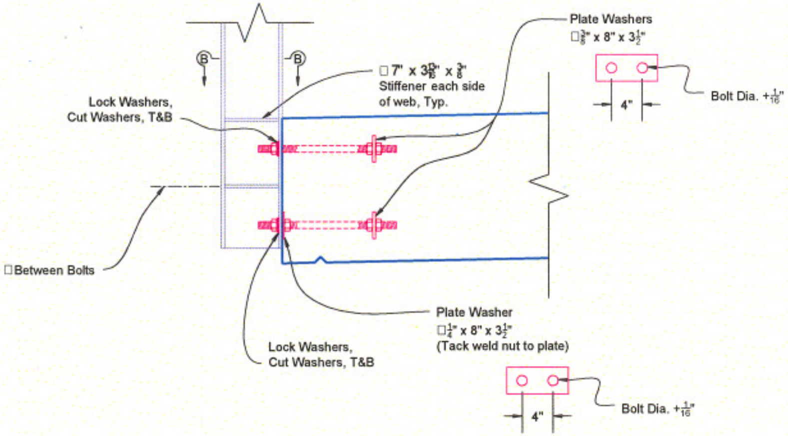
NOTES

1. Rail mounts to block with bolts on approaching traffic side of block and post web.
2. Posts shall be vertical.
3. Anchor bolt nuts shall be wrench tight.
4. Distance from End of Wingwall to ℄ of first post attached to bridge shall be no less than 9".
5. All rail shall be "Thrie Beam Bridge Rail" except the SRT on the northeast corner of the bridge. The length of the transition section shall be included in the length for payment for "Thrie Beam Bridge Rail"
4. For details not shown see Standard Plans A77A, A77B, A77C, A77D, A77F, A77L, A78A, A78B, A78D AND A78E.



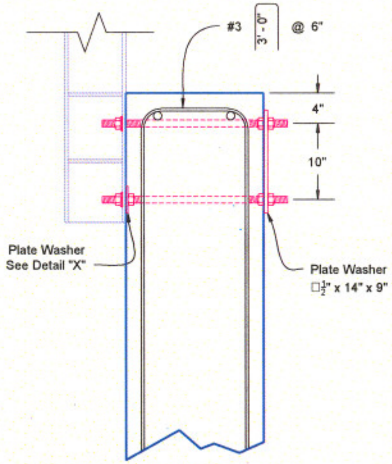
SECTION B-B

SCALE: 1" = 1'



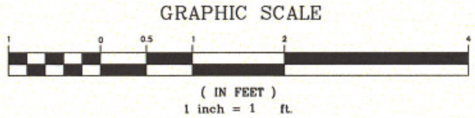
DETAIL "X"

SCALE: 1" = 1'



RAIL POST ON WINGWALL SECTION

SCALE: 1" = 1'



REGISTERED PROFESSIONAL ENGINEER CARL A. BONOMINI C 26121 CIVIL STATE OF CALIFORNIA

CARL A. BONOMINI, DIRECTOR
TRINITY COUNTY DEPARTMENT OF TRANSPORTATION

TRINITY COUNTY ROAD DEPARTMENT
BRIDGE PLAN AT LITTLE BROWNS CREEK
ON ROUNDY ROAD

SHEET 11 OF 11

PROJECT NO. 05-2871 CONTRACT 07-BRIDGE-232
LITTLE BROWN'S CREEK BRIDGE
REVISION DATES: 1-22-07
APPROVED:
DESIGNED BY: Andrew Pence
SCALE: Varies
DATE: 12/13/2006

THRIE BEAM BRIDGE RAIL

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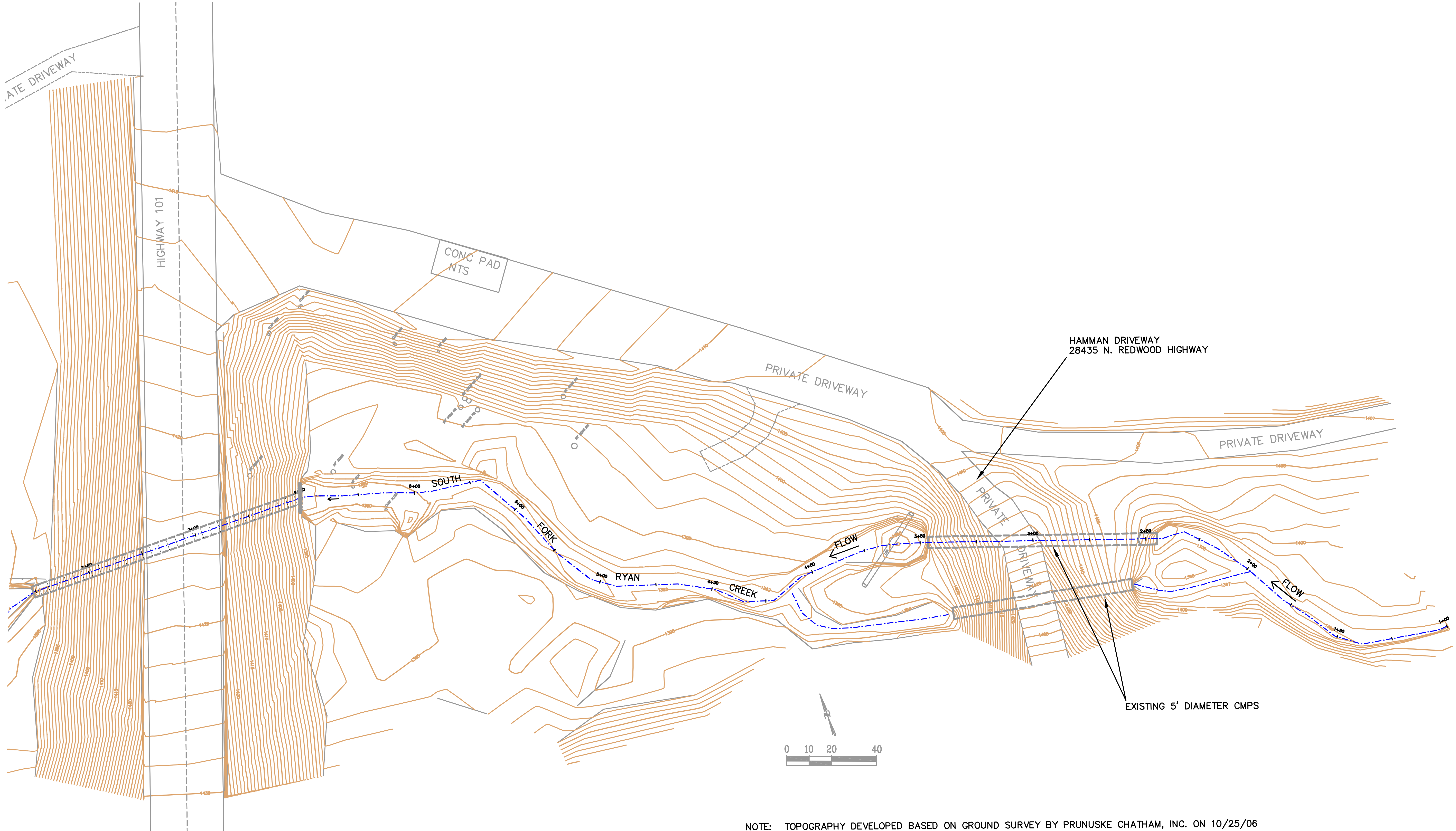
Attachment 7

North Fork Schooner Gulch Migration Barrier Removal
Project Design Report

Attachment 8

South Fork Ryan Creek Fish Passage Improvement Project – James L. Hamman Driveway Crossing Plans



FOR DESIGN STUDY ONLY

NOTE:
THIS DRAWING REDUCED TO
APPROXIMATELY 1/2 SCALE

PRUNUSKE CHATHAM, INC.
P.O. BOX 828
OCCIDENTAL, CA 95465
(707) 874-0100

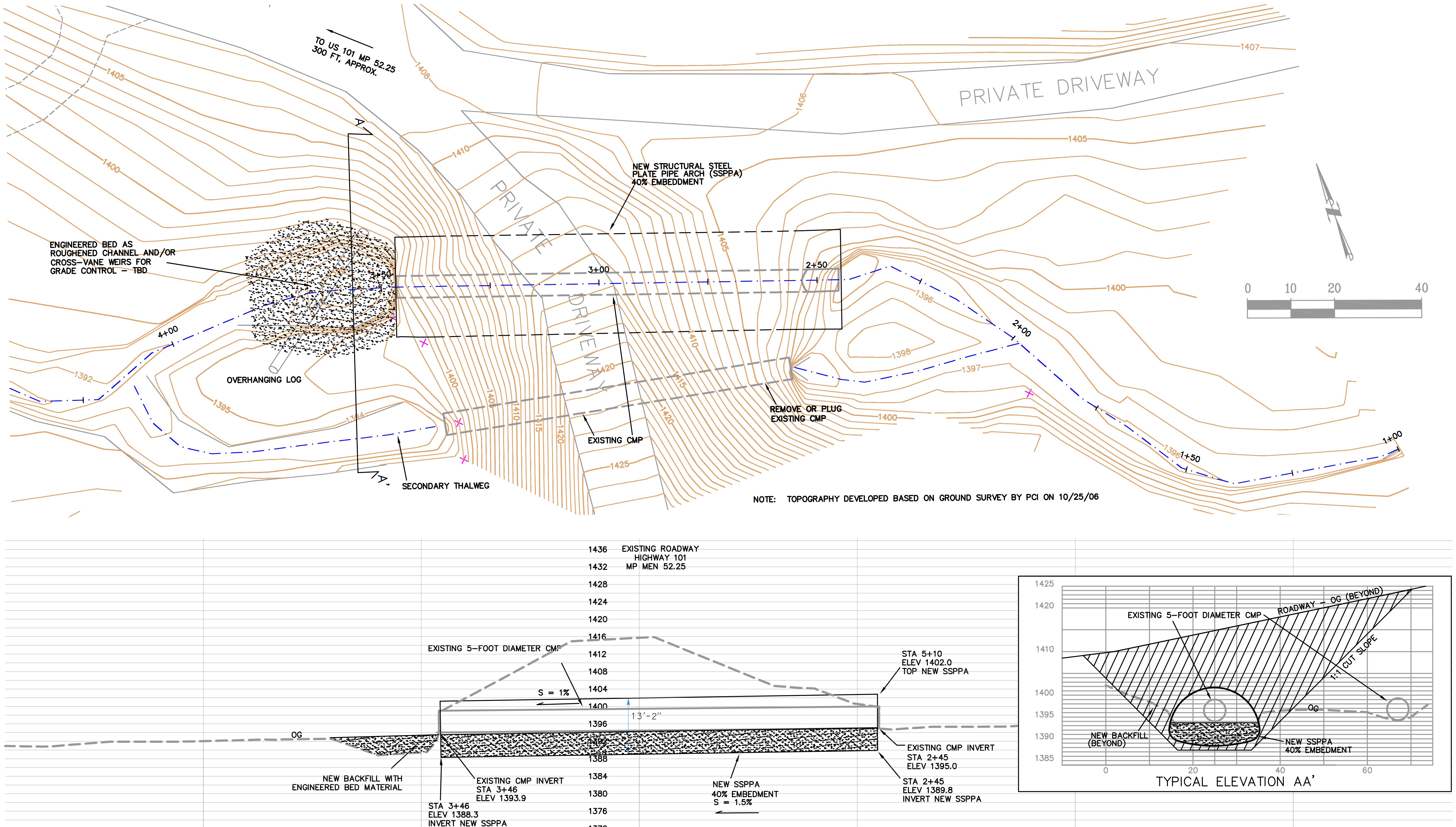
DATE: 04/23/07
SCALE: 1"=10'
DESIGNED BY: J Mann
DRAFTED BY: DR
CHECKED BY: JM

REVISIONS	DATE	BY

PREPARED FOR:
Five Counties Salmonid Conservation Program
Trinity County Planning Department
Ryan Creek Fish Passage Study

HAMMON CULVERT REPLACEMENT
EXISTING FEATURES
UPSTREAM OF CALTRANS MP MEN101 52.25

SHEET
1
1



NOTE:
THIS DRAWING REDUCED TO APPROXIMATELY 1/2 SCALE

FOR DESIGN STUDY ONLY

PRUNUSKE CHATHAM, INC.
P.O. BOX 828
OCCIDENTAL, CA 95465
(707) 874-0100

DATE: 04/23/07
SCALE: 1"=10'
DESIGNED BY: J Mann
DRAFTED BY: DR
CHECKED BY: JM

REVISIONS	DATE	BY

PREPARED FOR:
Five Counties Salmonid Conservation Program
Trinity County Planning Department
Ryan Creek Fish Passage Study

HAMMON CULVERT REPLACEMENT
PLAN AND PROFILE CONCEPT
UPSTREAM OF CALTRANS MP MEN101 52.25

SHEET 1

1

Attachment 9

North Fork and South Fork Ryan Creek Fish Passage Improvement Project Plans

Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
01	MEN	101	52.36	1	11

PREPARED FOR:

Five Counties Salmonid Conservation Program
Trinity County Planning Department
North Fork Ryan Creek Fish Passage Study

RECOMMENDATIONS PREPARED BY:

PRUNUSKE CHATHAM, INC.
P.O. BOX 828
OCCIDENTAL, CA 95465
(707) 874-0100

PROJECT ENGINEER REGISTERED CIVIL ENGINEER — DATE

PLANS APPROVAL DATE

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STATE OF CALIFORNIA

DEPARTMENT OF TRANSPORTATION

PROJECT PLANS FOR CONSTRUCTION ON

STATE HIGHWAY 101

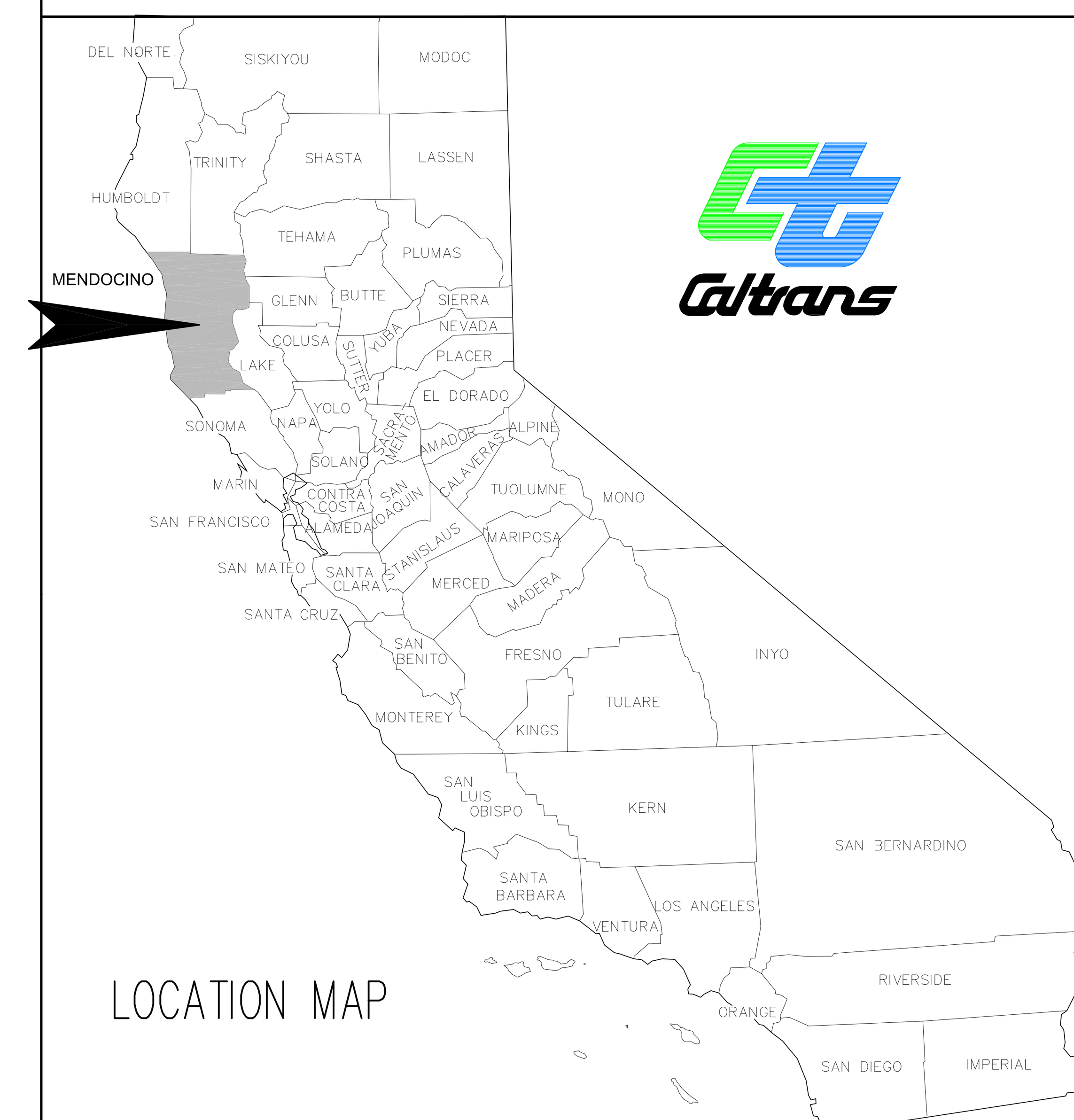
IN MENDOCINO COUNTY NEAR WILLITS AT NORTH FORK OF RYAN CREEK AT PM 52.36

TO BE SUPPLEMENTED BY STANDARD PLANS DATED MAY 2006

INDEX OF PLANS

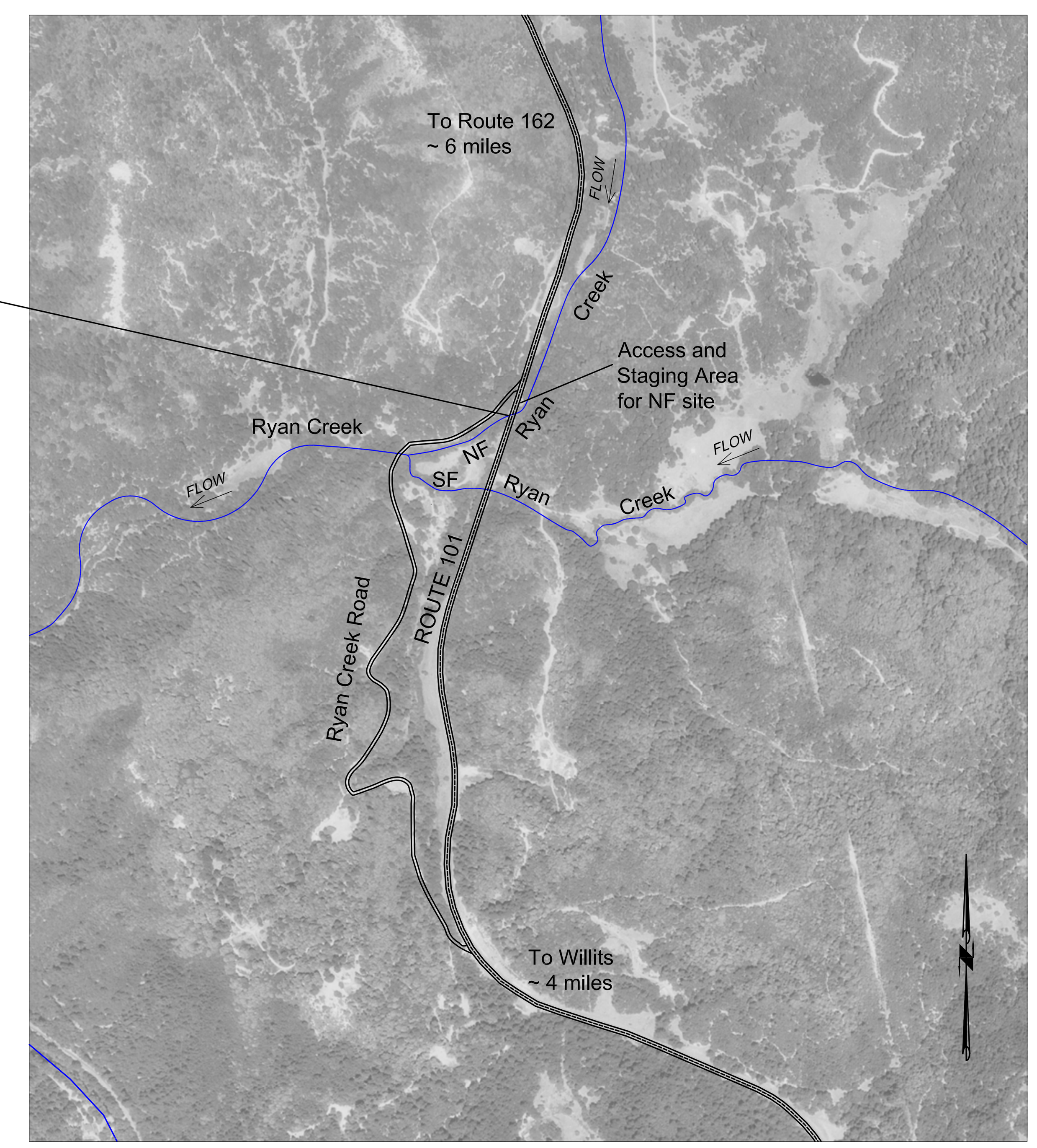
SHEET NO.	SHEET ID	DESCRIPTION
1		Title Sheet
2	L–1	Layout, Staging and Construction Phasing
3	P–1	Plan and Profile
4	C–1	Bed Detail and Typical Cross Sections
5	C–2	Cross Sections
6	C–3	Cross Sections
7	C–4	Construction Notes and Estimated Quantities
8	WPC–1	Temporary Water Pollution Control and Dewatering
9	PP–1	Planting Plan
10	PP–2	Planting Details
11	CS–1	Construction Area Signs

PROJECT LOCATION



LOCATION OF CONSTRUCTION

MEN 101 PM 52.36



APPROXIMATE SCALE 1" = 1000'

PRELIMINARY

DATE : *May 04, 2007*

THE CONTRACTOR SHALL POSSESS THE CLASS (OR CLASSES) OF LICENSES AS SPECIFIED IN THE "NOTICE TO CONTRACTORS".

CONTRACT No.

