Indian Creek Road Sediment Reduction Project

Indian Creek – Trinity County – January 2009

FINAL REPORT

California Department of Fish and Game – Fisheries Restoration Grant Program
Contract No. P0510325

Partners
Trinity County Department of Transportation

Trinity River Basin Fish & Wildlife Restoration Program: Targeted Watershed Implementation Program

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Summary:
The purpose of this project was to enhance water quality and improve salmonid habitat in the Indian Creek watershed by implementing cost-effective sediment reduction treatments at County road-related sediment sources on Indian Creek Road (Trinity County Road No. 336). Approximately 3,174 cubic yards of potential sediment delivery to Indian and Cannon Ball Creeks were treated during this project over a distance of 9.52 miles. 3,081 cubic yards were treated by implementing specific treatments at twenty sites and an additional estimated 93 cubic yards were treated from work conducted by the Trinity County Department of Transportation (DOT) as in-kind to the project. Treatment design was developed utilizing the results of the 2000 DIRT inventory and on-the-ground consultation with DOT and Five Counties Salmonid Conservation Program staff to modify the recommended treatments from DIRT. Construction was completed by the DOT from July 1, 2008 through August 29, 2008.

This project utilized three funding sources including the: California Department of Fish and Game's Fisheries Restoration Grant Program; the Trinity River Basin Fish and Wildlife Restoration Program's Targeted Watershed Implementation Program Grant and the Trinity County Department of Transportation (refer to Table 1).

To access the project site from Weaverville California, take State Highway 299 east to State Highway 3 near Douglas City. Turn right onto Highway 3 just after the Trinity River Bridge and follow the Highway for approximately ¾ of a mile to Reading Creek Road. Turn left onto Reading Creek Road and continue for approximately 4 miles to the intersection with Indian Creek Road. The first treatment Site is located at Milepost 1.52 and the last Site is at Milepost 11.04 (refer to Attachment 1; Project Location Map).

Purpose and Need:
Indian Creek Road (Trinity County Road No.336) is located within the Indian Creek and Cannon Ball Creek watersheds and is a moderate-use road that accesses private residences, private timberlands, and National Forest/Bureau of Land Management (BLM) lands. Indian Creek is a direct tributary to the Trinity River and is composed of the North and South Forks (11.83 & 5.56 square mile drainage areas, respectively) and the mainstem (16.83 square miles). Approximately 4.5 miles of the road runs parallel to the creek. The North Fork has two principal tributaries, Cannon Ball Creek and Corral Creek. Corral Creek is one of the principal sources of granitic-based sediment in the watershed (Parkinson *et al*, 1991). Indian Creek provides important spawning and rearing habitat for Coho and Chinook salmon and steelhead (USFWS, 1999; Boberg, 1979) and it is one of the first tributaries to the Trinity River below the Lewiston Dam. The watersheds are located within the 2,038 square mile Trinity River Basin hydrologic unit (HUC 18010211). The majority of the Trinity River Basin is administered by National Forest (Shasta-Trinity, Klamath and Six Rivers) with some Bureau of Land Management and tribal lands as well as private residential and rural communities, the largest being Weaverville. Within the project level watershed area however; land management is the inverse with 75% in private (primarily Sierra Pacific Industries (SPI) in the South Fork) and 25% in federal ownership (primarily BLM). Indian Creek Road was part of the first travel route between Red Bluff and Trinity County in the 1850's and

a large system of roads (now mostly utilized by SPI) exists in the upper part of the watershed. Extensive mining occurred within the watershed and evidence of that mining exists today, primarily in the mainstem reaches near stream mile 2.65.

The Indian Creek watershed is located within the Oregon Mountain Subprovince of the Klamath Mountains geologic province. This subsection is dominated by Paleozoic metavolcanic rocks of the Salmon Hornblende Schist, and metasedimentary and metavolcanic rocks of the Abrams Mica Schist located between the Bully Choop fault on the east and the Siskiyou fault on the west (USDA, 1998). The watershed is composed of steep to very steep, well-drained, gravelly clay loam soils derived from metamorphic and metasedimentary parent material. The primary management concerns in these soil regimes include severe hazard of erosion, steep slopes and low water availability. Cutslopes are susceptible to severe erosion in these soils and proper design of road drainage and culvert placement and sizing can help control that erosion. The elevation of the project treatment sites ranged from 2,300 feet at Treatment Site No. 498 to 5,016 feet at Site No. 438 near the Bully Choop Mine.