STATE OF CALIFORNIA – DEPARTMENT OF TRANSPORTATION

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DATE PLOTTED => May 04, 2007
TIME PLOTTED => 11:49

LAST REVISION 00-00-00

BORDER LAST REVISED 1/22/2007 by PCI

RELATIVE BORDER SCALE IS IN INCHES 0 1 2 3

USERNAME =>$USER
[PCI file:G:\ACAD Drawings\TCPD Ryan Creek Fish Passage\dwg\NF-PRECONST-TitleSheet.dwg]

CU 00000 | EA 000000

Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
1	MEN	101	52.25/52.36	2	11

PREPARED FOR:

Five Counties Salmonid Conservation Program
Trinity County Planning Department
North Fork Ryan Creek Fish Passage Study

RECOMMENDATIONS PREPARED BY:

PRUNUSKE CHATHAM, INC.
P.O. BOX 828
OCCIDENTAL, CA 95465
(707) 874-0100

PROJECT ENGINEER
REGISTERED CIVIL ENGINEER

DATE

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER
No.
Exp.
CIVIL
STATE OF CALIFORNIA

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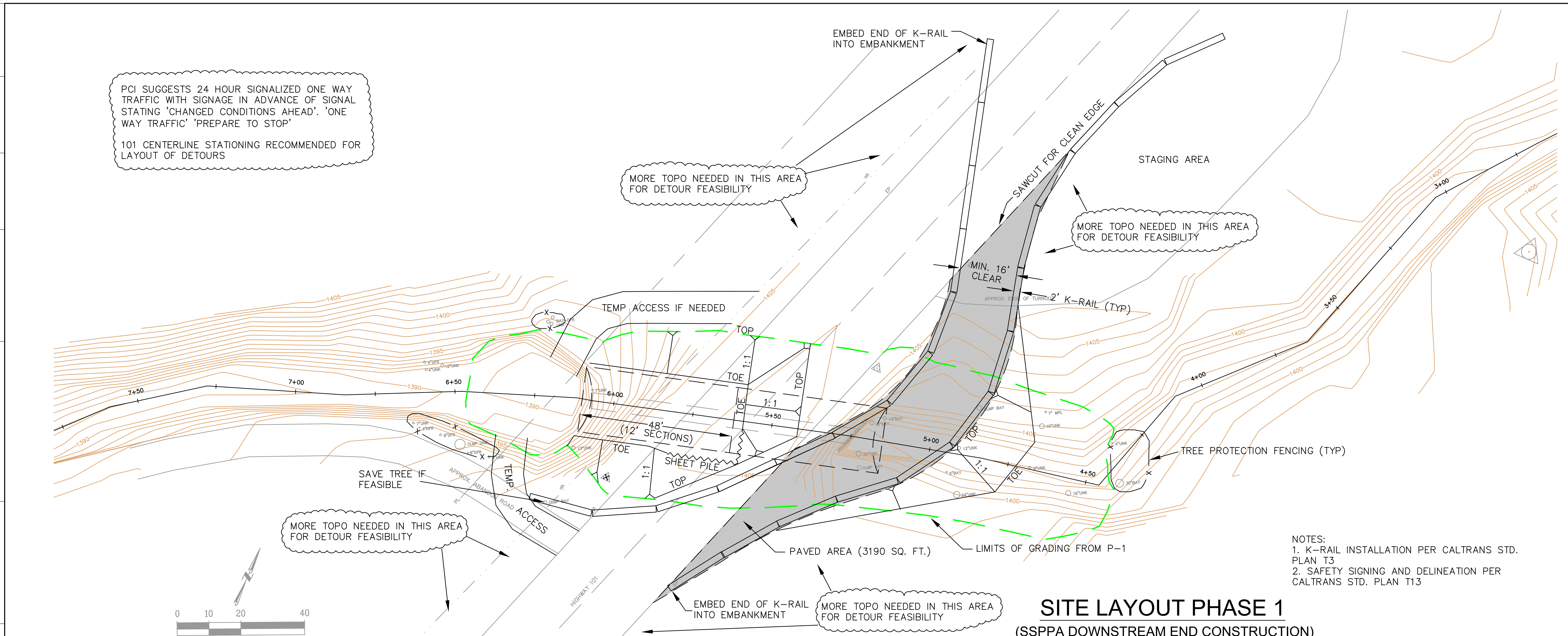
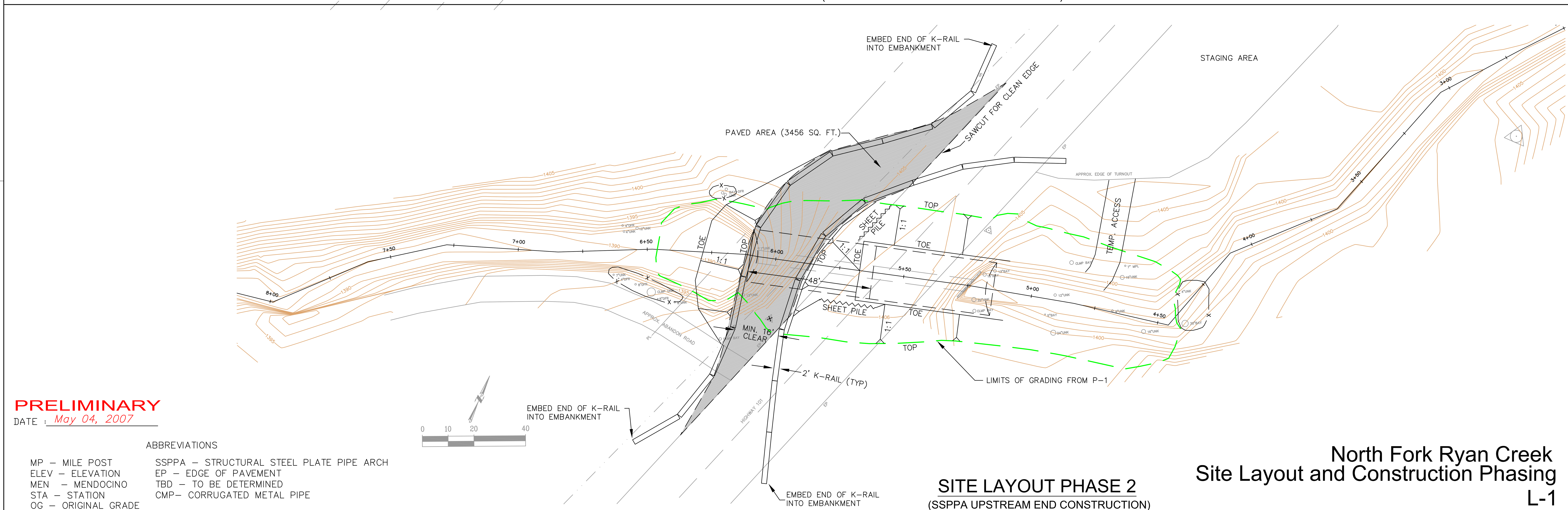


NOTES:
1. K-RAIL INSTALLATION PER CALTRANS STD. PLAN T3
2. SAFETY SIGNING AND DELINEATION PER CALTRANS STD. PLAN T13

SITE LAYOUT PHASE 1
(SSPPA DOWNSTREAM END CONSTRUCTION)



SITE LAYOUT PHASE 2
(SSPPA UPSTREAM END CONSTRUCTION)

PRELIMINARY
DATE : *May 04, 2007*

ABBREVIATIONS

MP – MILE POST
ELEV – ELEVATION
MEN – MENDOCINO
STA – STATION
OG – ORIGINAL GRADE
SSPPA – STRUCTURAL STEEL PLATE PIPE ARCH
EP – EDGE OF PAVEMENT
TBD – TO BE DETERMINED
CMP– CORRUGATED METAL PIPE

North Fork Ryan Creek
Site Layout and Construction Phasing
L-1

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Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
1	MEN	101	52.25/52.36	3	11

PREPARED FOR:

Five Counties Salmonid Conservation Program
Trinity County Planning Department
North Fork Ryan Creek Fish Passage Study

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(707) 874-0100

PROJECT ENGINEER REGISTERED CIVIL ENGINEER — DATE

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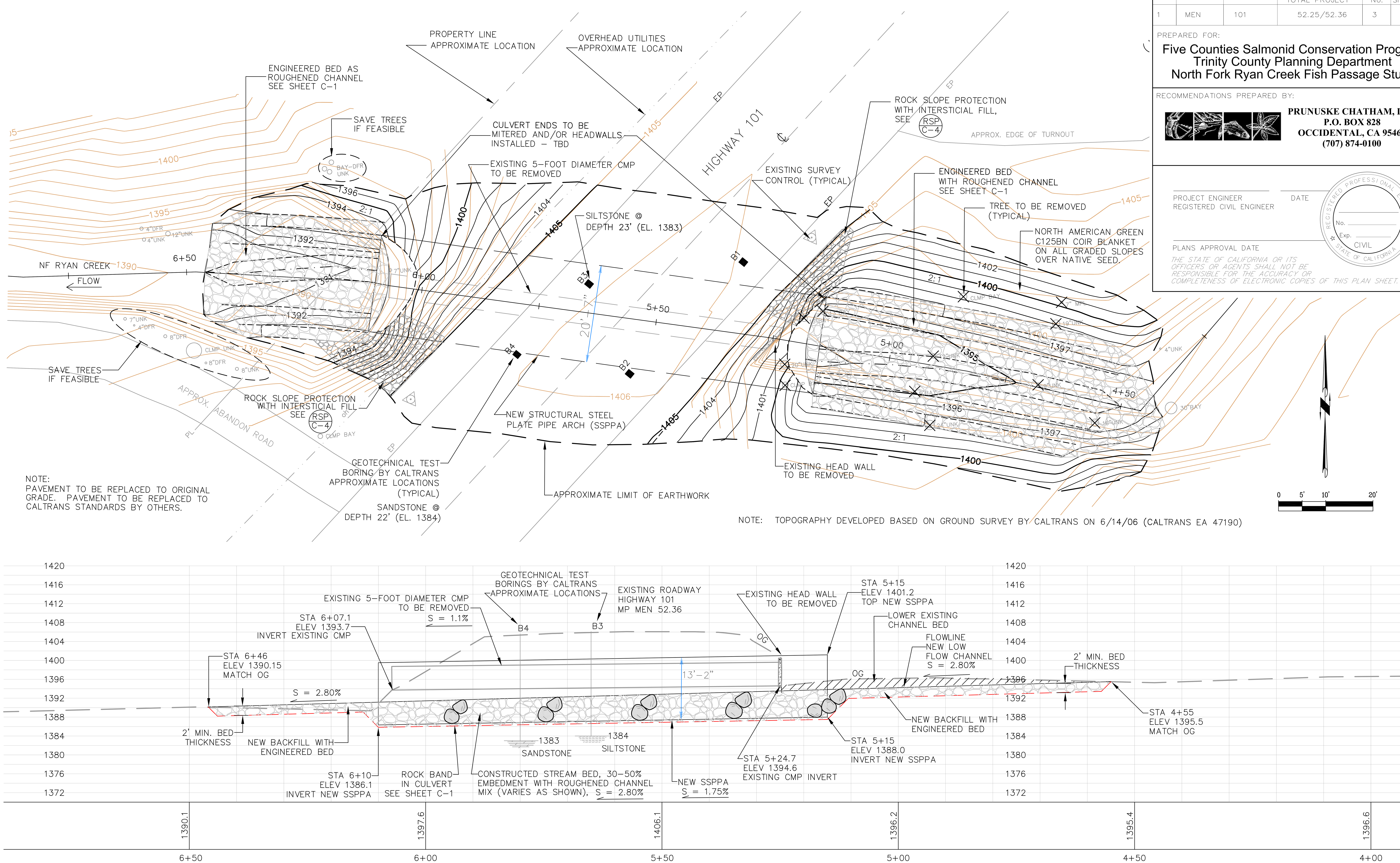

ABBREVIATIONS

MP – MILE POST
EL – ELEVATION
MEN – MENDOCINO
STA – STATION
OG – ORIGINAL GRADE
SSPPA – STRUCTURAL STEEL PLATE PIPE ARCH
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TBD – TO BE DETERMINED
CMP– CORRUGATED METAL PIPE

PRELIMINARY
DATE : *May 04, 2007*

North Fork Ryan Creek Plan and Profile
P-1

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Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
1	MEN	101	52.25/52.36	4	11

PREPARED FOR:

Five Counties Salmonid Conservation Program
Trinity County Planning Department
North Fork Ryan Creek Fish Passage Study

RECOMMENDATIONS PREPARED BY:

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P.O. BOX 828
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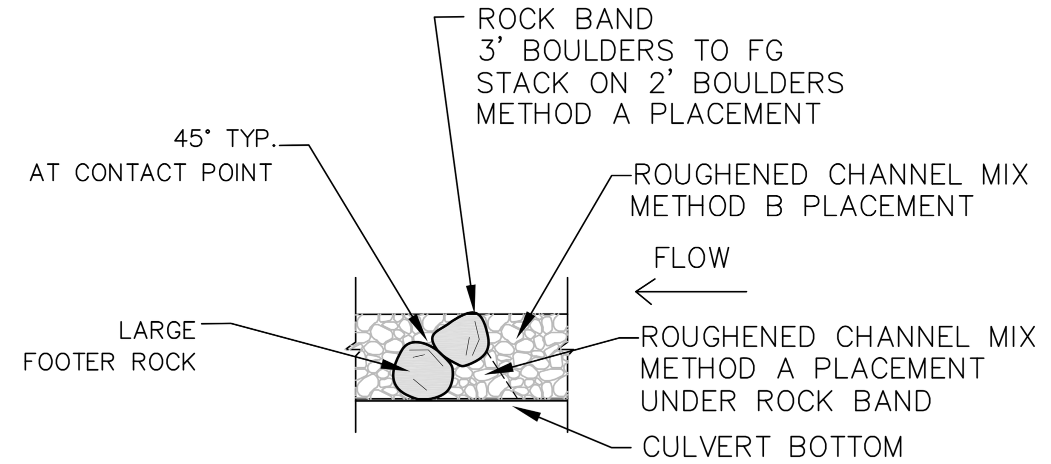
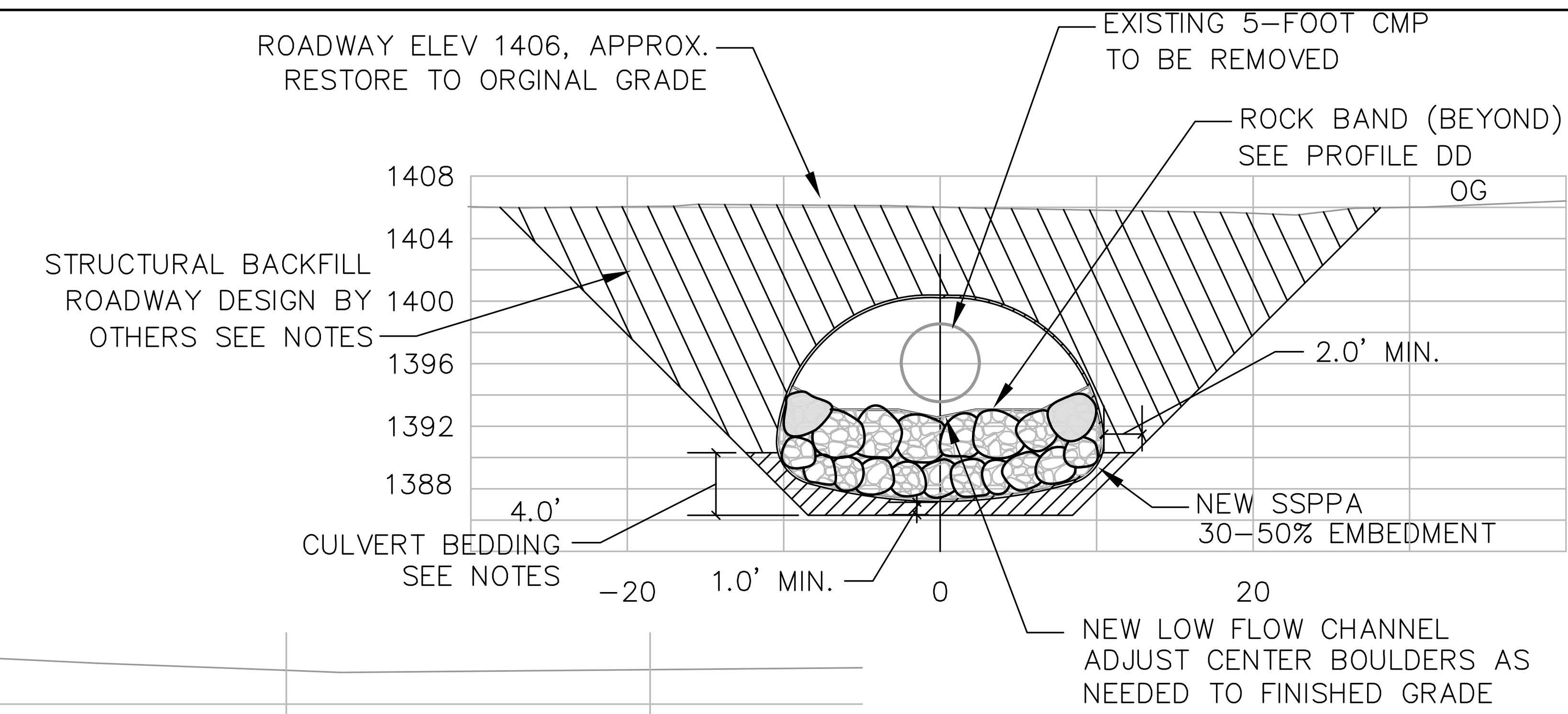
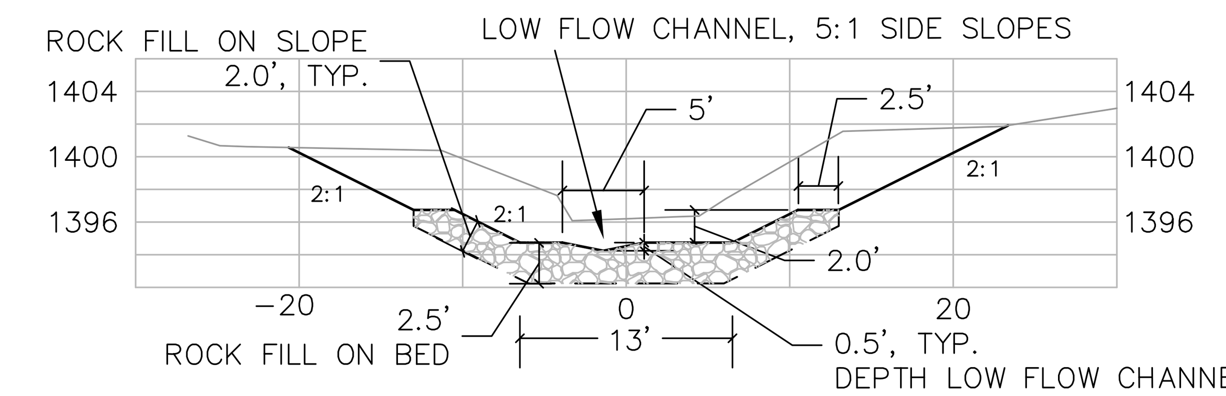


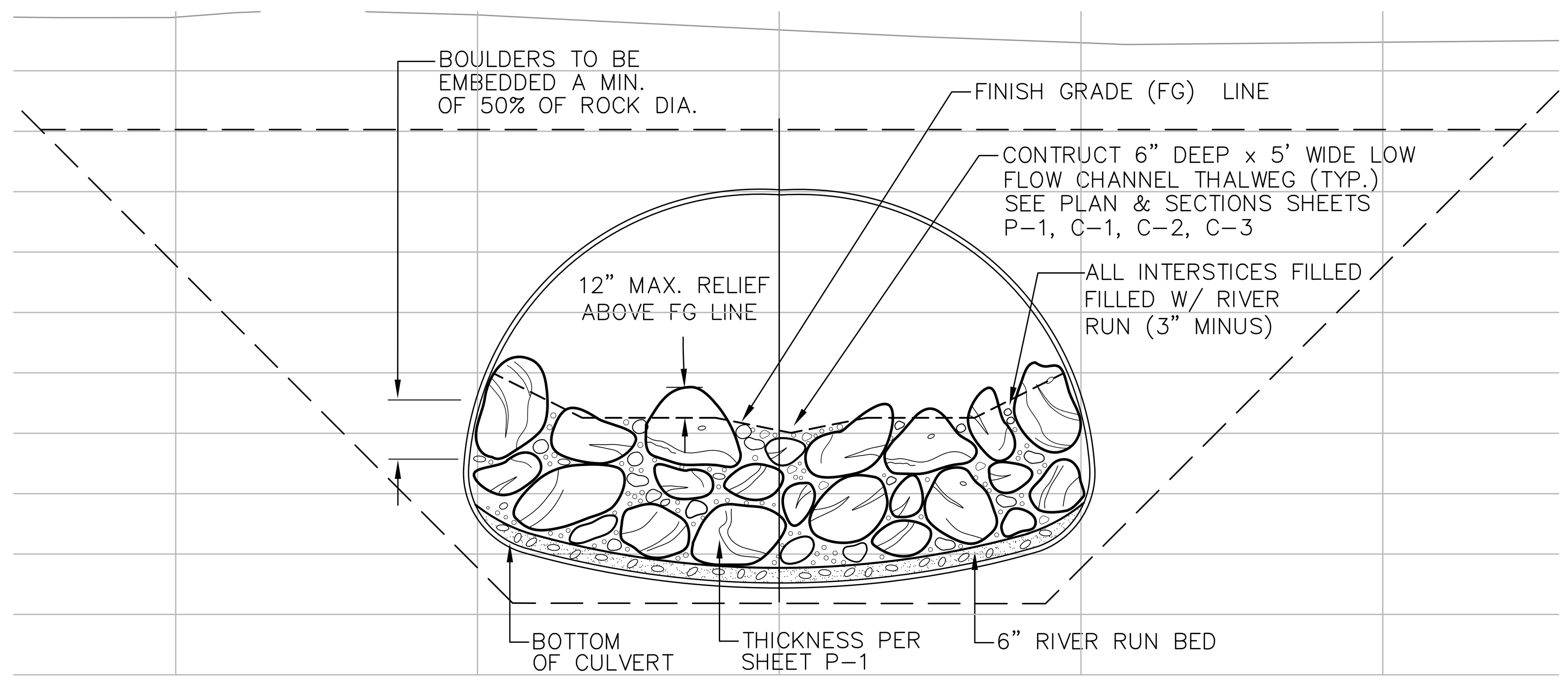
TYPICAL PROFILE DD
ROCK BAND



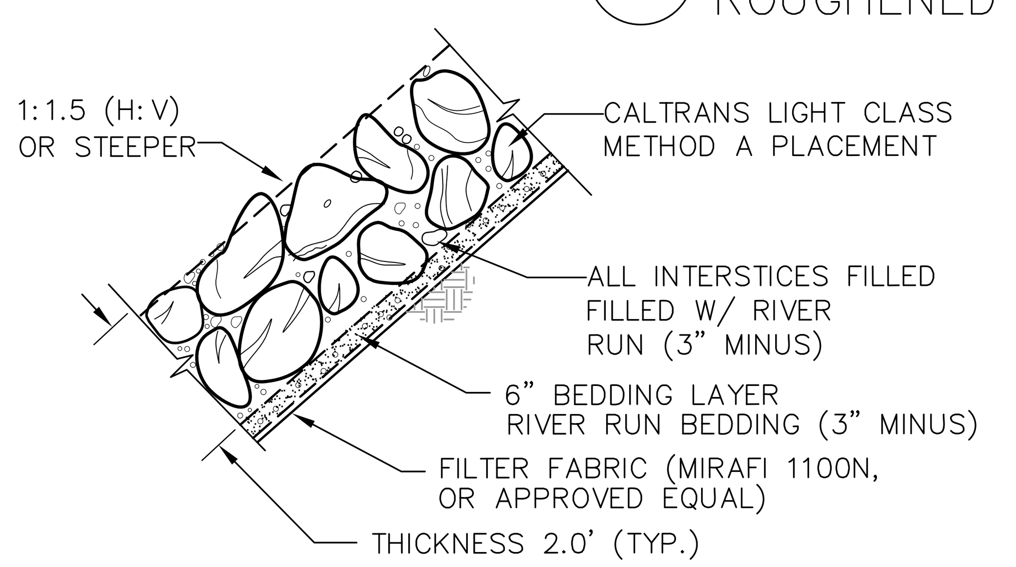
TYPICAL ELEVATION BB



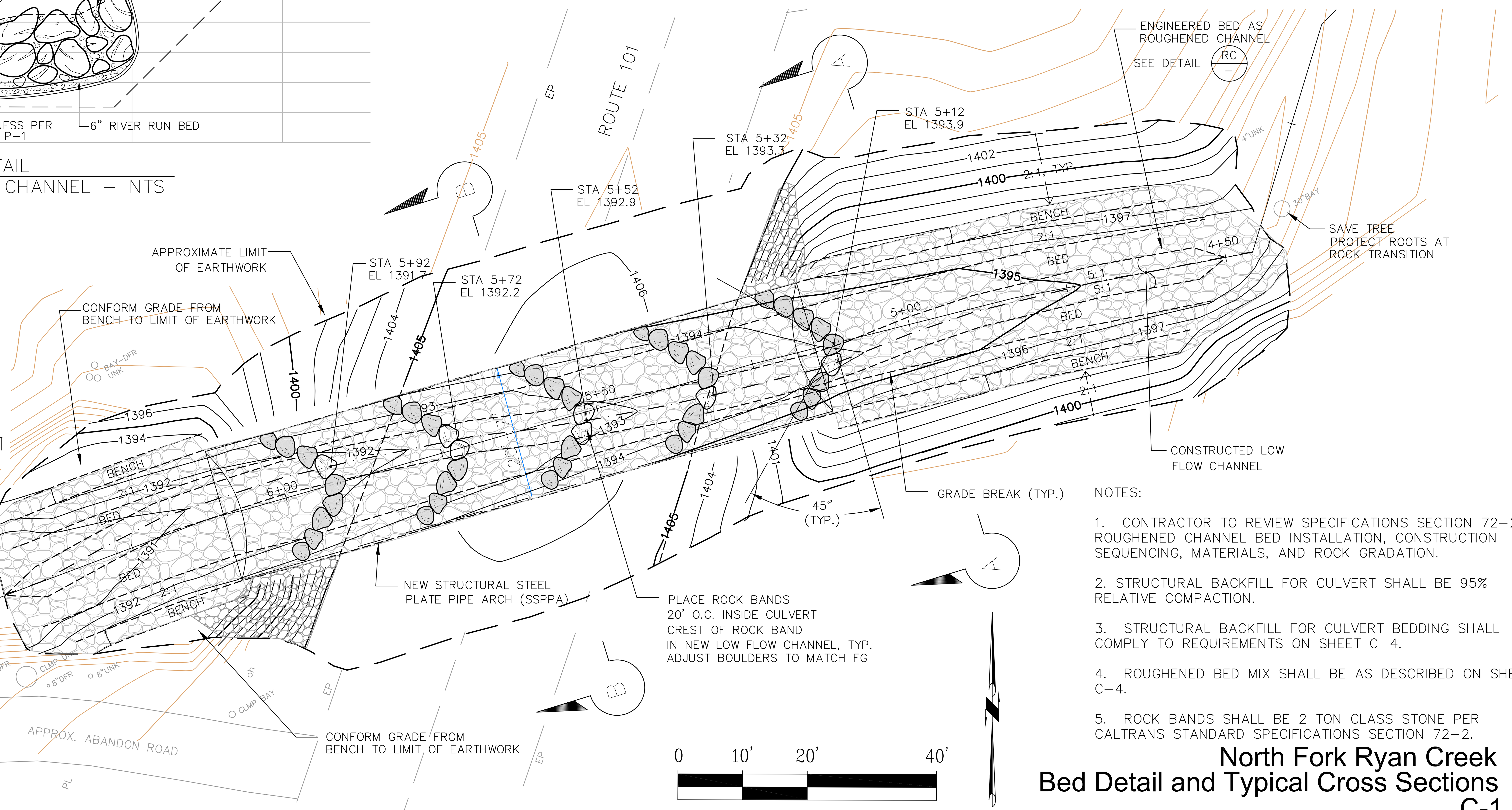
TYPICAL SECTION AA



RC — TYPICAL DETAIL
ROUGHENED CHANNEL – NTS



RSP — TYPICAL DETAIL
ROCK SLOPE PROTECTION – NTS



NOTES:

1. CONTRACTOR TO REVIEW SPECIFICATIONS SECTION 72-2 FOR ROUGHENED CHANNEL BED INSTALLATION, CONSTRUCTION SEQUENCING, MATERIALS, AND ROCK GRADATION.

2. STRUCTURAL BACKFILL FOR CULVERT SHALL BE 95% RELATIVE COMPACTION.

3. STRUCTURAL BACKFILL FOR CULVERT BEDDING SHALL COMPLY TO REQUIREMENTS ON SHEET C-4.

4. ROUGHENED BED MIX SHALL BE AS DESCRIBED ON SHEET C-4.

5. ROCK BANDS SHALL BE 2 TON CLASS STONE PER CALTRANS STANDARD SPECIFICATIONS SECTION 72-2.

North Fork Ryan Creek
Bed Detail and Typical Cross Sections
C-1

PRELIMINARY
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Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
1	MEN	101	52.36	5	11

PREPARED FOR:

Five Counties Salmonid Conservation Program
Trinity County Planning Department
North Fork Ryan Creek Fish Passage Study

RECOMMENDATIONS PREPARED BY:

PRUNUSKE CHATHAM, INC.
P.O. BOX 828
OCCIDENTAL, CA 95465
(707) 874-0100

PROJECT ENGINEER DATE
REGISTERED CIVIL ENGINEER

PLANS APPROVAL DATE

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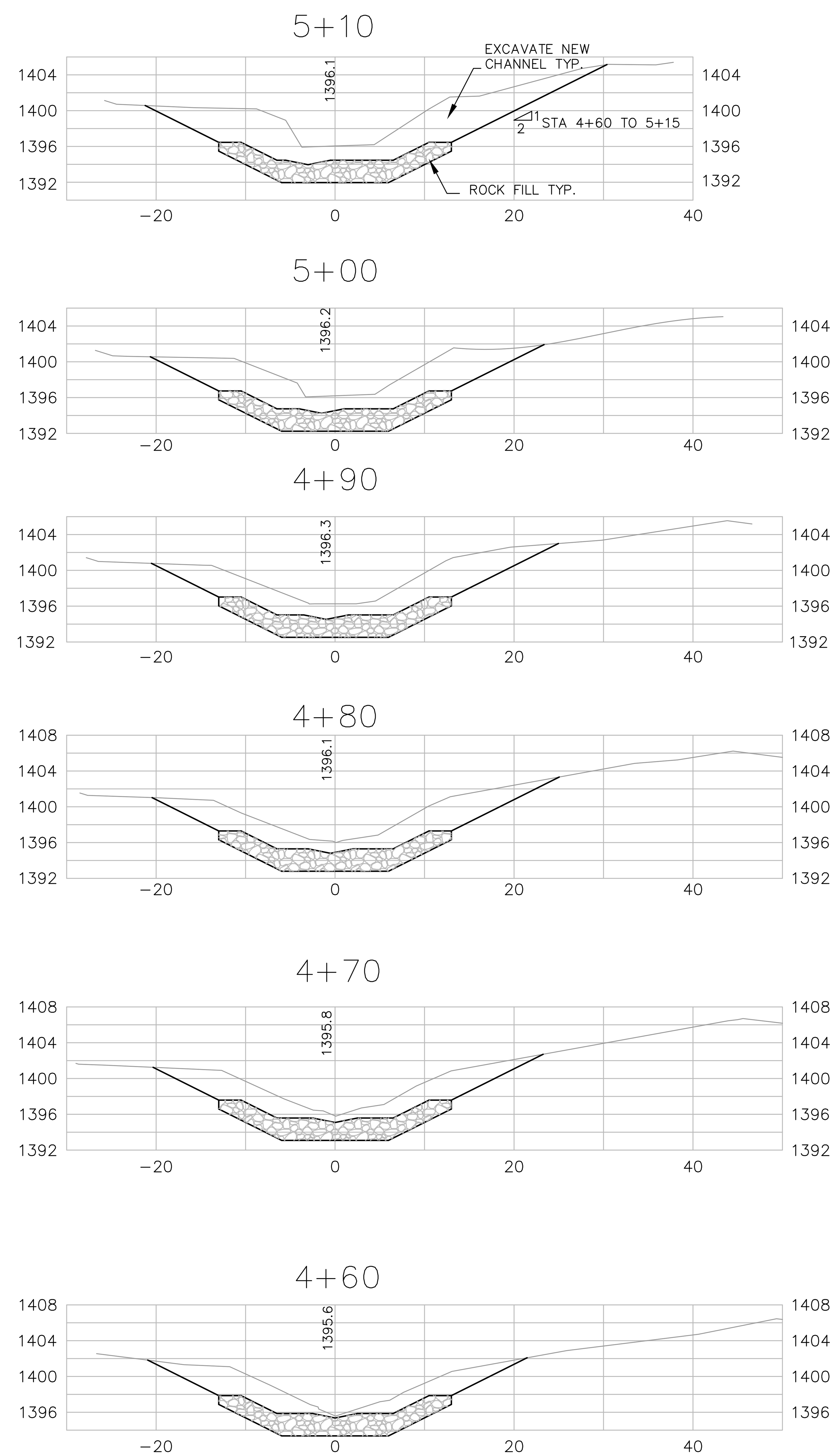

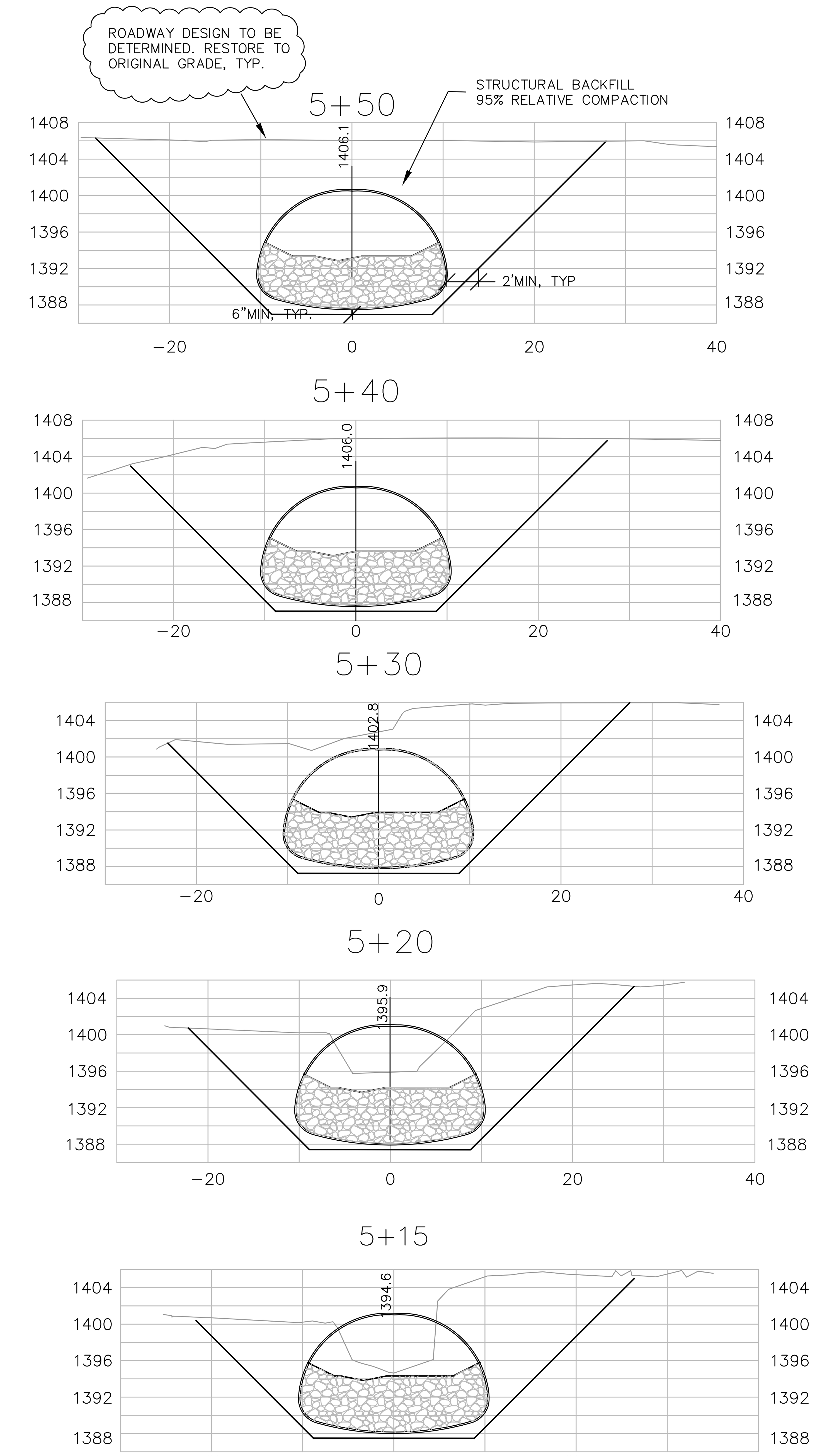

BEGIN CULVERT 5+15

TRANSITION FINISHED GRADE FROM STA 5+10 TO 5+15

NOTES:

1. ROCK BANDS IN CULVERT NOT SHOWN. SEE SHEETS P-1 AND C-1.
2. PLACE ROCK FILL TO GRADE AS SHOWN.
3. CONSTRUCT LOW FLOW CHANNEL AS SHOWN ON THIS SHEET AND SHEET C-1.

0 5' 10' 20'

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PRELIMINARY

DATE : *May 04, 2007*

North Fork Ryan Creek
Cross Sections
C-2

DATE PLOTTED => May 04, 2007
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Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
1	MEN	101	52.36	6	11

PREPARED FOR:

Five Counties Salmonid Conservation Program
Trinity County Planning Department
North Fork Ryan Creek Fish Passage Study

RECOMMENDATIONS PREPARED BY:

PRUNUSKE CHATHAM, INC.
P.O. BOX 828
OCCIDENTAL, CA 95465
(707) 874-0100

PROJECT ENGINEER DATE
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PLANS APPROVAL DATE

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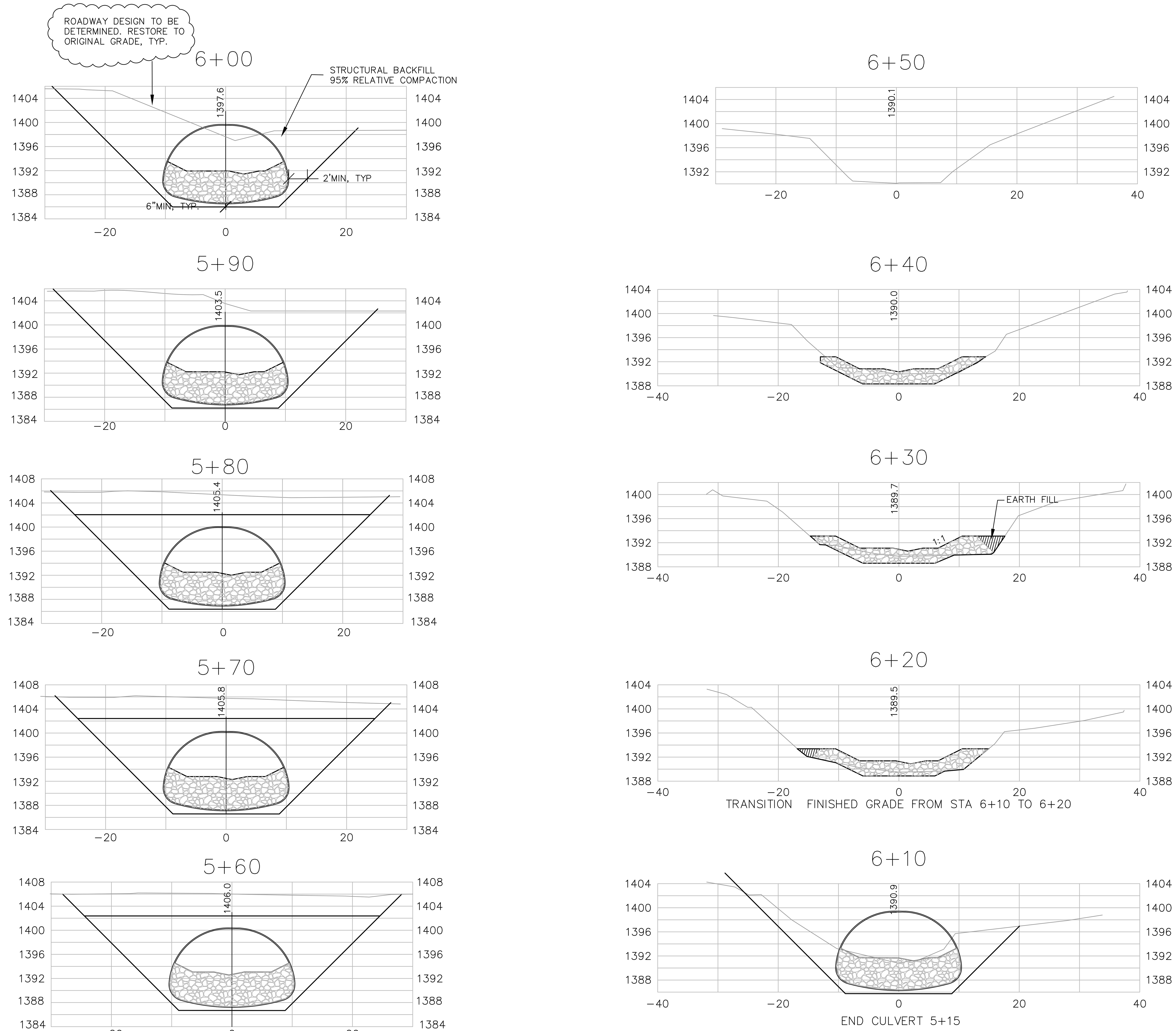

NOTES:

1. ROCK BANDS IN CULVERT NOT SHOWN. SEE SHEETS P-1 AND C-1.
2. PLACE ROCK FILL TO GRADE AS SHOWN.
3. CONSTRUCT LOW FLOW CHANNEL AS SHOWN ON THIS SHEET AND SHEET C-1

0 5' 10' 20'

North Fork Ryan Creek Cross Sections C-3

PRELIMINARY
DATE : *May 04, 2007*

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Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
1	MEN	101	PM	7	11

PREPARED FOR:

Five Counties Salmonid Conservation Program
Trinity County Planning Department
North Fork Ryan Creek Fish Passage Study

RECOMMENDATIONS PREPARED BY:

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PROJECT ENGINEER REGISTERED CIVIL ENGINEER — DATE

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER — No. — Exp. — CIVIL — STATE OF CALIFORNIA

GALVANIZED STEEL STRUCTURAL PLATE PIPE ARCH (SSPPA) CULVERT

Material:
The galvanized steel structural plate structure shall consist of plates and appurtenant items as shown on the plans and shall conform to the requirements of AASHTO M 167 / ASTM A 761. All manufacturing processes including corrugating, punching, curving and galvanizing shall be performed within the United States using raw materials made in the United States.

Assembly bolts and nuts shall be galvanized and meet the provisions of ASTM A 449, Type 1,and ASTM A-563, Grade C, respectively.

Assembly:
The structure shall be assembled in accordance with the shop drawings provided by the manufacturer and per the manufacturer's recommendations. Bolts shall be tightened using an applied torque of between 100 and 300 ft.-lbs.

Installation:
The structure shall be installed in accordance with the plans and specifications, the manufacturer's recommendations, and the AASHTO Standard Specifications for Highway Bridges, Section 26 (Division II).

Culvert bedding:
The culvert bedding material shall be well graded granular material (3" minus river run). Material shall be free of rock formations, protruding stones, and frozen matter that may cause unequal settlement.

Backfill:
The structure shall be backfilled using clean well graded granular material that meets the requirements of AASHTO M 145 for soil classification A-1, A-2 or A-3. Backfill must be placed symmetrically on each side of the structure in 6 to 8 inch lifts. Each lift shall be compacted to a minimum of 90 percent density per AASHTO T 99, unless otherwise noted.

During backfill, only small tracked vehicles (D-4 or smaller) shall be near the structure as fill progresses above the crown and to the finished grade. The Contractor is cautioned that the minimum cover may need to be increased to handle temporary construction vehicle loads (larger than D-4).

ROCK SPECIFICATION

All rock shall be of sound quality, free of cracks, of sufficient durability, and not contain swelling type clay. All rock shall conform to CALTRANS Standard Specifications Section 72-2.02, Materials, for all material qualities, such as but not limited to, durability, absorption, and apparent specific gravity (CALTRANS Standard Specifications, 2006).

Rock band boulders:
Rock band boulders shall be 2 ton class per Section 72-2.02 of CALTRANS Standard Specifications.

Roughened channel mix:

Percent by weight	Caltrans class	approximate median size
25%	Backing #2(5 lbf)	0.4 ft
50%	facing (75 lbf)	1.0 ft
25%	½ ton	2.0 ft

Bedding and Interstitial fill:
Bedding stone and interstitial fill shall be 3" minus river run (unrefined alluvium), or approved equal.

Rock slope protection:
Rock slope protection shall be light class, per section 72-2.02 of CALTRANS Standard Specifications.

ROCK PLACEMENT

1. No compacted soil fill should be allowed below roughened channel.

2. The objective of the rock placement is to create an interlocking matrix with each rock supported at a minimum of three points of contact. No movement shall be detected when walked on by Project Engineer.

3. All interstices to be filled with interstitial fill by water jetting and hand tools.

4. Rock band boulders, roughened channel mix, and rock slope protection shall be placed by Method A placement per section 72-2.03 of CALTRANS Standard Specifications. Bedding stone shall be placed by Method B placement.

5. Finished placement of roughened channel mix rock shall be well graded vertically and horizontally among the stone classes in the material specification, with voids filled with interstitial fill. Placement in 1-foot layers (as possible) with interstitial fill is recommended.

GENERAL CONSTRUCTION NOTES

1. Compact fill in 8" lifts with 90% relative compaction, unless otherwise noted.

2. All rock slope protection on highway embankment shall have Mirafi 1100N non-woven filter fabric installed between soil and rock. Alternate felt filter fabric may be approved by Project Engineer in advance of construction. Woven Geotextiles are not recommended

3. Maximum cut and fill slopes to be 2:1 unless otherwise noted.

4. Begin constructing rock structures at bottom of slope to insure each rock is interlocked.

5. All disturbed soil area to be seeded and mulched with native seed mix.

6. All graded slopes shall be covered with coir erosion control blanket (North American Green C125BN). Install seed prior to erosion control blanket. Blanket to be pinned w/ 12" or 18" soil pins 2' on center with triangular spacing.

7. Contractor shall use temporary dewatering systems to control minor surface flow from ground water seeps through work area. See Sheet WPC-1 and PCI Dewatering and Species Protection Plan (January 2007).

8. Contractor shall install straw wattles slopes where vegetation has been removed or on temporary access roads at the end of the job as needed. Contractor to coordinate with Project Engineer on location of wattles.

9. Roadway embankement design to be prepared by others. Restore roadway to original grade.

ENVIRONMENTALLY SENSITIVE AREAS

1. This construction site is considered an environmentally sensitive area. The Contractor shall take all precautions and utilize all measures necessary to protect the environmental integrity of the site and comply with project permits, including but not limited to the protection of plant, animal, and aquatic life. Construction shall follow recommendations in the PCI Dewatering and Species Protection Plan (January 2007). The following are integral aspects of this construction project:

2. All vehicles and equipment on the site must not leak any type of hazardous materials such as oil, hydraulic fluid, or fuel. Vehicles and equipment must be inspected and approved by Project Engineer before use. Fueling shall take place outside of the riparian corridor.

3. Contractor shall have emergency spill clean up gear (spill containment and absorption materials) and fire equipment available on site at all times. These items are to be reviewed by Project Engineer before construction begins.

4. Access to the site must be reviewed with the Project Engineer. Exact location of access way, number of trips planned, and type of vehicles used shall be submitted prior to construction start up & approved by Project Engineer. Contractor shall be responsible for repairing, at his own cost above and beyond the scope of work, any damage to property caused by access not approved by the Project Engineer.

5. Trash, litter, construction debris, cigarette butts, etc., must be stored in designated area approved by the Project Engineer or removed from the site at the end of each working day. Upon completion of work, Contractor is responsible for removing all debris to the satisfaction of the Project Engineer.

PRELIMINARY
DATE : May 04, 2007

ROADWAY QUANTITIES (NOTE 1)

ITEM	UNITS	QUANTITY	REMARKS
CHANNEL EXCAVATION	CY	500	
ROADWAY EXCAVATION	CY	2000	
ROADWAY FILL	CY	1600	
TEMPORARY FILL FOR HIGHWAY BYPASS	CY	2800	
TEMPORARY PAVING FOR BYPASS	SF	4800	
ASSEMBLE AND INSTALL SSPPA PIPE ARCH	LF	95	
RESTORE PAVED ROAD BED	SF	2100	NOTE 2
ROCK BAND BOULDERS	TONS	120	
ROUGHENED CHANNEL MIX	TONS	1000	
3" MINUS RIVER RUN	TONS	200	
ROCK SLOPE PROTECTION	TONS	50	

NOTES:

1. CONSTRUCTION QUANTITIES SHOWN ARE AN APPROXIMATION. IT IS THE CONTRACTOR'S RESPONSIBLIITY TO DETERMINE PROPER EARTHWORK AND ROCK QUANITIES.