Limiting factors to salmonids in Indian Creek include spawning and rearing requirements; excessive sediment yield; and water quality. Spawning gravel permeability has been recorded at the 258 centimeters per hour level (U.S. Environmental Protection Agency, 2001); considered indicative of low survival rates for salmonids. Permeability is a general measure of the oxygenated water supply directly affecting salmon egg survival and high permeability rates are directly correlated to high dissolved oxygen mobilization to salmon eggs and removal of metabolic wastes. There is approximately 24,075 square feet of potential spawning area in the combined watershed with 94% of that being within the lower mainstem reach, mostly comprised of pools and low gradient riffles (Parkinson *et al*, 1991). The same study noted that particle size distribution for the whole watershed broke down as follows: Bedrock (11.5%); Boulders (26.7%); Cobbles (28.6%), Gravel (21%); and Sand (12%). Indian Creek's channel bed consists primarily of bedrock with alluvial and colluvial components and large boulders. Low gradient riffles and lateral scour pools with bedrock are the primary fisheries habitat types. The mainstem also contains a 12,500-foot reach of hydraulic mining dredge tailings. Hydraulic mining was conducted from the mid 1870's to the 1890's when the practice was declared illegal; however it did not end in Trinity County until 1940. Before mining, this reach was composed of nested fluvial terraces and were either forested or otherwise vegetated. The dredging and hydraulic mining completely disturbed the terraces and left boulders, cobbles, gravel and sand; resulting in a reach that lacks all components of a healthy stream. Efforts to ameliorate the effects of the dredging in this reach have been attempted by the BLM through the construction of channel and holding pools, but Indian Creek still flows subsurface at this location from late July through September. This reach is the largest, most visible fish habitat-limiting factor within the watershed. Water temperature is also a limiting factor in this reach, notably due to lack of riparian vegetation and shade and cover components. Sediment (sand and fines) is also filling in the pools and riffle components, effectively reducing the amount of rearing habitat.

This project was planned and conducted by the Five Counties Salmonid Conservation Program (5C) with Trinity County. 5C is a conservation strategy formed in 1998 by the counties of Del Norte, Humboldt, Mendocino, Siskiyou and Trinity to develop land use conservation standards and implement modifications in policies and practices that will result in reducing erosion and restoring anadromous salmonid fisheries habitat within the federally threatened Southern Oregon-Northern California Coast (SONCC) Evolutionarily Significant Unit (ESU) for coho salmon. The 5C Program's work on sediment reduction and barrier removal projects has been, and continues to be, an essential step toward the delisting of this ESU, The Program's policies and projects have been cited in a decision to not list Smith, Klamath and Trinity River steelhead trout as "Threatened" under the Endangered Species Act (Federal Register: April 4, 2001).

The Trinity River is a cultural and recreational resource for which there is a TMDL (Total Maximum Daily Load) allocation plan that identifies roads as significant sediment sources. The Recovery Strategy for California Coho Salmon (CDFG, 2004) also lists recommendations, including TR-DC-04: "Implement sediment reduction plans consistent with County plans and policies". As stated above, this project, and Trinity County, is part of 5C Program. One of the 5C Program elements is a systematic inventory of county road-related sediment sources that could result in erosion and sediment yield to anadromous streams. To date, 2,455 miles of County roads have been inventoried for sediment sources within the Program Area and recommendations for treatments have been developed (see DIRT description below). Fourteen, including Indian Creek Road, sediment reduction projects based on these inventories have been completed. Another six projects are in progress or planned by the Program's County Departments of Transportation/Public Works. The completed projects are estimated to have treated ~ 43,000 yd3 of sediment over a ten year period. The Indian Creek watershed is also listed as a "Key Population to Maintain or Improve". The Recovery Strategy range-wide recommendations that this project implemented include RW-VI-B-01, RW-VI-B-02 and RW-VI-D-01 to encourage hydrologic connectivity and implement sediment reduction work. The Trinity River TMDL also references the 2000 DIRT Inventory that identified 787 stream crossings as potential sediment delivery sites to the Trinity River. Several of those stream-crossing sites are located on "key tributary streams including Canyon Creek Road (49), Coffee Creek Road (42), *Indian Creek Road (52)*, Deadwood Creek Road (34), Rush Creek Road (40)". Eighteen of the 52 stream crossings identified on Indian Creek Road were treated during this project.

This project was also part of a concerted local effort to implement a variety of restoration projects in the upper reaches of the Trinity River watershed below Lewiston Dam. Those projects include the Trinity River at Indian Creek Flow Rehabilitation (completed in 2007 and 2008 by the Trinity River Restoration Program); the Little Browns Creek Watershed Sediment Reduction Project (in progress by 5C); the Little Browns Creek Migration Barrier Removal Project (completed in 2007 by 5C); and the Grass Valley Creek Monitoring & Revegetation Project (in progress by the Trinity County RCD). A potential project to assist private landowners with sediment reduction treatments on private roads in the Indian Creek watershed is currently planned by the Resource Conservation District (RCD).

Project Development and Implementation:
Project phases include: 1) Site Treatment Design; 2) Permitting; 3) Treatment Staking; 4) Construction; and 5) Pre/During/Post-project Monitoring.