2. ROADWAY DESIGN AND ESTIMATES TO BE COMPLETED BY OTHERS.

North Fork Ryan Creek Construction Notes C-4

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Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
1	MEN	101	52.25/52.36	9	11

PREPARED FOR:

Five Counties Salmonid Conservation Program
Trinity County Planning Department
North Fork Ryan Creek Fish Passage Study

RECOMMENDATIONS PREPARED BY:

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P.O. BOX 828
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PROJECT ENGINEER　　DATE
REGISTERED CIVIL ENGINEER

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER
No.
Exp.
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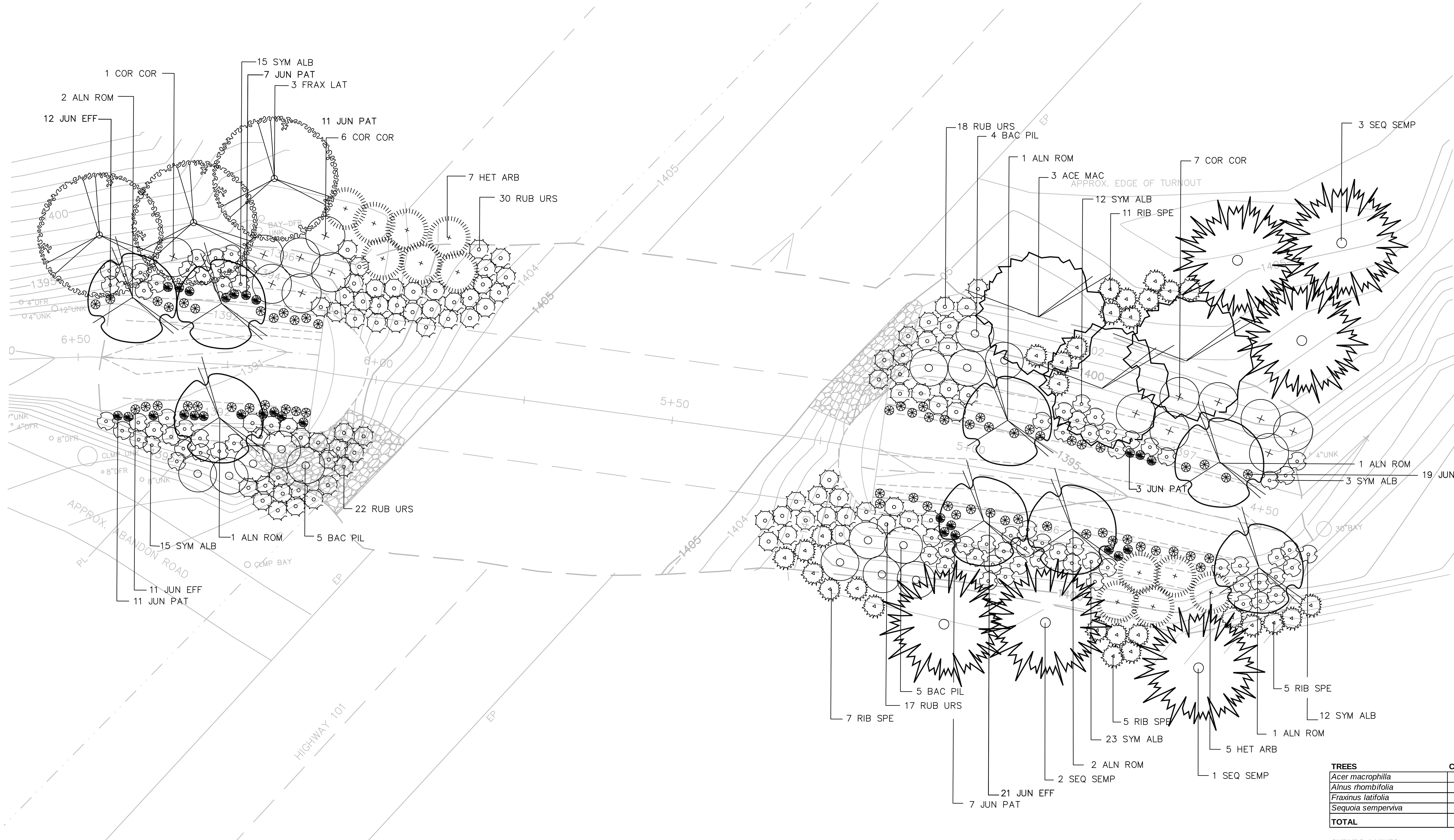

TABLE 1
NORTH FORK RYAN CREEK

TREES	COMMON NAME	Key	Plant size size	Protector	Weed mat	# of plants
Acer macrophilla	Big leaf maple	ACE MAC	TP	V	Yes	3
Alnus rhombifolia	White Alder	ALN ROM	15 gal	V	Yes	8
Fraxinus latifolia	Oregon Ash	FRA LAT	TP	V	Yes	3
Sequoia semperviva	Redwood	SEQ SEM	TP	V	Yes	6
TOTAL						**20**
SHRUBS & VINES						
Baccharis pillularis	Coyote brush	BAC PIL	DP, 1 gal		Mulch	14
Corylus americana	Hazelnut	COR AME	TP	V	Yes	13
Heteromeles arbutifolia	Toyon	HET ARB	TP		Yes	12
Rubus ursinus	California blackberry	RUB URS	DP		Mulch	87
Symphorocarpus albus	Snowberry	SYM ALB	DP	V	Mulch	80
Ribes speciosum	Gooseberry	RIB SPE	DP		Yes	28
TOTAL						**234**
FORBS						
Juncus effusus	Soft rush	JUN EFF	SC		No	54
Juncus pattens	Gray rush	JUN PAT	SC		No	28
TOTAL						**82**

V= VEXAR TREE PROTECTION
TP= TREEPOT CONTAINER DP= DEEPOT CONTAINER
SC= SUPERCELL CONTAINER

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North Fork Ryan Creek Planting Plan PP-1

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Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
1	MEN	101	52.36	8	11

PREPARED FOR:
Five Counties Salmonid Conservation Program
Trinity County Planning Department
North Fork Ryan Creek Fish Passage Study

RECOMMENDATIONS PREPARED BY:
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PROJECT ENGINEER
REGISTERED CIVIL ENGINEER

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STATE OF CALIFORNIA

PLANS APPROVAL DATE

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DEWATERING

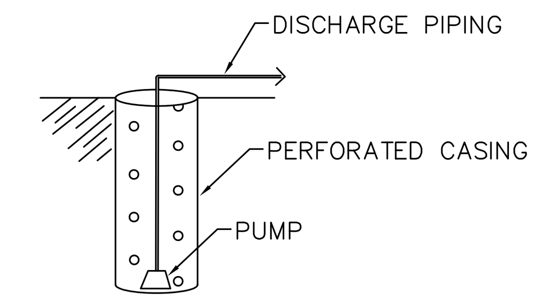
DEWATERING OF THE PROJECT SITE WILL REQUIRE BYPASSING OF SURFACE FLOWS OF THE CREEK AROUND THE CONSTRUCTION AREA AND RETURNING SURFACE FLOWS TO THE NATURAL FLOW PATH (REWATERING) AFTER CONSTRUCTION.

SITE CONDITIONS
THE CREEK'S SUMMERTIME BASE FLOW IS EXPECTED TO BE 1.0 CUBIC FEET PER SECOND (CFS) OR LESS DURING THE CONSTRUCTION PERIOD.

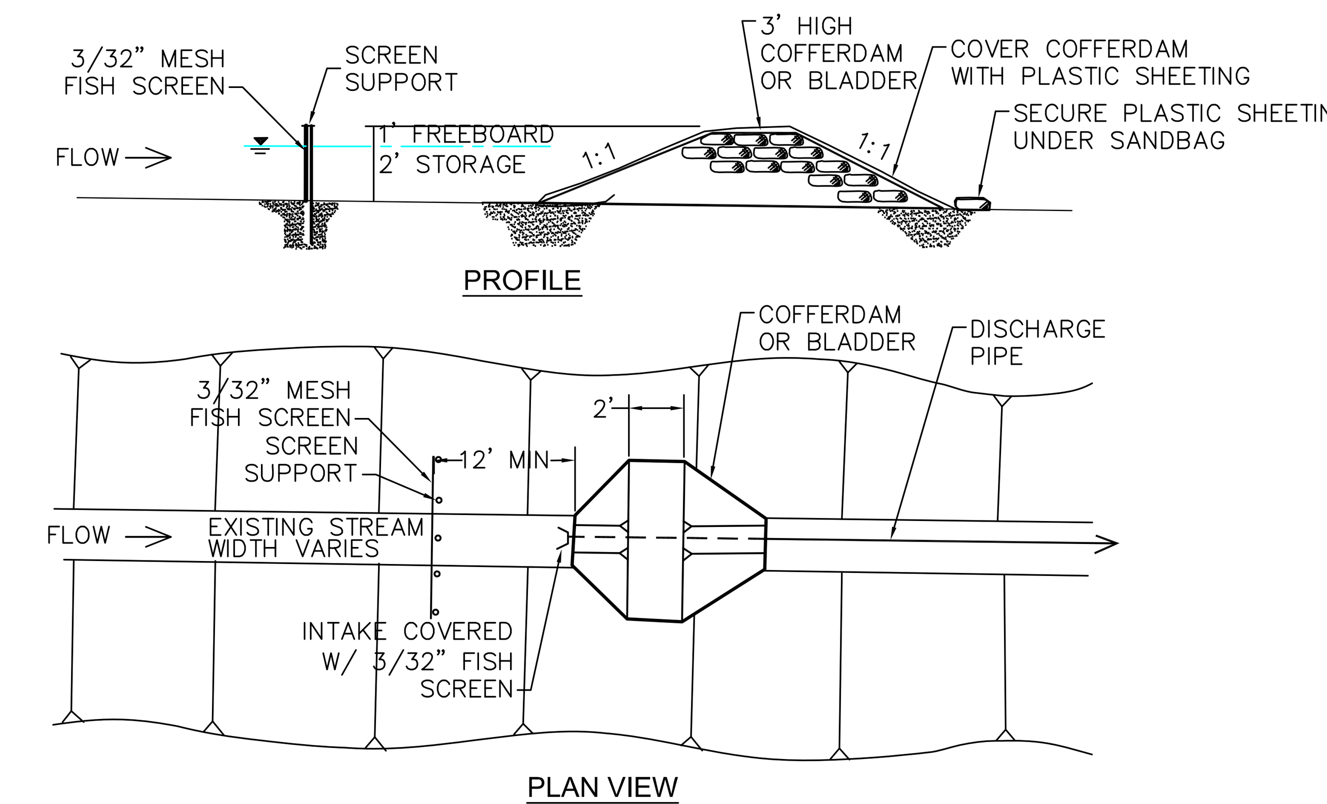
DEWATERING PLAN
THE CONTRACTOR WILL BE REQUIRED TO PREPARE A DEWATERING PLAN FOR THE ENGINEER'S APPROVAL. THE ANTICIPATED DEWATERING PLAN WILL INCLUDE THE FOLLOWING ELEMENTS:
1. INSTALL A COFFERDAM WITH GRAVITY-FED OR PUMPED PIPING SYSTEM,
2. REDUCE THE WATER LEVEL IN THE CONSTRUCTION AREA BELOW EXCAVATION LEVELS, AND
3. REWATERING THE CONSTRUCTED CHANNEL.

THE FOLLOWING INFORMATION IS PROVIDED TO ILLUSTRATE THE DEWATERING CONCEPT PLAN. THE CONTRACTOR IS RESPONSIBLE FOR SUBMITTING THE PROJECT DEWATERING PLAN FOR THE ENGINEER'S AND PROJECT BIOLOGIST'S APPROVAL.

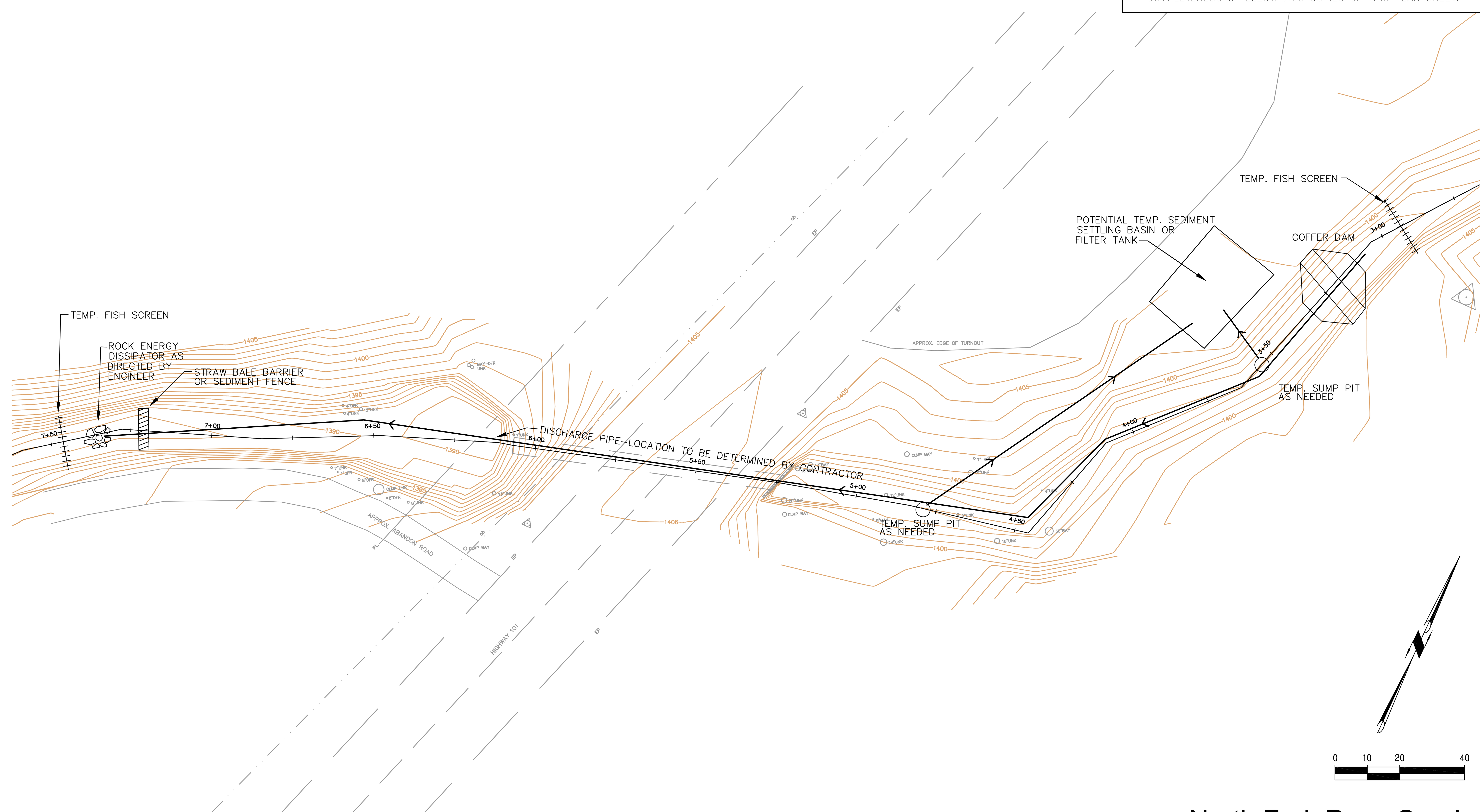
STEP 1: INSTALL FISH SCREENS AT LIMITS OF AREA TO BE DEWATERED.
STEP 2: CONDUCT FISH RESCUE IN SEGMENT OF CREEK TO BE DEWATERED USING CAPTURE SEINES AND TEMPORARY BLOCKING SEINES. FISH WILL BE RELOCATED TO AN APPROVED AREA UPSTREAM OF THE COFFERDAM SITE. NOTE: PROJECT BIOLOGIST WILL BE PRESENT PRIOR TO PLACEMENT OF COFFERDAM TO RELOCATE FISH THAT ARE PRESENT.
STEP 3: INSTALL BYPASS PIPING.
STEP 4: BUILD COFFERDAM USING A WATER BLADDER OR SANDBAGS (PER PLAN AND DETAIL).
STEP 4: FOR PUMPED SYSTEMS, A SUMP MAY BE REQUIRED IF THE COFFERDAM SITE DOES NOT NATURALLY PROVIDE ADEQUATE HEAD FOR OPERATING THE SUMP PUMP. ALLOW TURBIDITY TO SETTLE PRIOR TO PUMPING.
STEP 5: PROJECT BIOLOGIST WILL CONDUCT FISH RESCUE ONCE DEWATERING OPERATIONS HAVE BEGUN.
STEP 6: PROJECT BIOLOGIST WILL DICTATE INITIAL DEWATERING RATE FOR SUCCESSFUL FISH RELOCATION.
STEP 7: DEWATER SURFACE WATER AND GROUNDWATER.
STEP 8: INSTALL ONE OR MORE SUMP PITS IN THE CONSTRUCTION AREA BY EXCAVATING A HOLE AND INSTALLING A PERFORATED CASING AND SUMP PUMP.
STEP 9: LOCATE A FILTER TANK OR SEDIMENT SETTLING BASIN TO SETTLE ANY TURBID WATER FROM SUMP PIT PUMPS. INSTALL SUMP PUMP DISCHARGE PIPING BETWEEN SUMP PITS AND FILTER TANK OR SETTLING BASIN. THE FILTER TANK OR SETTLING BASIN SHALL DISCHARGE CLEAN WATER TO THE DOWNSTREAM CHANNEL.
STEP 10: AFTER END OF ALL CONSTRUCTION REWATER CONSTRUCTED CHANNEL BY GRADUALLY REMOVING COFFERDAM SO THAT FLOW THROUGH THE CONSTRUCTED CHANNEL REACHES DOWNSTREAM AREAS PRIOR TO THE REMOVAL OF THE DISCHARGE PIPE INLET FROM THE CREEK CHANNEL.



SUMP PIT DETAIL
NTS



COFFERDAM DETAIL
NTS



North Fork Ryan Creek
Water Pollution Prevention and Dewatering Plan
WPC-1

PRELIMINARY
DATE : *May 04, 2007*

STATE OF CALIFORNIA — DEPARTMENT OF TRANSPORTATION
Caltrans

SUPERVISING ENGINEER
CALCULATED-DESIGNED BY
CHECKED BY
REVISED BY
DATE REVISED

DATE PLOTTED => May 04, 2007
TIME PLOTTED => 12:15
LAST REVISION
00-00-00

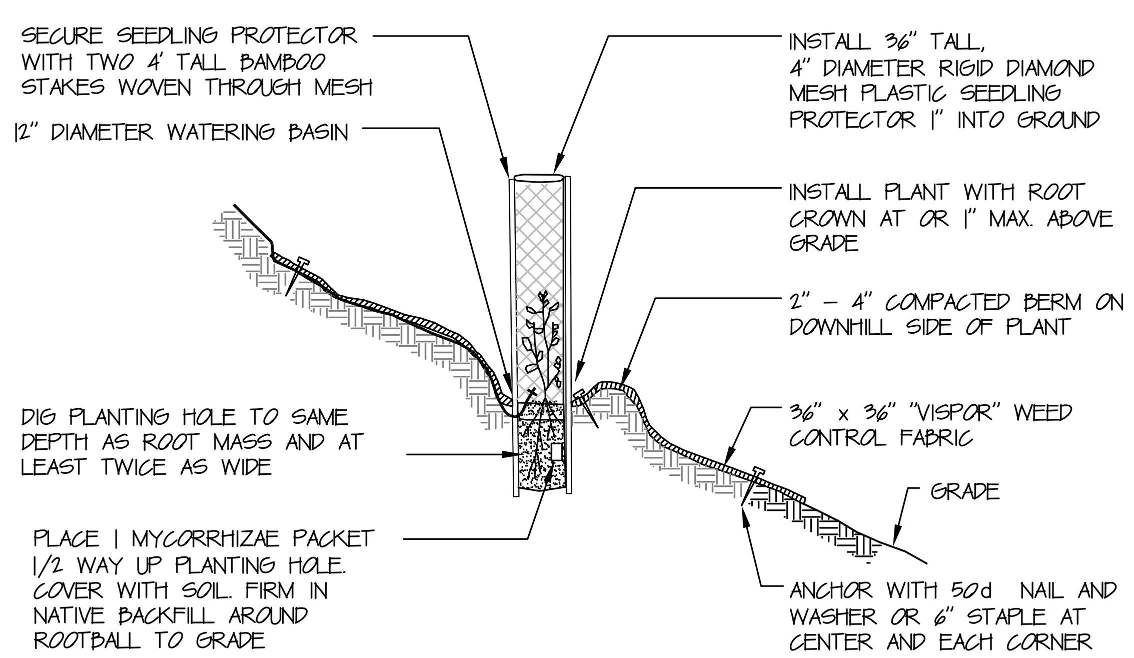
Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
1	MEN	101	52.25	10	11

PREPARED FOR:

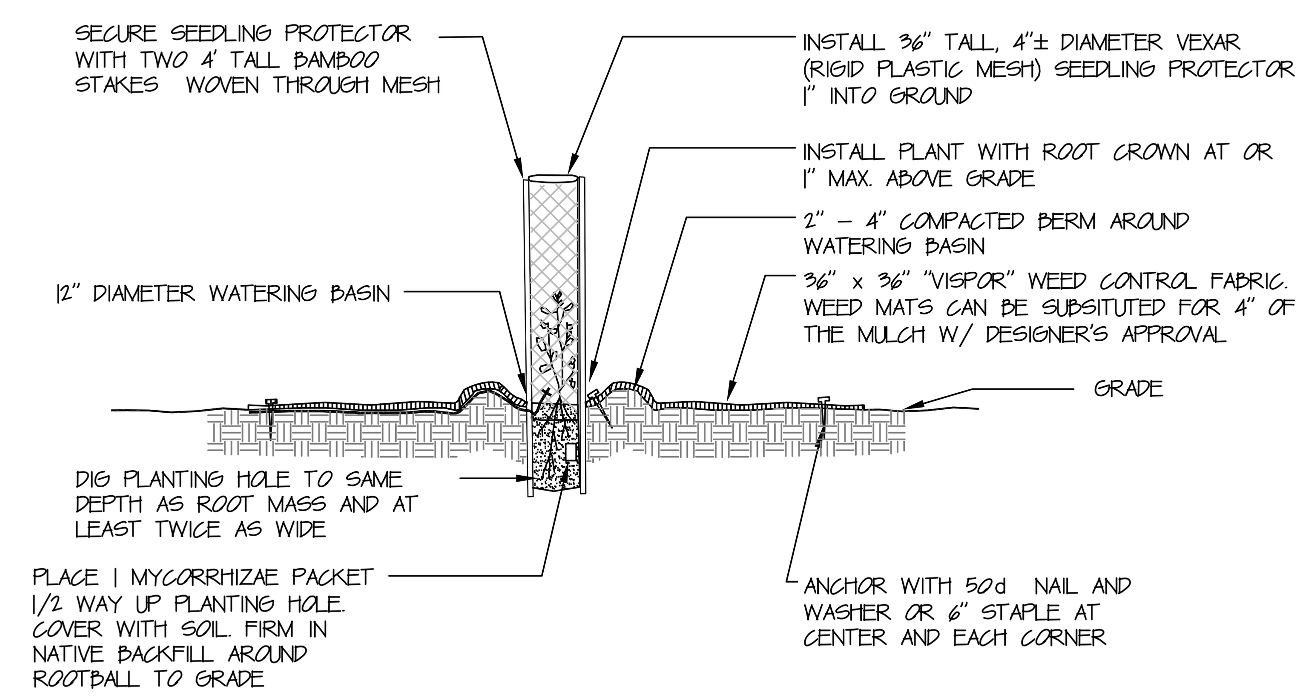
Five Counties Salmonid Conservation Program
Trinity County Planning Department
Ryan Creek Fish Passage Study

RECOMMENDATIONS PREPARED BY:

PRUNUSKE CHATHAM, INC.
P.O. BOX 828
OCCIDENTAL, CA 95465
(707) 874-0100

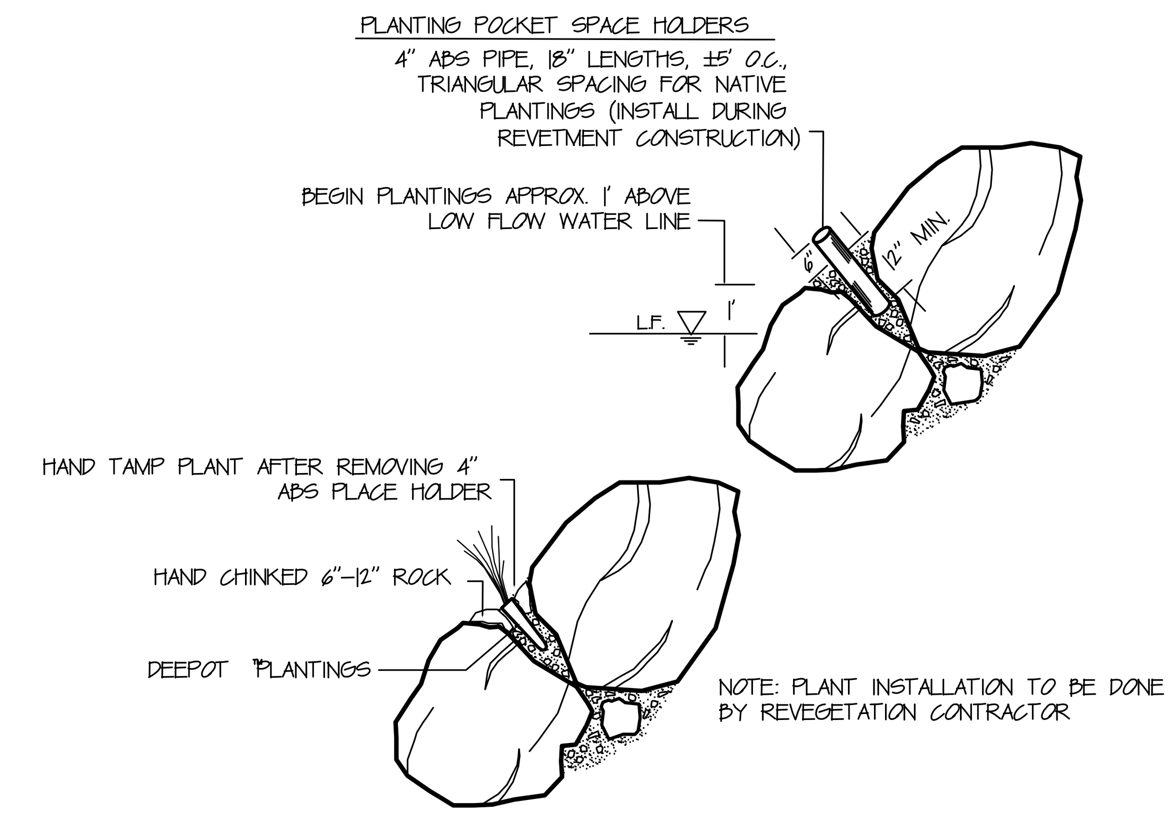


INSTALLATION ON HILL SLOPE

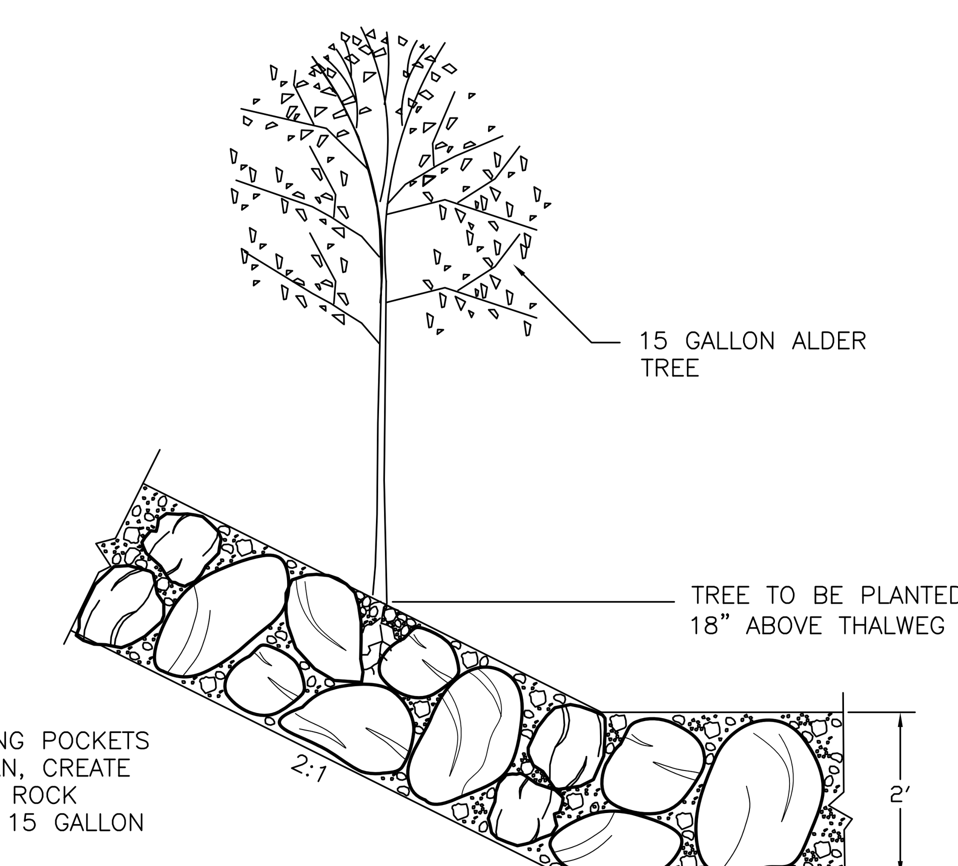


INSTALLATION ON FLAT GROUND

C — CONTAINER - GROWN PLANTS PLANTING DETAIL
NTS



JP — CONTAINER PLANT JOINT PLANTING DETAIL
NTS



NOTES:
1. INSTALL ALDER IN PLANTING POCKETS AT LOCATIONS SHOWN ON PLAN, CREATE PLANTING POCKET AT TIME OF ROCK PLACEMENT TO ACCOMMODATE 15 GALLON POT.
2. PLACE ROOT CROWN OF ALDER APPROX. AT GRADE OF INTRESTICAL FILL.
3. CAP ALDER PLANTING POCKET WITH HAND PLACED COBBLE

ALDER PLANTING POCKET DETAIL (TYP)

PLANT MATERIAL, INSTALLATION, MAINTENANCE AND ESTABLISHMENT CRITERIA

1.0 PLANT MATERIALS
1.1 USING GOOD QUALITY PLANT MATERIALS IS CRITICAL TO A SUCCESSFUL REVEGETATION PROJECT. THE CONTRACTOR SHALL SECURE THE NECESSARY CONTAINER-GROWN PLANTING MATERIALS SHOWN IN PLANT LIST SHEET 9. THE TABLE SPECIFIES THE SPECIES AND SIZE OF PLANTS TO BE INSTALLED. TREEPOTS (T) ARE 14" DEEP CONTAINERS THAT SUPPORT A 173-CU.IN. ROOT MASS. DEEPOTS (D) ARE 10" DEEP CONTAINERS THAT SUPPORT A 40-CU.IN. ROOT MASS. ALL HERBACEOUS SPECIES SHALL BE IN SUPERCELL-SIZED CONTAINERS OR 1 GALLON POTS. ALL PLANTS TO BE USED MUST HAVE BEEN FOUND TO NOT SUPPORT BREEDING POPULATIONS OF THE BLUE-GREEN SHARPSHOOTER.
1.2 ALL PLANT SOURCES TO BE FROM **MENDOCINO COUNTY**.
1.3 THE CONTRACTOR SHALL SUPPLY LOCAL WILLOW POLE CUTTINGS OBTAINED FROM AREAS IDENTIFIED BY THE PROJECT DESIGNER. WILLOW CUTTINGS SHALL BE APPROXIMATELY 1/2" TO 1-1/2" BOTTOM DIAMETER AND 4' TO 6' LONG. EACH CUTTING WILL BE PLANTED WITH BUDS POINTED UP AND TWO-THIRDS OF THE CUTTING IN THE SOIL.

2.0 SCHEDULE
PLANTING OF CONTAINER-GROWN SPECIES WILL OCCUR BETWEEN NOVEMBER 15TH AND MARCH 15. THE IRRIGATION SYSTEM SHALL BE INSTALLED BEFORE OR CONCURRENT WITH PLANTING. WILLOW STAKES SHALL BE CUT WITHIN 48 HOURS OF PLANT INSTALLATION. WILLOW POLES SHALL BE KEPT MOIST AT ALL TIMES BY COVERING IN WET BURLAP OR SUBMERGING IN WATER. ROOTED WILLOW POLES MAY BE SUBSTITUTED FOR LIVE POLES.

3.0 INSTALLATION, FERTILIZATION, WEED MAT & BROWSE PROTECTION
3.1 CONTAINER GROWN TREES AND SHRUBS
PLANTING HOLES ARE TO BE NO DEEPER THAN THE ROOT BALL AND AT LEAST TWICE AS WIDE. KEEP ROOTS STRAIGHT AND AVOID "J" ROOTING. BACKFILL WITH NATIVE MATERIAL HALF WAY UP THE ROOT BALL AND INSTALL THE SLOW RELEASE MYCORRHIZAE PACKET. CONTINUE THE BACKFILL TO GRADE AND FIRM IN SOIL. ROOT CROWN SHOULD BE AT OR 1/2" ABOVE GRADE BUT NOT BELOW GRADE. INSTALL INDIVIDUAL TREE PROTECTORS ON TREE SPECIES ONLY. INSTALL 3' X 3' WEED MAT (VISPORE OR EQUIVALENT) AROUND TREE SPECIES AS SHOWN ON PLANTING SPECIFICATIONS.
3.2 WILLOW CUTTINGS
INSTALL CUTTINGS (LIVE STAKES OR SPRIGS) AS PER PLANTING DETAILS AND NOTES HEREIN. NO FERTILIZER IS PRESCRIBED FOR WILLOWS. HOWEVER, TREE PROTECTORS WILL BE REQUIRED IN WILLOW PLANTING AREAS.

4.0 IRRIGATION
4.1 A 3-YEAR, TEMPORARY DRIP IRRIGATION SYSTEM OR A DRI-WATER SYSTEM, OR EQUIVALENT WILL BE INSTALLED FOR ALL TREE AND SHRUB SEEDLINGS. ONE TO TWO GALLONS PER PLANT PER WATERING WILL LIKELY BE NECESSARY FOR PLANT SUCCESS.
4.2 CONTRACTOR SHALL SUBMIT A DRIP IRRIGATION PLAN THAT MEETS THE WATERING REQUIREMENTS DETAILED IN THESE NOTES TO THE PROJECT DESIGNER AND LANDOWNER FOR APPROVAL PRIOR TO INSTALLATION.
4.3 IRRIGATION WILL BEGIN IMMEDIATELY FOLLOWING INSTALLATION AND BE TURNED OFF DURING THE RAINY SEASON.
4.4 TYPICALLY PLANTS ARE WATERED ONCE OR TWICE PER WEEK DURING THE 3-YEAR ESTABLISHMENT PERIOD. WATER AMOUNT SHOULD BE ADJUSTED ACCORDING TO PLANT AND SOIL REQUIREMENTS. THE TOP 1/2" OF SOIL SHOULD BE DRY AFTER TWO DAYS TO AVOID FUNGUS GROWTH.
4.5 WATERING PERIOD WILL BE APRIL 1 THROUGH OCTOBER 31.
4.6 ADDITIONAL WATERING WILL BE REQUIRED IF LESS THAN 0.5" OF PRECIPITATION FALLS DURING ANY 6-WEEK PERIOD FROM DECEMBER THROUGH FEBRUARY.
4.7 INDIVIDUALLY PLANTED WILLOW POLES AND STAKES WILL RECEIVE AT LEAST 2 GALLONS EACH WATERING DAY.
4.8 WILLOW WALL AND WILLOW STAKES WILL RECEIVE MINIMUM WATER SOAKING OF 1" PER WEEK.
4.9 WHERE DRIP IRRIGATION IS USED, WATER WILL BE APPLIED WITH A ONE OR TWO -GALLON PER HOUR (GPH) EMITTER AT EACH PLANT, EXCEPT FOR 5-GALLON AND LARGER PLANTS THAT WILL HAVE TWO EVENLY SPACED EMITTERS FOR EACH TREE AND ONE FOR EACH SHRUB. EMITTERS WILL BE LOCATED HALFWAY BETWEEN THE TRUNK AND THE EDGE OF THE PLANTING HOLE TO PREVENT FUNGAL INFECTION AT THE BASE OF THE TRUNK. OVER-WATERING OAKS IN THE LATE SUMMER CAN CAUSE ROOT ROT AS WELL AS ATTRACT GOPHERS AND OTHER ANIMALS.
4.10 WHERE DRI WATER IS USED ALL TREES AND SHRUBS WILL RECIEVE TWO DRI WATER TUBES EACH. ONE DRI WATER TUBE IS REQUIRED FOR SMALL SHRUBS AND VINES INCLUDING BLACKBERRY, SNOWBERRY & GOOSEBERRY. DRI WATER TUBES TO BE MONITORED AND FILLED DURING THE WATERING PERIOD.

5.0 MAINTENANCE OF REVEGETATION AREAS
THE TYPICAL ESTABLISHMENT PERIOD FOR NATIVE PLANTINGS IS THREE YEARS UNLESS HIGH MORTALITY REQUIRES A LONGER PERIOD. DURING THE ESTABLISHMENT PERIOD, PLANTS SHALL BE WATERED, WEEDED, MONITORED, AND REPLACED AS NEEDED. BROWSE PROTECTORS SHALL BE MAINTAINED, AND IF GOPHERS, GROUND SQUIRRELS, DEER, OR OTHER ANIMALS BECOME A PROBLEM, THESE ANIMALS MUST BE CONTROLLED.

5.1 WATERING
ALL TREE AND SHRUB SEEDLINGS WILL BE WATERED-IN IMMEDIATELY FOLLOWING PLANTING UNLESS RAIN IS FORECAST WITHIN 24 HOURS. WATERING AND WEEDING OF TREE PLANTING SITES WILL BEGIN, AS NEEDED, IN THE SPRING FOLLOWING PLANTING AND CONTINUE UNTIL THE ONSET OF THE FOLLOWING RAINY SEASON.

THE MAINTENANCE CREW WILL MONITOR THE WATER NEEDS OF INSTALLED PLANTS. THIS MAY INCLUDE WEEKLY OR BIWEEKLY VISITS DURING DRY, HOT WEATHER IN THE FIRST YEAR, AND THEREAFTER QUARTERLY OR AS NEEDED. PHASING OUT IRRIGATION BY THE END OF THE THIRD YEAR OF MAINTENANCE WILL ENHANCE LONG-TERM SURVIVAL OF PLANTED NATIVE TREES AND SHRUBS BY ENCOURAGING THEM TO DEVELOP DEEPER AND DENSER ROOT SYSTEMS.

5.2 WEEDING
DURING THE 3-YEAR ESTABLISHMENT PERIOD, THE MAINTENANCE CREW SHALL KEEP THE AREA WITHIN THE 3' X 3' PLANTING SPOT WEED FREE. WEEDING WILL BE REQUIRED APPROXIMATELY THREE TIMES EACH YEAR IN APRIL, MAY, AND JUNE. INVASIVE WEED SPECIES SHALL BE PULLED BY HAND, BAGGED, AND DISPOSED OF AT AN ACCEPTABLE OFF-SITE LOCATION (SUCH AS THE COUNTY DUMP).

PRELIMINARY
DATE : May 04, 2007

North Fork Ryan Creek
Recommended Planting Details
PP-2

STATE OF CALIFORNIA – DEPARTMENT OF TRANSPORTATION

SUPERVISING ENGINEER | CALCULATED-DESIGNED BY | CHECKED BY | REVISED BY | DATE REVISED

DATE PLOTTED => May 04, 2007
TIME PLOTTED => 13:15

LAST REVISION 00-00-00

BORDER LAST REVISED 1/22/2007 by PCI

RELATIVE BORDER SCALE IS IN INCHES 0 1 2 3

USERNAME =>$USER

[PCI file:\\Serge\PCI Central Project Files\ACAD Drawings\TCPD Ryan Creek Fish Passage\dwg\NF-PRECONST-DESIGN-PP-DT2.dwg]

CU 00000

EA 000000

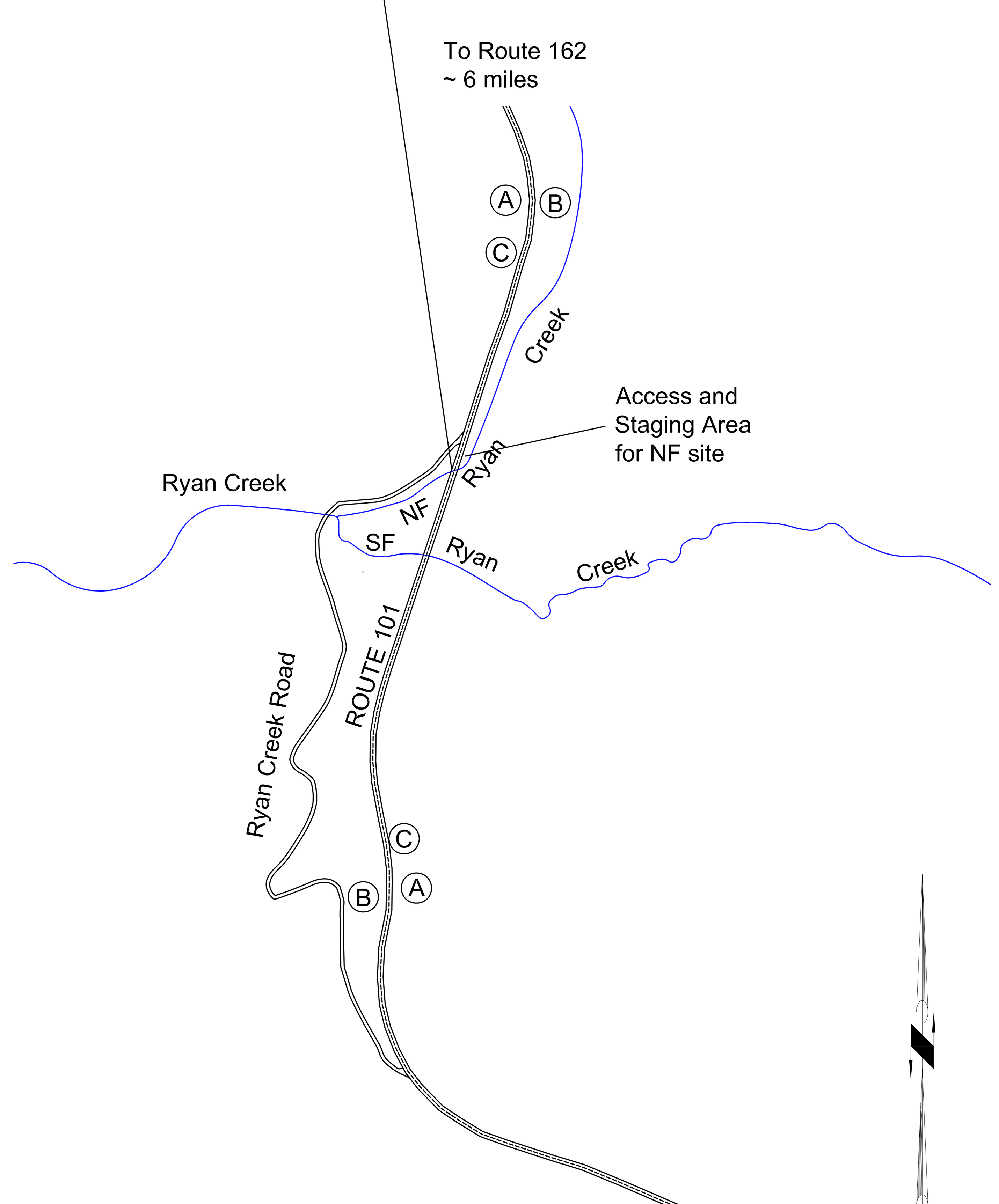
STATIONARY MOUNTED CONSTRUCTION AREA SIGNS

SIGN	SIGN CODE	SIGN MESSAGE	PANEL SIZE	NUMBER OF POSTS AND SIZE	NUMBER OF SIGNS
A	W20-1	ROAD WORK AHEAD	TBD	TBD	TBD
B	G20-2	END ROAD WORK	TBD	TBD	TBD
C	SP-1	HIGHWAY CONSTRUCTION (SP-1)	TBD	TBD	TBD

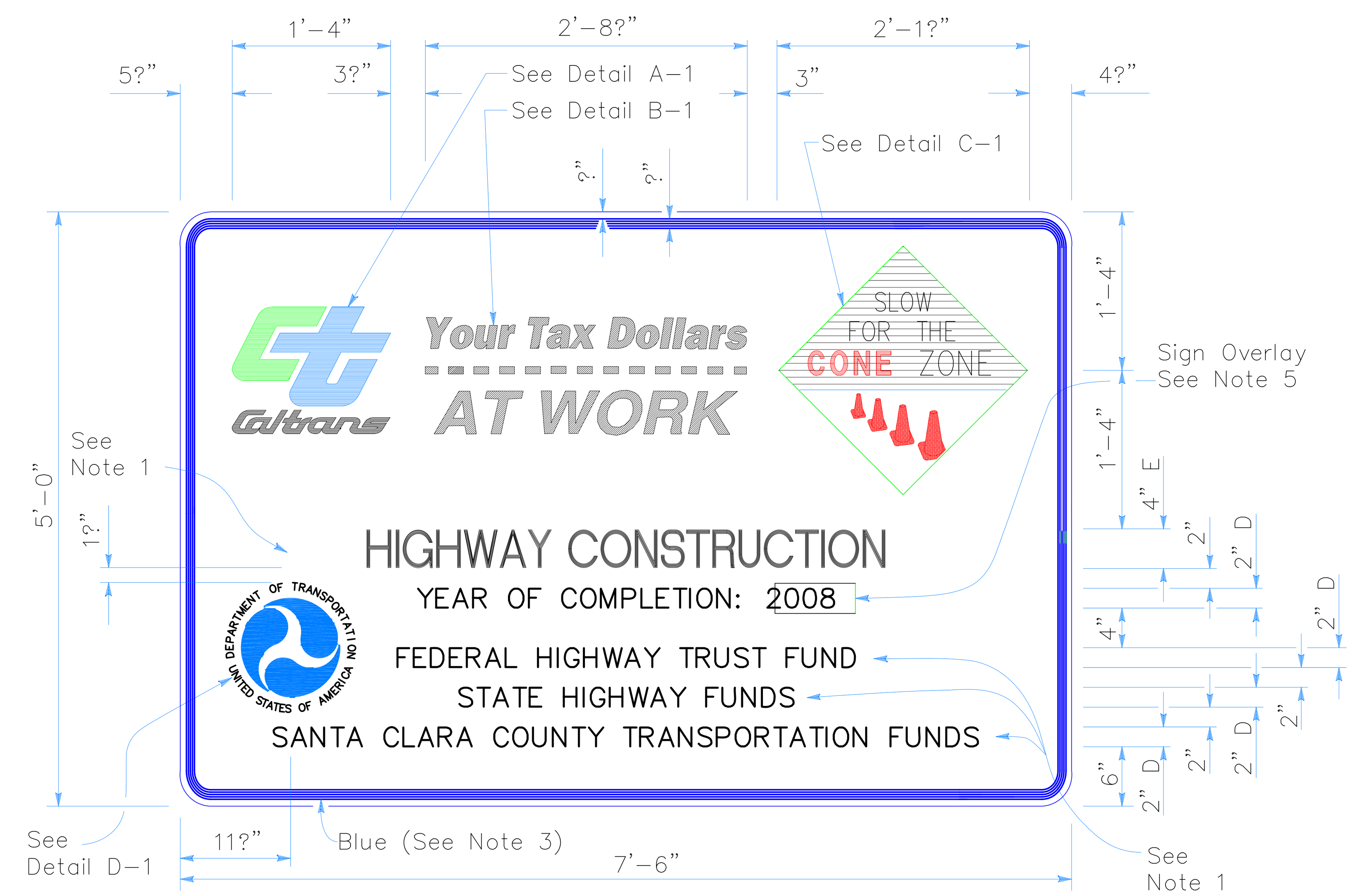
TO BE SUPPLEMENTED BY STANDARD PLANS DATED MAY 2006
EXACT LOCATION TO BE DETERMINED (TBD) BY THE ENGINEER

LOCATION OF CONSTRUCTION

MEN 101 PM 52.36



APPROXIMATE SCALE 1" = 200'



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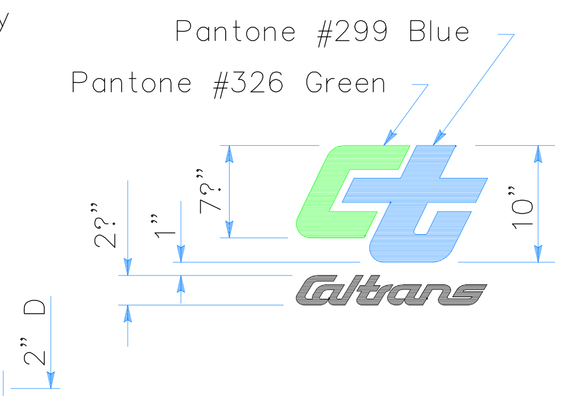
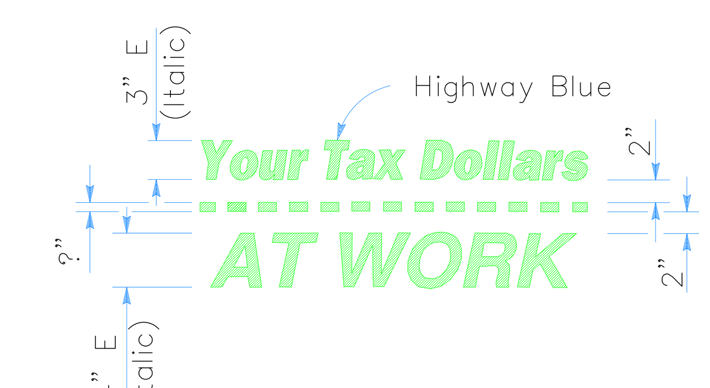
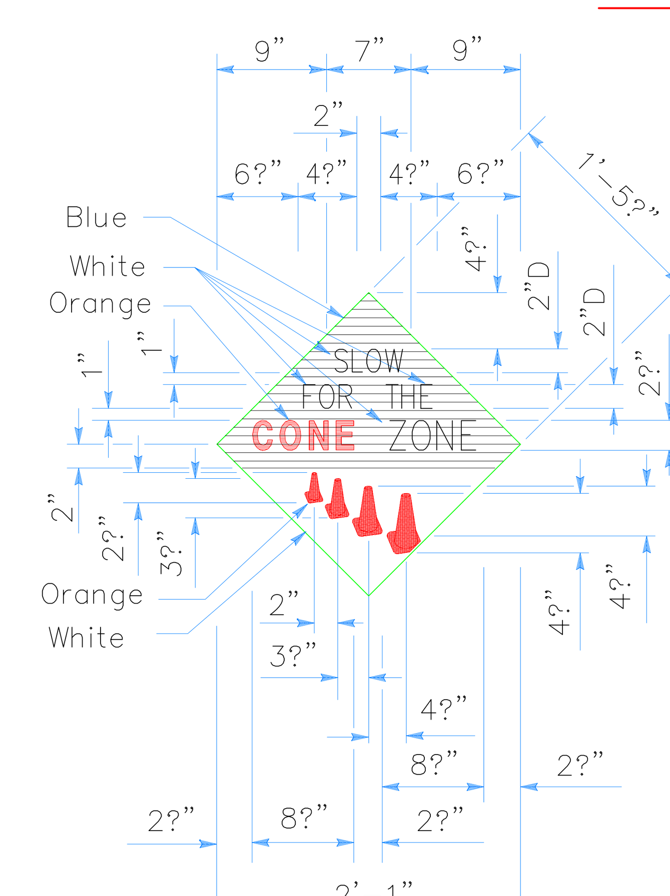


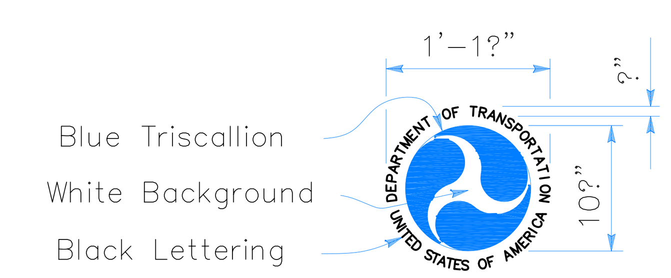
DETAIL A-1



DETAIL B-1
(See Note 3)



DETAIL C-1
(See Note 4)



DETAIL D-1
(See Note 6)

NOTES:

1. The sign messages shown for type of project and fund types are examples only. See the Special Provisions for the applicable type of project and fund type messages to be used.
2. Except as otherwise shown, the legend of sign shall be black on a white background (non-reflective).
3. The border of the signs and details "B-1" shall be blue (non-reflective).
4. The diamond in details "C-1"shall be blue for the background of message, " SLOW FOR THE CONE ZONE", and white background for the orange cones. The color and type of font for the "SLOW FOR THE CONE ZONE" message shall be: "SLOW" white D; "FOR THE" white D; "CONE" orange Arial font; "ZONE" white Arial font.
5. Year of completion of project construction shown on the overlay is an example only. See the Special Provisions.
6. Use when the Project involves Federal Highway Trust Fund.

Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
1	MEN	101	52.36	11	11

PREPARED FOR:
Five Counties Salmonid Conservation Program
Trinity County Planning Department
North Fork Ryan Creek Fish Passage Study

RECOMMENDATIONS PREPARED BY:

PRUNUSKE CHATHAM, INC.
P.O. BOX 828
OCCIDENTAL, CA 95465
(707) 874-0100

PROJECT ENGINEER DATE
REGISTERED CIVIL ENGINEER

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER No. Exp. CIVIL STATE OF CALIFORNIA

THE STATE OF CALIFORNIA OR ITS OFFICERS OR AGENTS SHALL NOT BE RESPONSIBLE FOR THE ACCURACY OR COMPLETENESS OF ELECTRONIC COPIES OF THIS PLAN SHEET.

REVISED BY | DATE REVISED | CALCULATED-DESIGNED BY | CHECKED BY | SUPERVISING ENGINEER

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION

PRELIMINARY
DATE : *May 04, 2007*

THE CONTRACTOR SHALL POSSESS THE CLASS (OR CLASSES) OF LICENSE AS SPECIFIED IN THE "NOTICE TO CONTRACTORS."

North Fork Ryan Creek Construction Area Signs
CS-1

LAST REVISION 00-00-00 | DATE PLOTTED => May 04, 2007 | TIME PLOTTED => 12:26

RELATIVE BORDER SCALE IS IN INCHES 0 1 2 3

USERNAME =>$USER
[PCI file:G:\ACAD Drawings\TCPD Ryan Creek Fish Passage\Files Sent\For CD To TCPD 4-30-07\North Fork Ryan Creek\NF-PRECONST-Signs-CS-1.dwg]

CU 00000 | EA 000000

Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
01	MEN	101	52.25	1	7

PREPARED FOR:

Five Counties Salmonid Conservation Program
Trinity County Planning Department
South Fork Ryan Creek Fish Passage Study

RECOMMENDATIONS PREPARED BY:

PRUNUSKE CHATHAM, INC.
P.O. BOX 828
OCCIDENTAL, CA 95465
(707) 874-0100

PROJECT ENGINEER DATE
REGISTERED CIVIL ENGINEER

REGISTERED PROFESSIONAL ENGINEER
No.
Exp.
CIVIL
STATE OF CALIFORNIA

PLANS APPROVAL DATE

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STATE OF CALIFORNIA

DEPARTMENT OF TRANSPORTATION

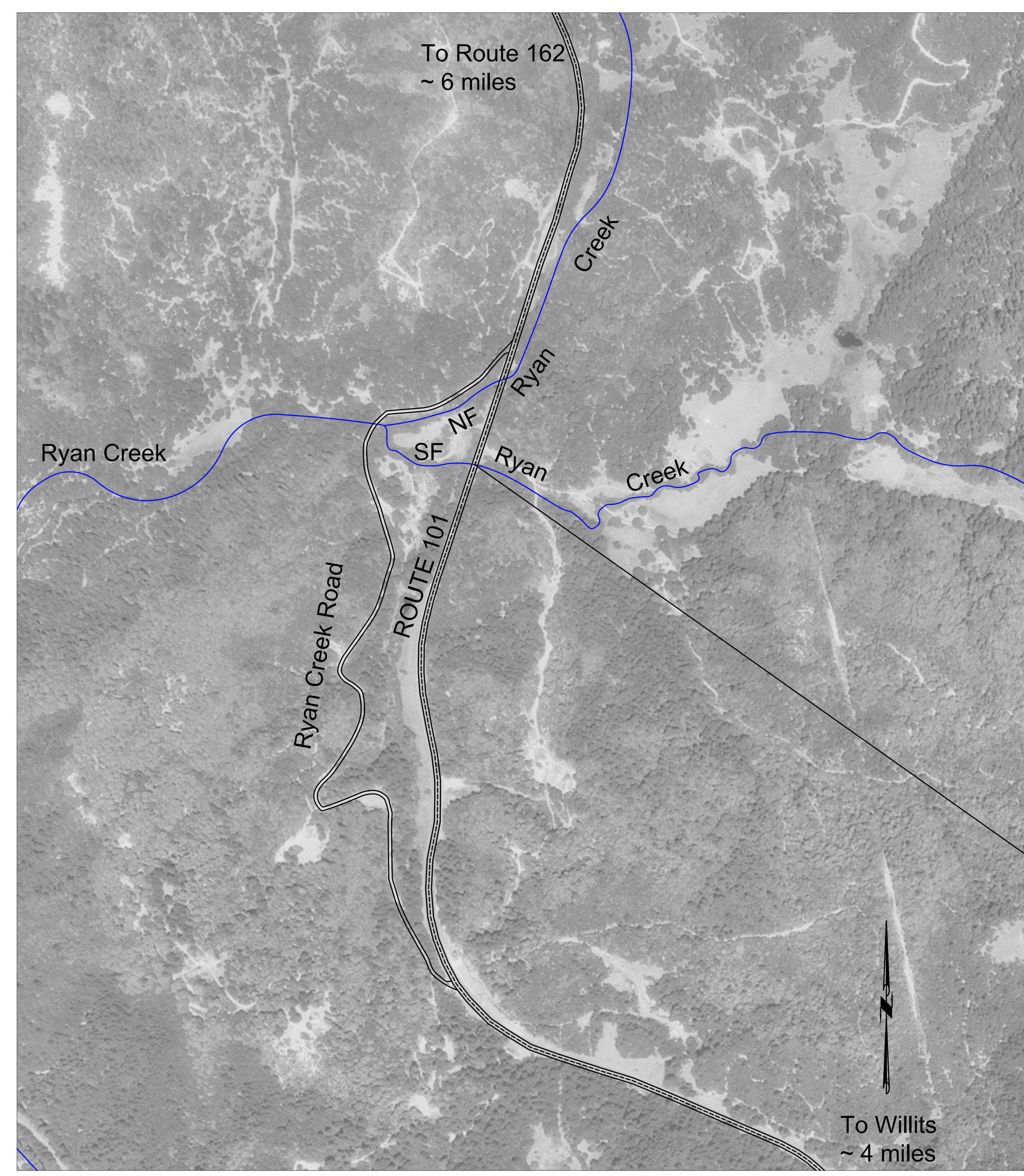
PROJECT PLANS FOR CONSTRUCTION ON

STATE HIGHWAY 101

IN MENDOCINO COUNTY
NEAR WILLITS AT
SOUTH FORK OF RYAN CREEK
AT PM 52.25

TO BE SUPPLEMENTED BY STANDARD PLANS DATED MAY 2006

INDEX OF PLANS



APPROXIMATE SCALE 1" = 200'

PROJECT LOCATION

LOCATION OF CONSTRUCTION

MEN 101 PM 52.25

LOCATION MAP

PRELIMINARY
DATE : *May 04, 2007*

THE CONTRACTOR SHALL POSSESS THE CLASS (OR CLASSES) OF LICENSE AS SPECIFIED IN THE "NOTICE TO CONTRACTORS."

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION

SUPERVISING ENGINEER

CALCULATED-DESIGNED BY

CHECKED BY

CONTRACT No.

RELATIVE BORDER SCALE IS IN INCHES 0 1 2 3

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CU 00000

EA 000000

DATE PLOTTED => May 04, 2007
TIME PLOTTED => 13:26

LAST REVISION 00-00-00

Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
1	MEN	101	52.25	2	7

PREPARED FOR:

Five Counties Salmonid Conservation Program
Trinity County Planning Department
South Fork Ryan Creek Fish Passage Study

RECOMMENDATIONS PREPARED BY:

PRUNUSKE CHATHAM, INC.
P.O. BOX 828
OCCIDENTAL, CA 95465
(707) 874-0100

PROJECT ENGINEER
REGISTERED CIVIL ENGINEER

DATE

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER
No.
Exp.
CIVIL
STATE OF CALIFORNIA

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STAGING AND ACCESS PLAN NOTES

TRAFFIC CONTROL:
1. CONTRACTOR IS RESPONSIBLE FOR PROVIDING ALL TRAFFIC CONTROL MEASURES, INCLUDING FLAGGERS AND CONSTRUCTION SIGNAGE AS REQUIRED BY CALTRANS STANDARD SPECIFICATIONS TO ENSURE TRAFFIC SAFETY ON HWY 101.

ACCESS:
1. ACCESS TO THE UPSTREAM AND DOWNSTREAM CONSTRUCTION AREAS ARE VIA PRIVATE DRIVEWAYS.
2. CONTRACTOR SHALL PROTECT THE PRIVATE DRIVEWAYS FROM DAMAGE. CONTRACTOR SHALL RESTORE DRIVEWAYS TO ORIGINAL CONDITION AND MAKE ALL REPAIRS TO CORRECT DAMAGE AT THEIR OWN EXPENSE.
3. CONTRACTOR SHALL IMPROVE ACCESS RAMPS BETWEEN PRIVATE DRIVEWAYS AND CONSTRUCTION AREAS AND RESTORE TO ORIGINAL CONDITION AT END OF CONSTRUCTION.

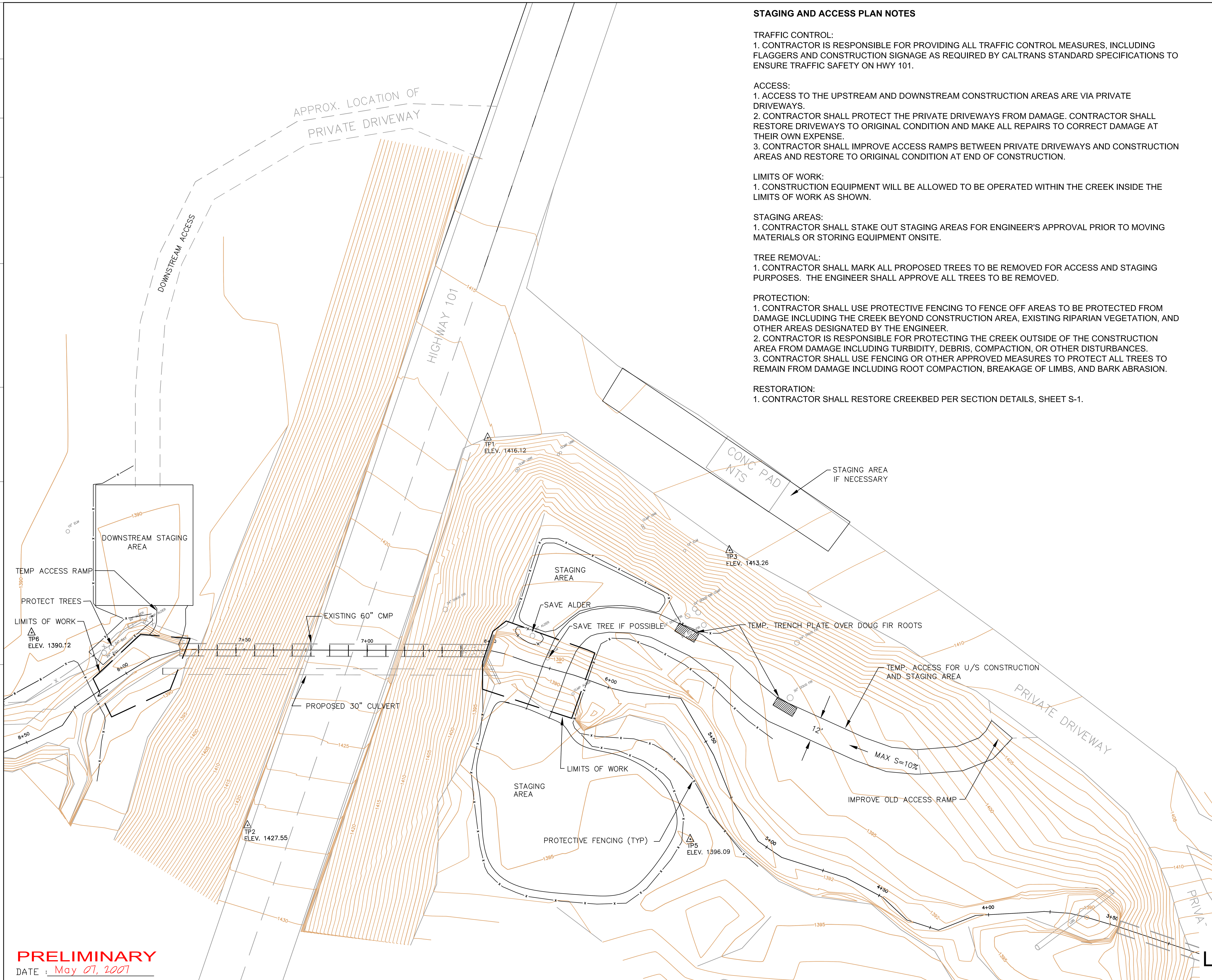
LIMITS OF WORK:
1. CONSTRUCTION EQUIPMENT WILL BE ALLOWED TO BE OPERATED WITHIN THE CREEK INSIDE THE LIMITS OF WORK AS SHOWN.

STAGING AREAS:
1. CONTRACTOR SHALL STAKE OUT STAGING AREAS FOR ENGINEER'S APPROVAL PRIOR TO MOVING MATERIALS OR STORING EQUIPMENT ONSITE.

TREE REMOVAL:
1. CONTRACTOR SHALL MARK ALL PROPOSED TREES TO BE REMOVED FOR ACCESS AND STAGING PURPOSES. THE ENGINEER SHALL APPROVE ALL TREES TO BE REMOVED.

PROTECTION:
1. CONTRACTOR SHALL USE PROTECTIVE FENCING TO FENCE OFF AREAS TO BE PROTECTED FROM DAMAGE INCLUDING THE CREEK BEYOND CONSTRUCTION AREA, EXISTING RIPARIAN VEGETATION, AND OTHER AREAS DESIGNATED BY THE ENGINEER.
2. CONTRACTOR IS RESPONSIBLE FOR PROTECTING THE CREEK OUTSIDE OF THE CONSTRUCTION AREA FROM DAMAGE INCLUDING TURBIDITY, DEBRIS, COMPACTION, OR OTHER DISTURBANCES.
3. CONTRACTOR SHALL USE FENCING OR OTHER APPROVED MEASURES TO PROTECT ALL TREES TO REMAIN FROM DAMAGE INCLUDING ROOT COMPACTION, BREAKAGE OF LIMBS, AND BARK ABRASION.

RESTORATION:
1. CONTRACTOR SHALL RESTORE CREEKBED PER SECTION DETAILS, SHEET S-1.



South Fork Ryan Creek
Layout, Staging and Access Plan
L-1

PRELIMINARY
DATE : May 07, 2007

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION

Caltrans

REVISED BY
DATE REVISED
CALCULATED-DESIGNED BY
CHECKED BY
SUPERVISING ENGINEER

DATE PLOTTED => May 07, 2007
TIME PLOTTED => 15:06
LAST REVISION
00-00-00

Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
1	MEN	101	52.25	3	7

PREPARED FOR:

Five Counties Salmonid Conservation Program
Trinity County Planning Department
South Fork Ryan Creek Fish Passage Study

RECOMMENDATIONS PREPARED BY:

PRUNUSKE CHATHAM, INC.
P.O. BOX 828
OCCIDENTAL, CA 95465
(707) 874-0100

PROJECT ENGINEER
REGISTERED CIVIL ENGINEER
DATE

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER
No.
Exp.
CIVIL
STATE OF CALIFORNIA

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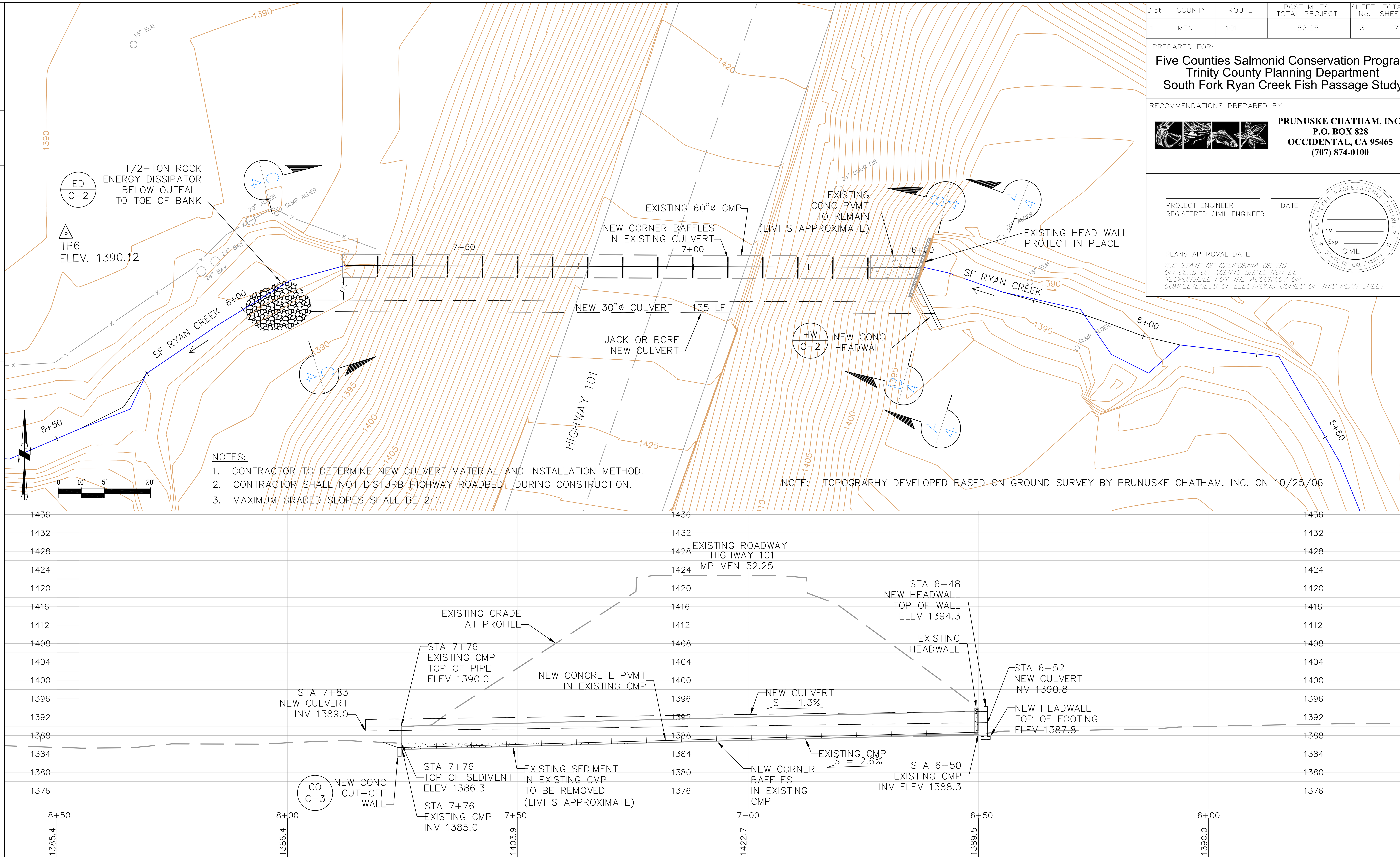

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION

Caltrans

REVISED BY | DATE REVISED | CALCULATED-DESIGNED BY | CHECKED BY | SUPERVISING ENGINEER

PRELIMINARY
DATE : May 04, 2007

South Fork Ryan Creek Plan and Profile
P-1

DATE PLOTTED => May 04, 2007
TIME PLOTTED => 13:33

LAST REVISION 00-00-00

CU 00000 EA 000000

Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
1	MEN	101	52.25	4	7

PREPARED FOR:

Five Counties Salmonid Conservation Program
Trinity County Planning Department
South Fork Ryan Creek Fish Passage Study

RECOMMENDATIONS PREPARED BY:

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PROJECT ENGINEER DATE
REGISTERED CIVIL ENGINEER

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER No. Exp. CIVIL STATE OF CALIFORNIA

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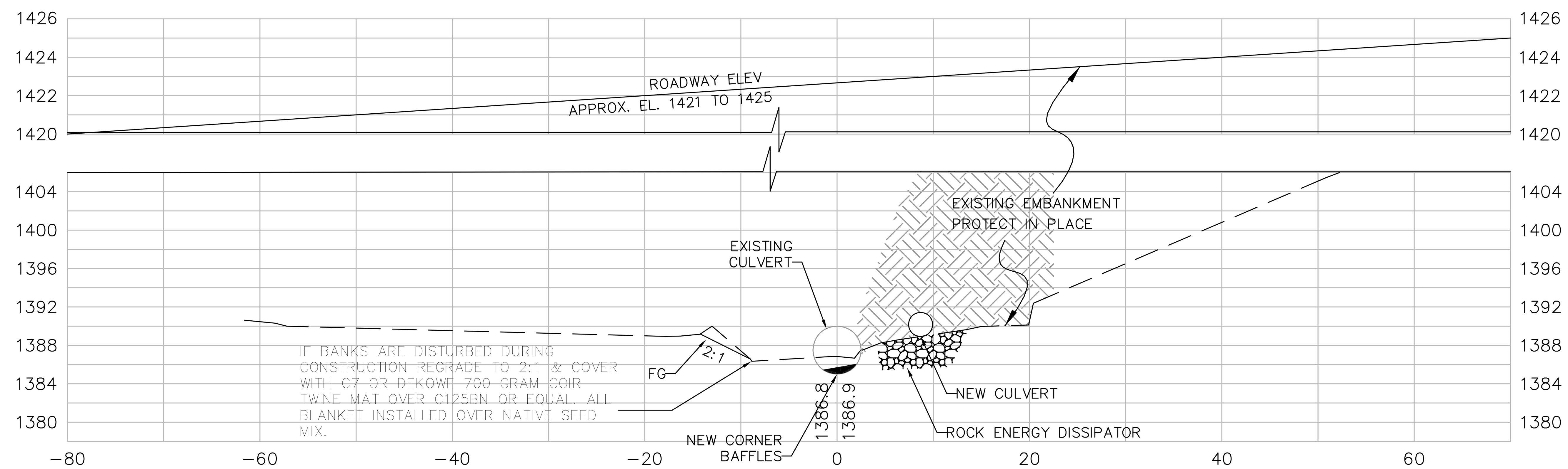
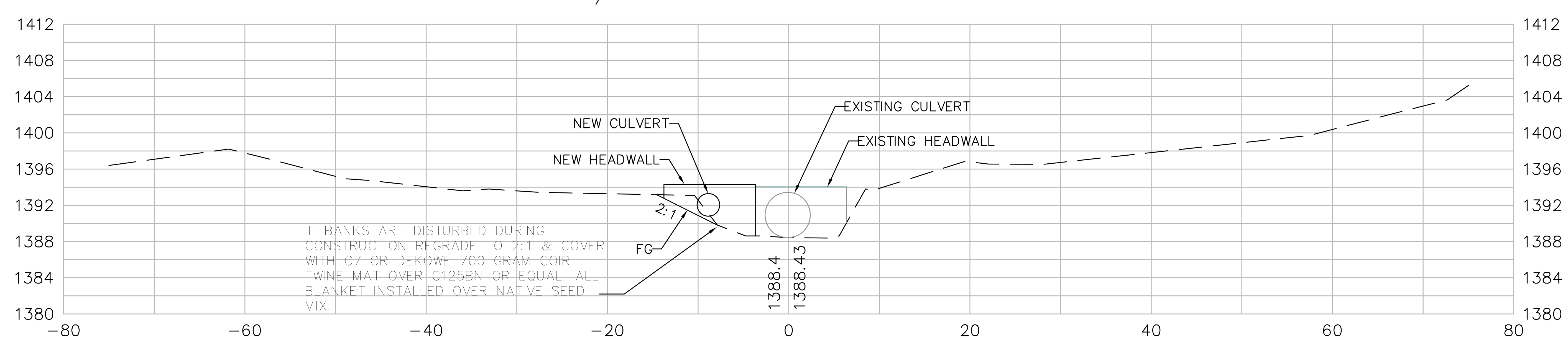
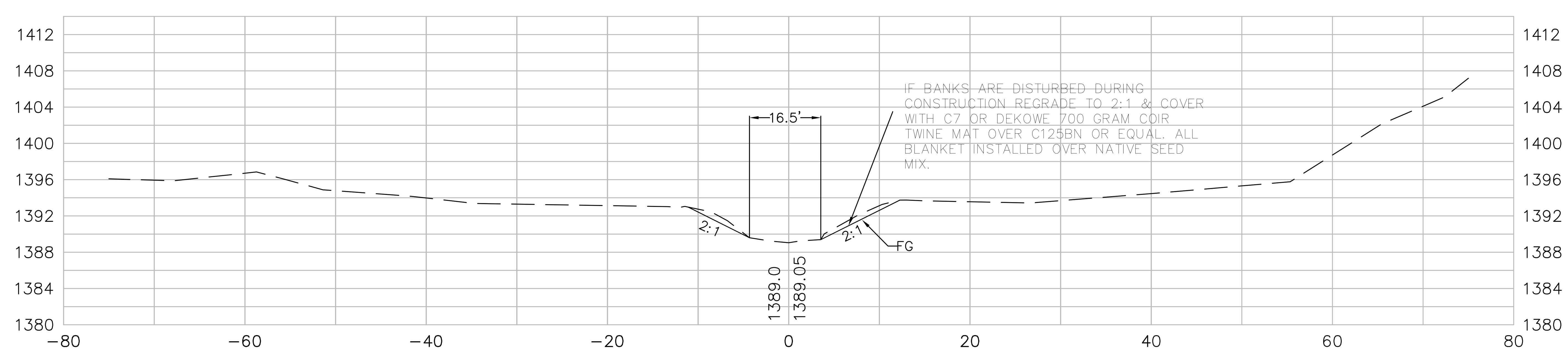
SECTION/ELEVATION C – STA 7+86



SECTION/ELEVATION B – STA 6+48.60



SECTION A – STA 6+35



0 10' 5' 20'

STATE OF CALIFORNIA – DEPARTMENT OF TRANSPORTATION

Caltrans

SUPERVISING ENGINEER

CALCULATED-DESIGNED BY CHECKED BY

REVISED BY DATE REVISED

PRELIMINARY
DATE : May 04, 2007

South Fork Ryan Creek Sections and Elevations C-1

DATE PLOTTED => May 04, 2007
TIME PLOTTED => 13:41

LAST REVISION 00-00-00

Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
1	MEN	101	52.25	5	7

PREPARED FOR:

Five Counties Salmonid Conservation Program
Trinity County Planning Department
South Fork Ryan Creek Fish Passage Study

PREPARED BY:

PRUNUSKE CHATHAM, INC.
P.O. BOX 828
OCCIDENTAL, CA 95465
(707) 874-0100

PROJECT ENGINEER
REGISTERED CIVIL ENGINEER
DATE
PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER
No.
Exp.
CIVIL
STATE OF CALIFORNIA

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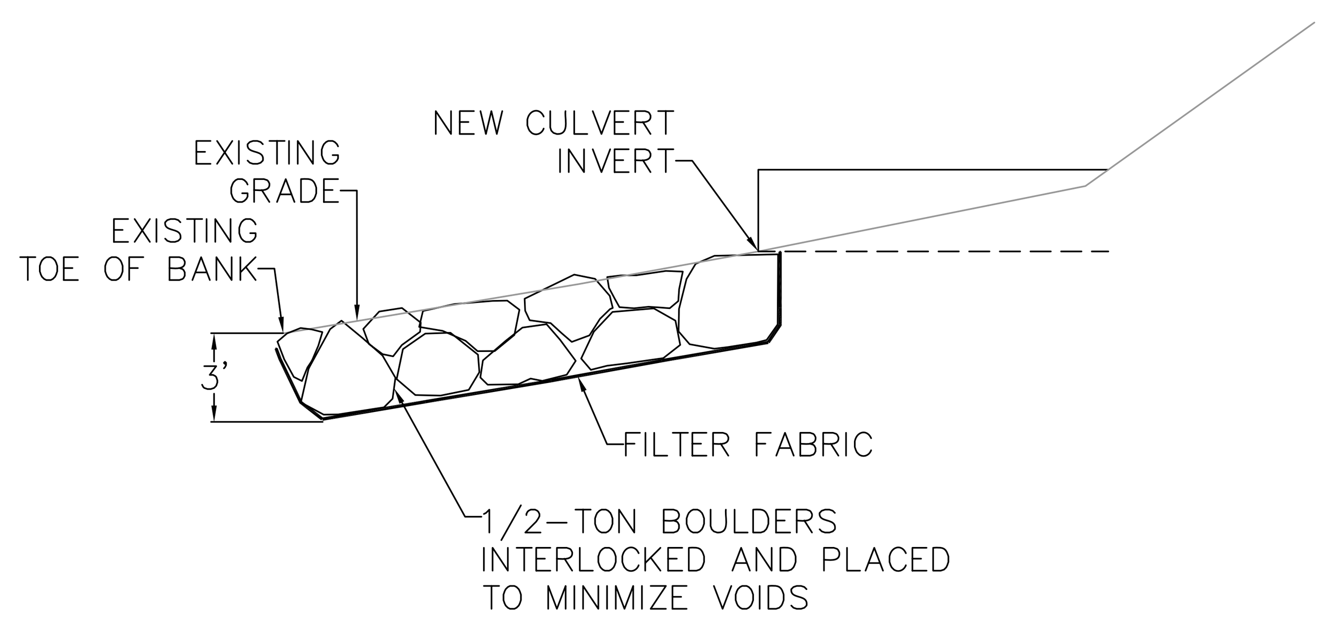
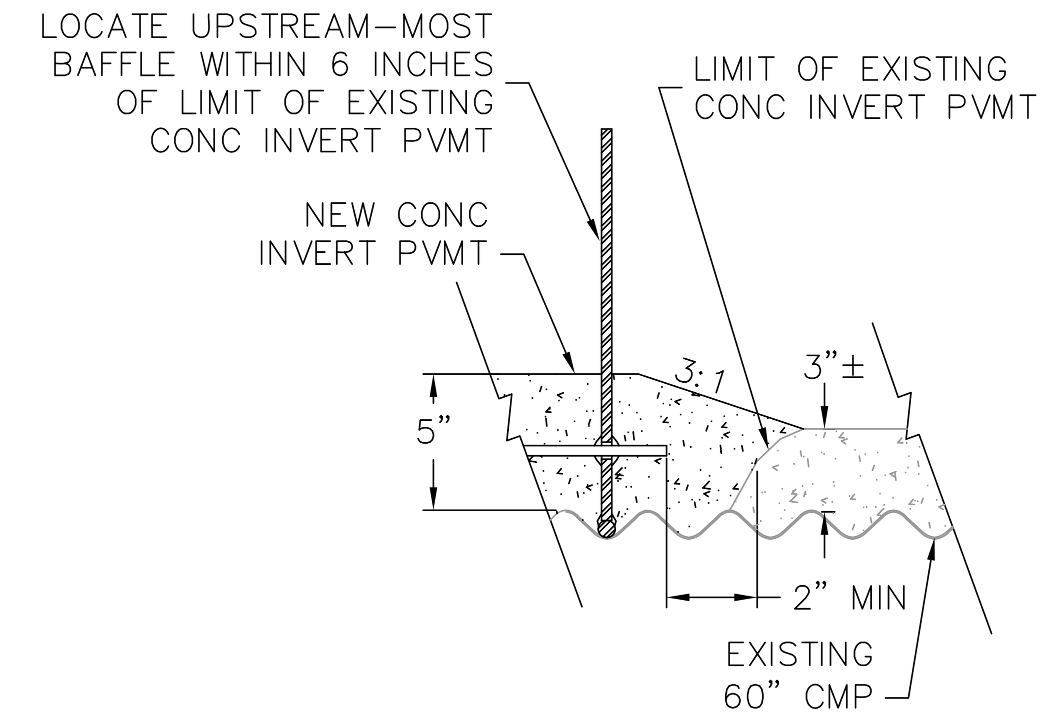
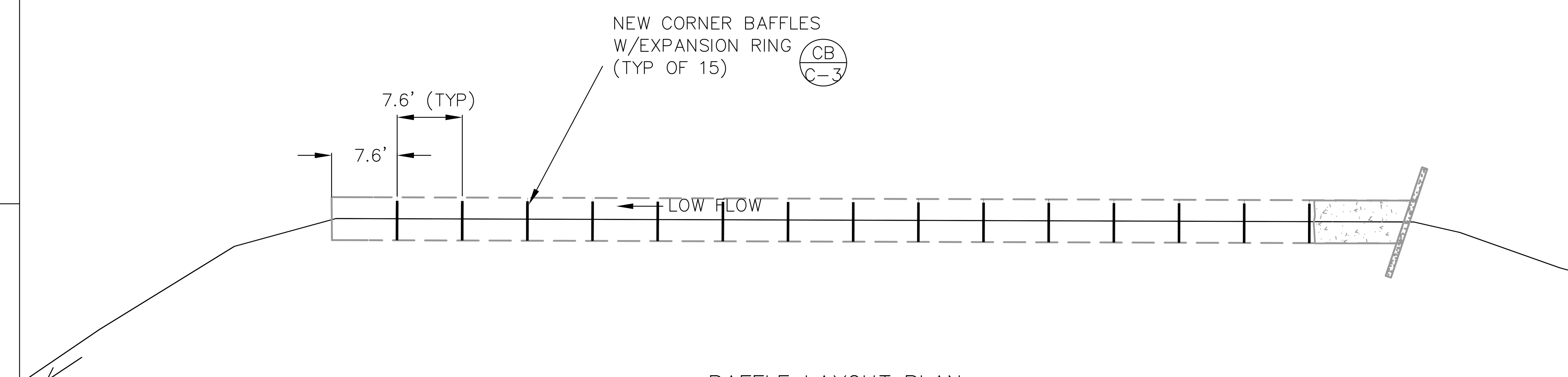


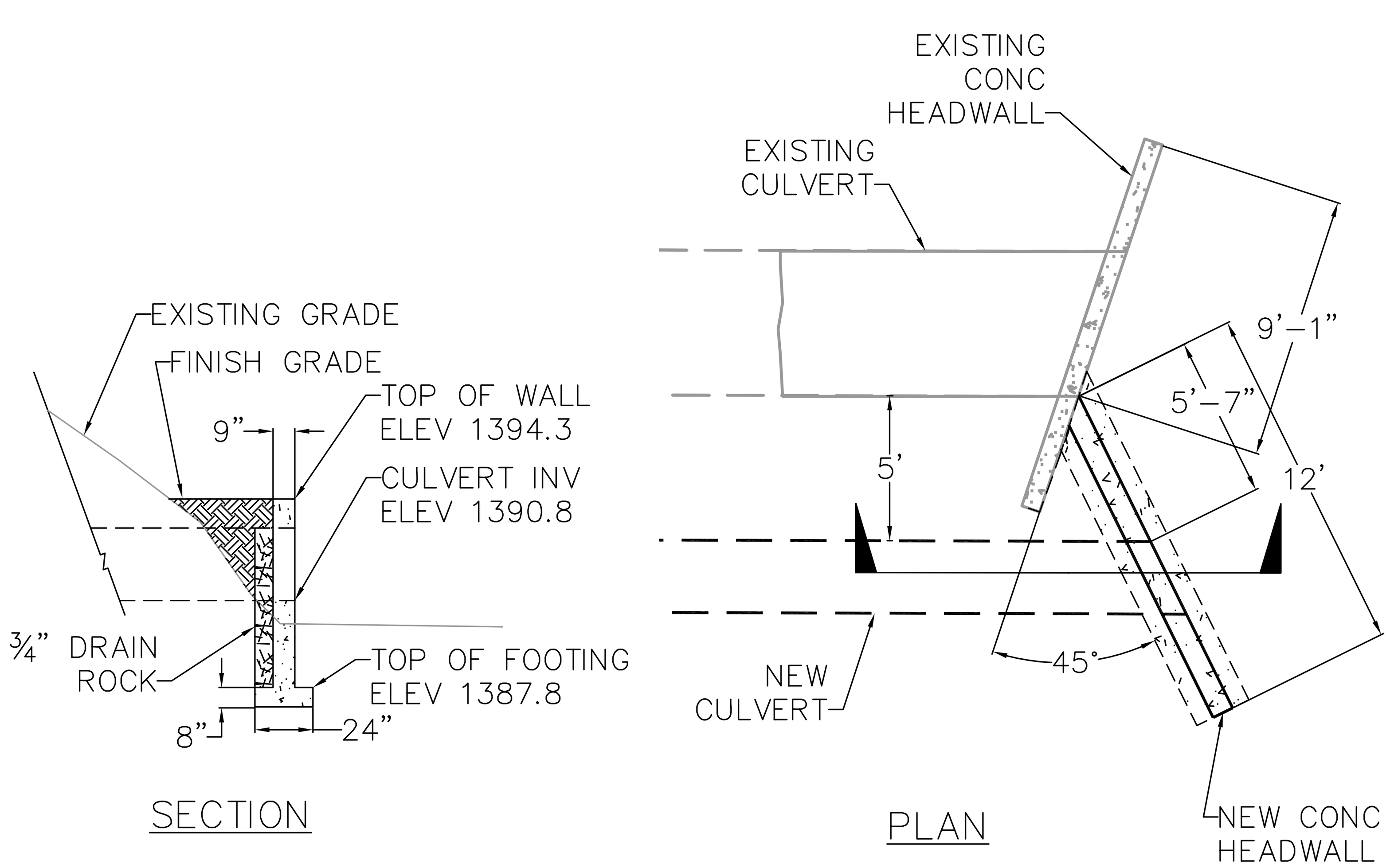
ROCK ENERGY DISSIPATOR (ED)
SCALE: 1"=5'



CONC PVMT TRANSITION (TI)
SCALE: 1"=2'

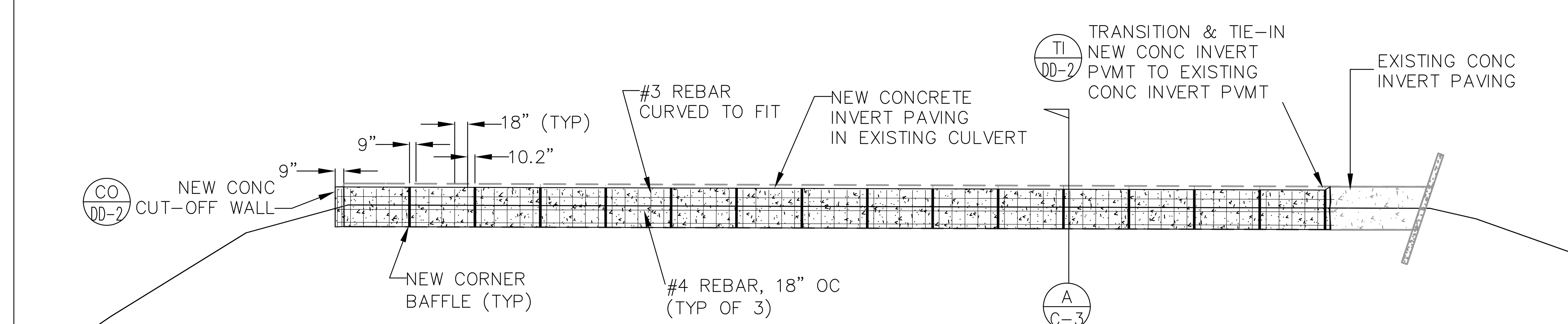


BAFFLE LAYOUT PLAN
SCALE: 1"=10'



NOTES:
1. REINFORCEMENT PER CALTRANS STANDARD PLANS, PLAN D89.
2. CONSTRUCT HEADWALL IN ACCORDANCE WITH CALTRANS STANDARD SPECIFICATIONS, SECTION 51 "CONCRETE STRUCTURES".

CONC HEADWALL (HW)
SCALE: 1"=5'



NOTES:
1. DIMENSIONS SHOWN ARE EXCEPTIONS TO THE STANDARD SPACING OF 18" OCEW.
2. CONCRETE SHALL BE NORMAL WEIGHT WITH A MINIMUM 28-DAY COMPRESSIVE STRENGTH OF 3,000 PSI.

INVERT PAVING AND REINFORCEMENT PLAN
SCALE: 1"=10'

South Fork Ryan Creek Details

C-2

PRELIMINARY
DATE : May 04, 2007

STATE OF CALIFORNIA – DEPARTMENT OF TRANSPORTATION
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Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
1	MEN	101	52.25	6	7

PREPARED FOR:

Five Counties Salmonid Conservation Program
Trinity County Planning Department
South Fork Ryan Creek Fish Passage Study

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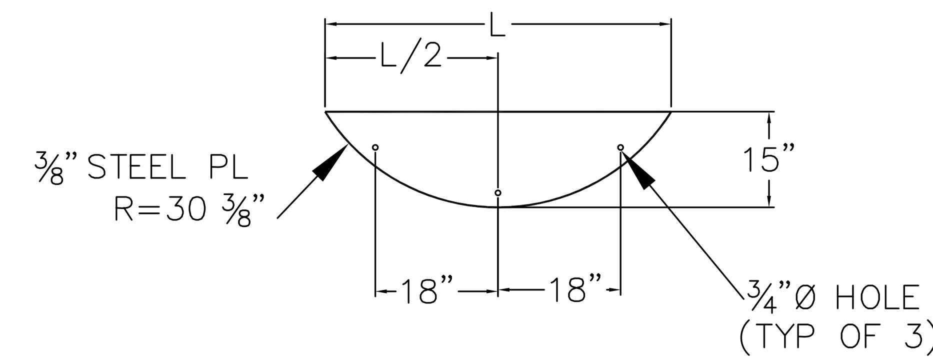
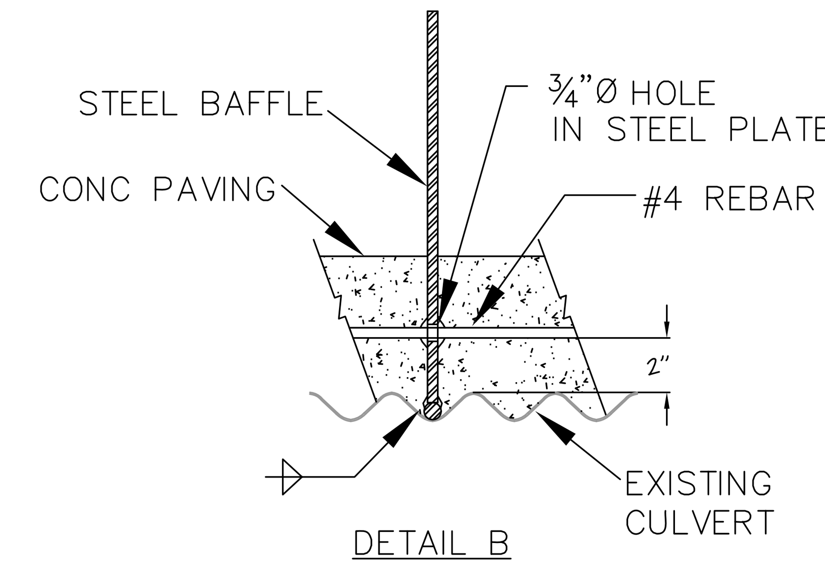
PROJECT ENGINEER REGISTERED CIVIL ENGINEER — DATE

PLANS APPROVAL DATE

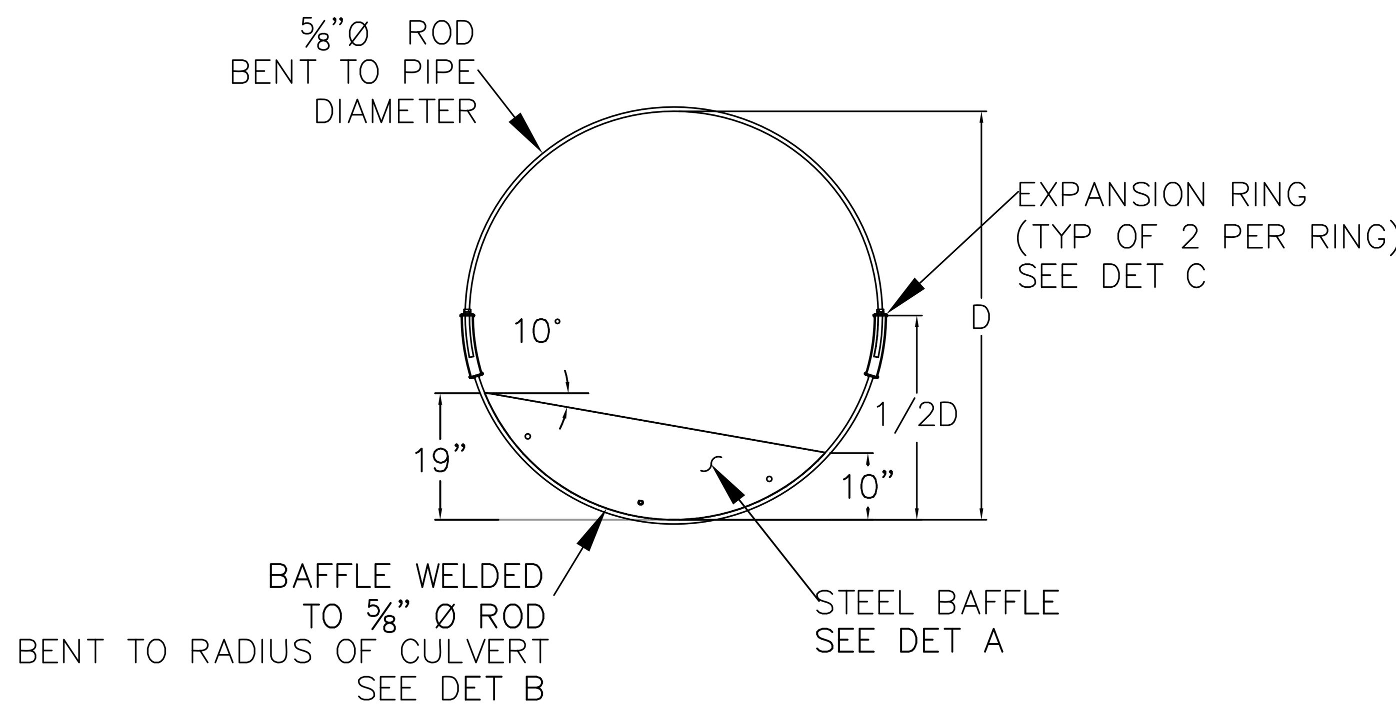
REGISTERED PROFESSIONAL ENGINEER No. Exp. CIVIL STATE OF CALIFORNIA



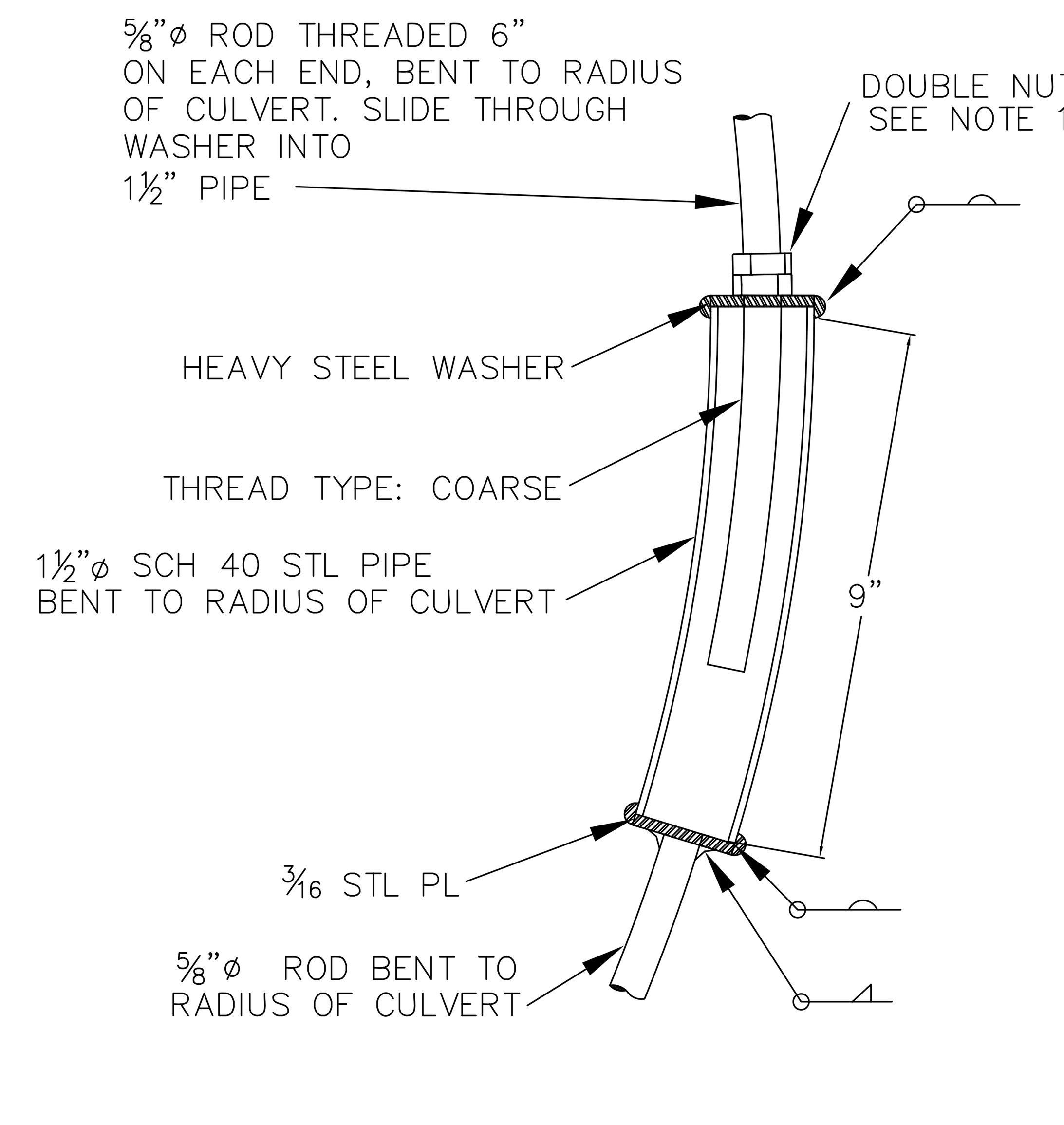
DETAIL A



DETAIL B
NTS

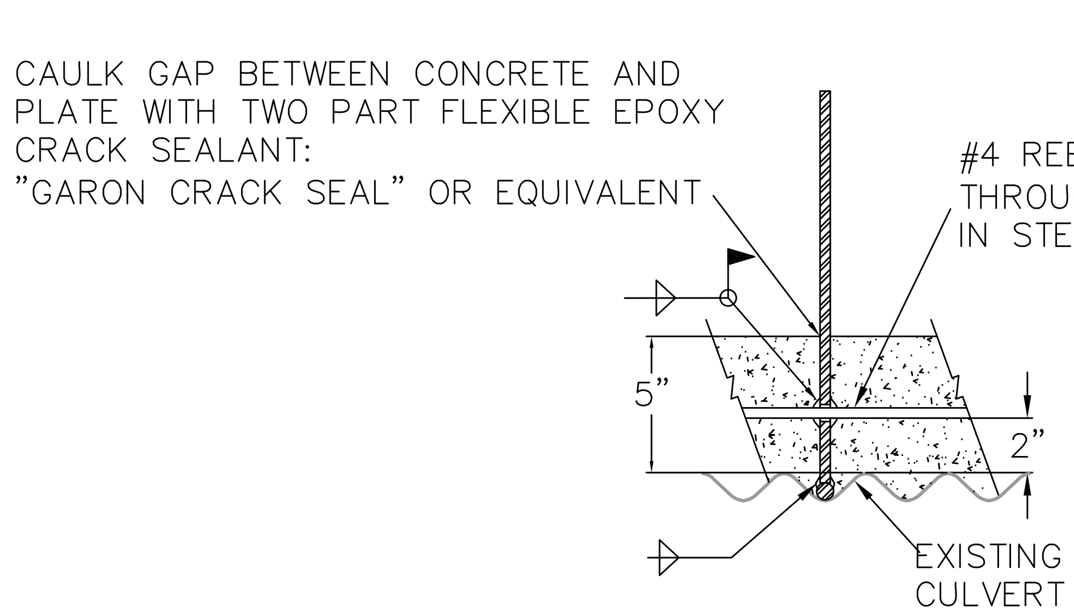


CORNER BAFFLE DETAIL (CB)
SCALE: 1"=2'

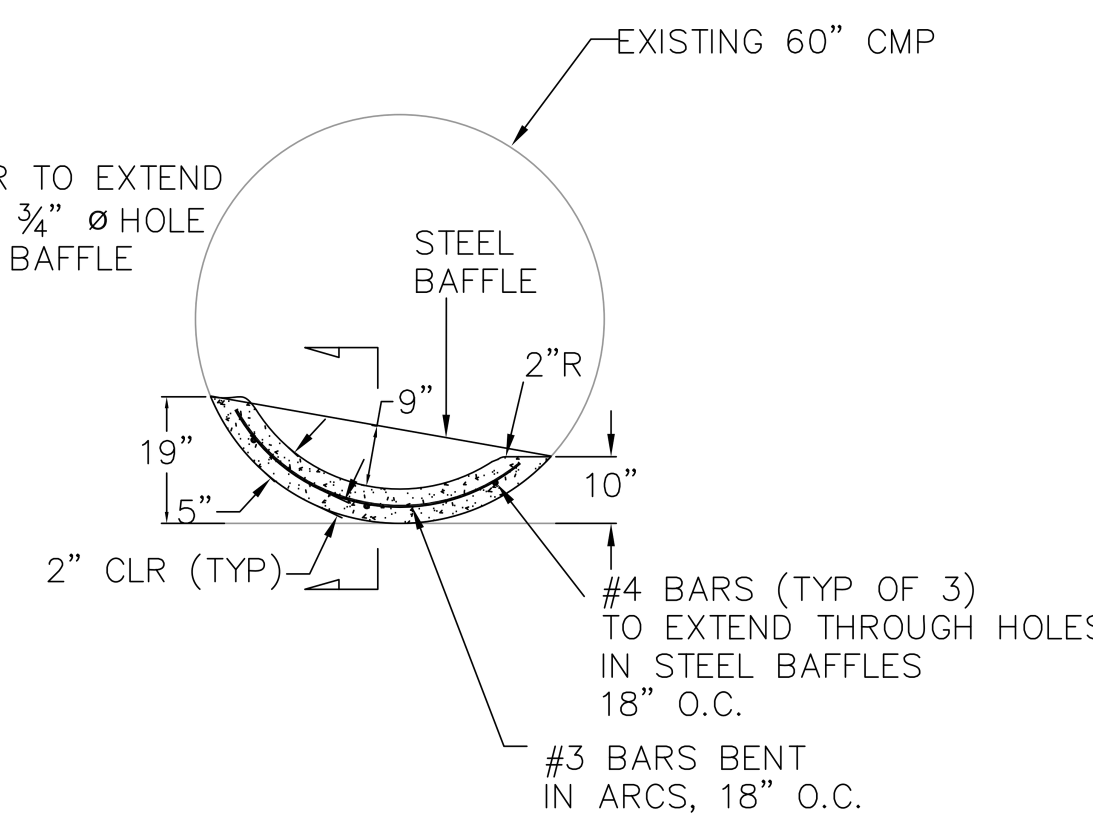


DETAIL C
NTS

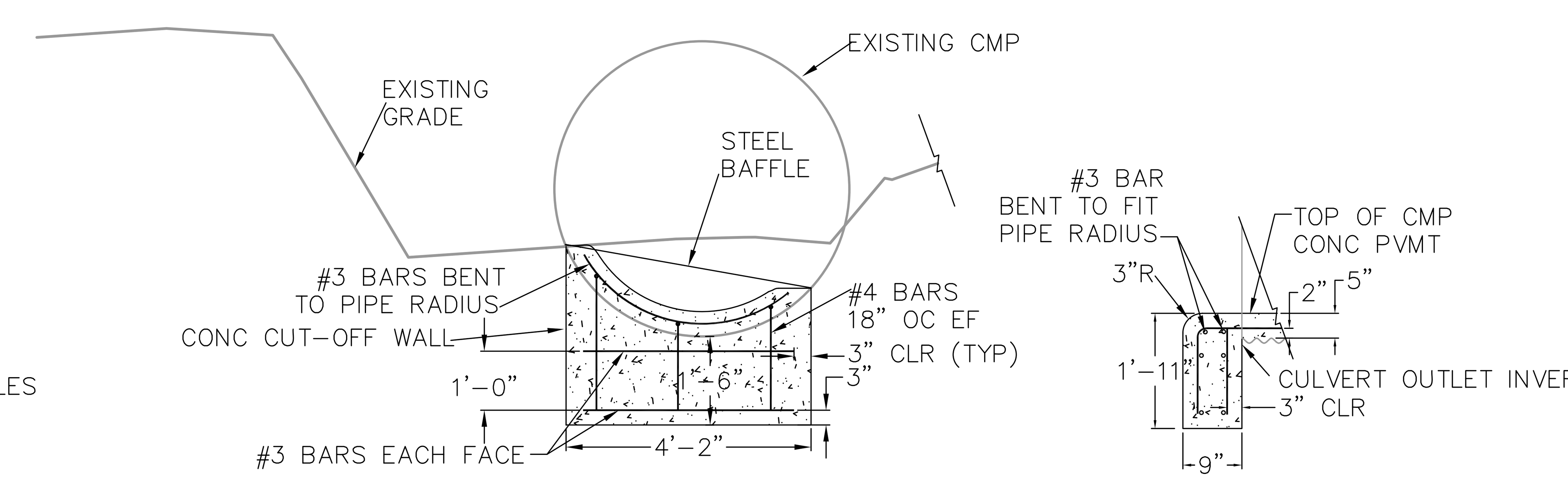
NOTES
1. AFTER COMPLETE INSTALLATION IS APPROVED BY ENGINEER, APPLY LOCK–TITE (PERMANENT STRENGTH)TO NUTS PER MANUFACTURER'S INSTRUCTIONS TO PREVENT LOOSENING.
2. ⅜" STEEL PLATE SHALL BE PROVIDED CUT TO ROUGH SHAPE WITH CLEAN EDGES.
3. CONTRACTOR SHALL CUT AND SHAPE MISCELLANEOUS COMPONENTS.
4. ALL FABRICATION SHALL BE FIRST–CLASS THROUGHOUT WITH NO SHARP EDGES.
5. ALL WELDS SHALL BE FILLET ¼" WELDS UNLESS OTHERWISE NOTED AND SHALL BE MADE BY CERTIFIED WELDERS.



SECTION



SECTION A (A)
SCALE: 1"=2'



CONC CUT–OFF WALL (CO)
SCALE: 1"=2'

South Fork Ryan Creek
Baffle Details
C-3

PRELIMINARY
DATE : May 04, 2007

STATE OF CALIFORNIA – DEPARTMENT OF TRANSPORTATION
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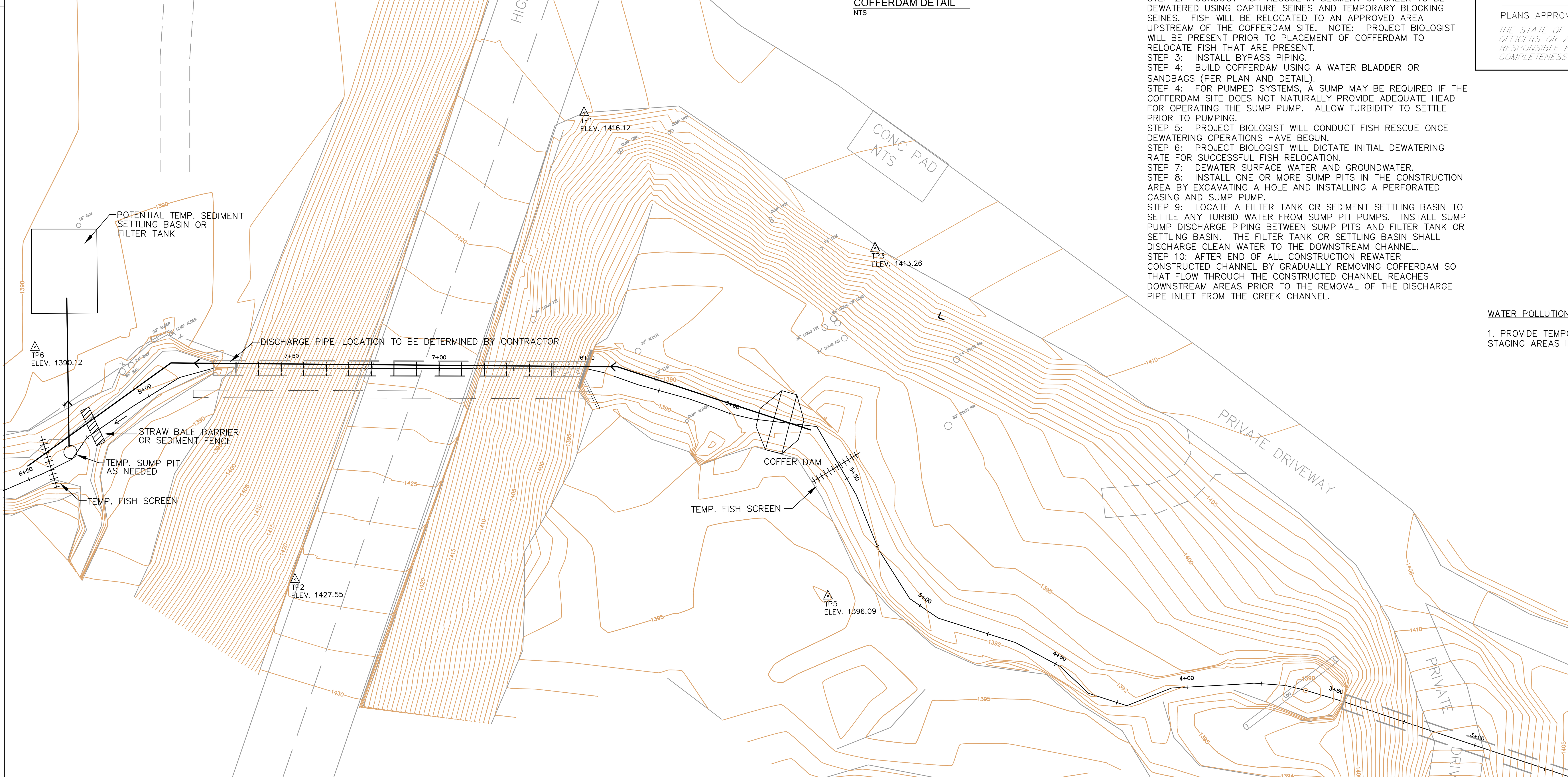

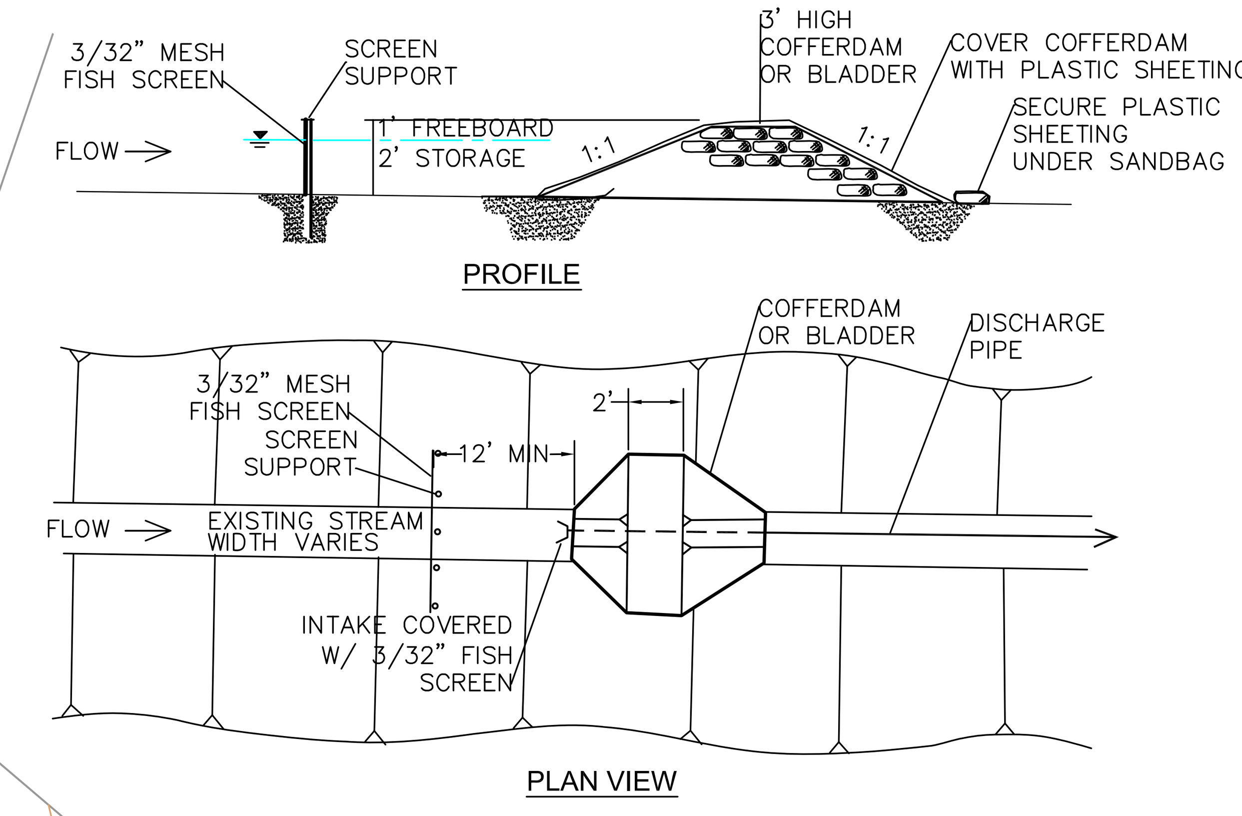

COFFERDAM DETAIL
NTS

DEWATERING

DEWATERING OF THE PROJECT SITE WILL REQUIRE BYPASSING OF SURFACE FLOWS OF THE CREEK AROUND THE CONSTRUCTION AREA AND RETURNING SURFACE FLOWS TO THE NATURAL FLOW PATH (REWATERING) AFTER CONSTRUCTION.

SITE CONDITIONS
THE CREEK'S SUMMERTIME BASE FLOW IS EXPECTED TO BE 1.0 CUBIC FEET PER SECOND (CFS) OR LESS DURING THE CONSTRUCTION PERIOD.

DEWATERING PLAN
THE CONTRACTOR WILL BE REQUIRED TO PREPARE A DEWATERING PLAN FOR THE ENGINEER'S APPROVAL. THE ANTICIPATED DEWATERING PLAN WILL INCLUDE THE FOLLOWING ELEMENTS:
1. INSTALL A COFFERDAM WITH GRAVITY–FED OR PUMPED PIPING SYSTEM,
2. REDUCE THE WATER LEVEL IN THE CONSTRUCTION AREA BELOW EXCAVATION LEVELS, AND
3. REWATERING THE CONSTRUCTED CHANNEL.

THE FOLLOWING INFORMATION IS PROVIDED TO ILLUSTRATE THE DEWATERING CONCEPT PLAN. THE CONTRACTOR IS RESPONSIBLE FOR SUBMITTING THE PROJECT DEWATERING PLAN FOR THE ENGINEER'S AND PROJECT BIOLOGIST'S APPROVAL.

STEP 1: INSTALL FISH SCREENS AT LIMITS OF AREA TO BE DEWATERED.
STEP 2: CONDUCT FISH RESCUE IN SEGMENT OF CREEK TO BE DEWATERED USING CAPTURE SEINES AND TEMPORARY BLOCKING SEINES. FISH WILL BE RELOCATED TO AN APPROVED AREA UPSTREAM OF THE COFFERDAM SITE. NOTE: PROJECT BIOLOGIST WILL BE PRESENT PRIOR TO PLACEMENT OF COFFERDAM TO RELOCATE FISH THAT ARE PRESENT.
STEP 3: INSTALL BYPASS PIPING.
STEP 4: BUILD COFFERDAM USING A WATER BLADDER OR SANDBAGS (PER PLAN AND DETAIL).
STEP 4: FOR PUMPED SYSTEMS, A SUMP MAY BE REQUIRED IF THE COFFERDAM SITE DOES NOT NATURALLY PROVIDE ADEQUATE HEAD FOR OPERATING THE SUMP PUMP. ALLOW TURBIDITY TO SETTLE PRIOR TO PUMPING.
STEP 5: PROJECT BIOLOGIST WILL CONDUCT FISH RESCUE ONCE DEWATERING OPERATIONS HAVE BEGUN.
STEP 6: PROJECT BIOLOGIST WILL DICTATE INITIAL DEWATERING RATE FOR SUCCESSFUL FISH RELOCATION.
STEP 7: DEWATER SURFACE WATER AND GROUNDWATER.
STEP 8: INSTALL ONE OR MORE SUMP PITS IN THE CONSTRUCTION AREA BY EXCAVATING A HOLE AND INSTALLING A PERFORATED CASING AND SUMP PUMP.
STEP 9: LOCATE A FILTER TANK OR SEDIMENT SETTLING BASIN TO SETTLE ANY TURBID WATER FROM SUMP PIT PUMPS. INSTALL SUMP PUMP DISCHARGE PIPING BETWEEN SUMP PITS AND FILTER TANK OR SETTLING BASIN. THE FILTER TANK OR SETTLING BASIN SHALL DISCHARGE CLEAN WATER TO THE DOWNSTREAM CHANNEL.
STEP 10: AFTER END OF ALL CONSTRUCTION REWATER CONSTRUCTED CHANNEL BY GRADUALLY REMOVING COFFERDAM SO THAT FLOW THROUGH THE CONSTRUCTED CHANNEL REACHES DOWNSTREAM AREAS PRIOR TO THE REMOVAL OF THE DISCHARGE PIPE INLET FROM THE CREEK CHANNEL.

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PREPARED FOR:
Five Counties Salmonid Conservation Program
Trinity County Planning Department
South Fork Ryan Creek Fish Passage Study

PREPARED BY:
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P.O. BOX 828
OCCIDENTAL, CA 95465
(707) 874-0100

PROJECT ENGINEER
REGISTERED CIVIL ENGINEER
DATE

REGISTERED PROFESSIONAL ENGINEER
No.
Exp.
CIVIL
STATE OF CALIFORNIA

PLANS APPROVAL DATE

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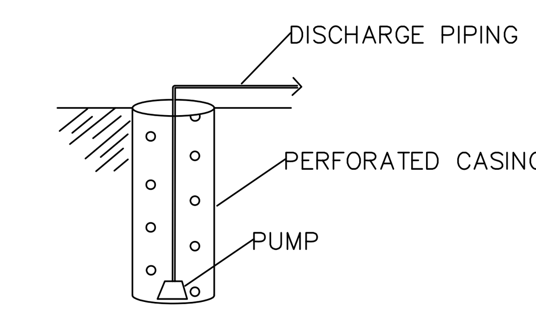

SUMP PIT DETAIL
NTS

WATER POLLUTION PREVENTION

1. PROVIDE TEMPORARY CONCRETE WASHOUT FACILITY IN APPROVED STAGING AREAS IN ACCORDANCE WITH CALTRANS STD. PLANS, T59.

STATE OF CALIFORNIA – DEPARTMENT OF TRANSPORTATION
Caltrans

SUPERVISING ENGINEER
CALCULATED– DESIGNED BY
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DATE REVISED

PRELIMINARY
DATE : May 04, 2007

South Fork Ryan Creek
Water Pollution Prevention and Dewatering Plan
WPC-1

DATE PLOTTED => May 04, 2007
TIME PLOTTED => 13:50
LAST REVISION
00-00-00