The original DIRT inventory (Direct Inventory of Roads and Treatments) was completed in 2000 as part of the Trinity River Watershed County Road Erosion Inventory by the 5C Program. In summary, the DIRT methodology is based on the protocols for forest and ranch road inventories set forth by Pacific Watershed Associates (PWA) but are modified to reflect the differences between private and public roads. Refer to www.5counties.org for a thorough DIRT background and description.

During the 2000 inventory, a total of 66 'Sites', or road-related sediment sources that could each yield at least 20 cubic yards (yd3) of sediment over a 10-year period, were assessed and prioritized for treatment on Indian Creek Road. From these 66 Sites, DIRT estimated 5,515 yd3 of potential sediment delivery over a ten-year period. Fifty-seven sites were actually recommended for treatment; ranging from low to high immediacy and erosion potential. Nine were deemed "No Treatment", most likely due to proper culvert sizing or placement. The 57 sites recommended for treatment had the potential to deliver 5,427 yd3 of sediment to Indian and Cannon Ball Creeks over a ten-year period. Of those 57, 20 were selected for implementation under this project with a calculated sediment savings of 3,081 yd3. Selection was based on a Simplified Prioritization Ranking Model that takes into account the Site's erosion potential and treatment immediacy; the treatment cost; and the DOT staff workload. Biological factors and project complexity were also considered. An initial meeting to discuss the proposed work was held on February 25, 2008 with Carl Bonomini and Ron Martin of the DOT, Christine Jordan (Project Manager), Sandra Perez and Mark Lancaster (5C Program staff). DOT committed road department staff to completing the project in summer 2008, reducing the overall project costs by not contracting out construction. Two field reviews occurred on March 5 and March 27 to discuss and modify specific treatment sites. 31 treatment sites were submitted in the original grant proposal and during the two site visits; 14 sites were removed from the treatment list due to their low potential for erosion and or complexity and cost to implement and three additional sites were added that had not been included in the submitted grant treatment list which were a high priority based on potential erosion. The 20 implemented treatments, developed from the DIRT inventory recommendations and on-site discussion with DOT staff, are intended to return the road at the treatment sites to as hydrologically neutral a state as is safe, practical, and economical for the benefit of water quality and salmonid habitat. Treatments consist primarily of stream crossing culvert upgrades, rolling and critical dip installation to keep runoff in its natural drainage, and road surface treatment. Refer to Attachment 2 for the list of sites and treatments implemented which also includes Site GPS information.

The project was not included in the Fisheries Restoration Grant Program's CEQA document (Mitigated Negative Declaration) for 2005-2006 funded projects and subsequent Regional General Permit No. 12 through the ACOE; therefore, the separate CEQA document was prepared. A Categorical Exemption under Class 1 Section's

15301(c) & 15302(c) was filed on May 6, 2008. A CDFG Streambed Alteration Agreement notification was prepared and submitted in June 2008 followed by a site visit with CDFG Environmental Staff Mike Harris and Grant Manager James Thompson of the four sites included in the Notification on July 21. The completed permit (R1-08-0377) was received August 8, 2008 and was distributed to the DOT staff working on the project to have on-site at all times throughout project construction. The DOT completed the required USA Dig notifications in June 2008.

Carolyn Rourke, 5C Natural Resources Technician, conducted all of the pre-project photo monitoring and treatment site staking for this project. A photo-monitoring protocol was established and records were maintained. This work was completed intermittently from April 10 to June 30, 2008 under a matching grant source. Pre-project, as well as during and post-project photos, are included in Attachment 3.

Construction of this project was completed by DOT road crew staff and started on July 1 and was completed on August 29, 2008. Jordan conducted weekly site visits and coordinated with DOT staff Ron Martin on treatment progress and questions. The following general treatments were implemented (refer to Attachment 2 for a complete list): 11 stream crossing culverts were upgraded; 1 new stream crossing culvert was installed; 1 ditch relief culvert was installed and 1 was replaced; 2 rolling dips were installed and rocked; 2 existing rolling dips were redefined and rocked; and 3 critical dips were installed. Where stream crossing and ditch relief culverts were replaced or installed, and where critical dips were installed, approximately 9,340 square feet of outboard/inboard fill faces and upstream/downstream channels were rocked: 2,970 square feet with 8” to 10” angular size rock (~725 yd3) and 6,370 square feet with ¼-ton size rock (~413 yd3). 160 feet of native surface road was outsloped; 175 feet of berm was removed (~15 yd3) and asphalt-grinding surface was applied to 7,520 square feet of road. In addition to the prescribed treatments implemented at the 20 Sites, an additional 19 existing rolling dips between Milepost 11.04 (Site 438 at the top of the project area) and Milepost 8.27 were redefined and rocked. Three additional overside drain structures were also constructed between Milepost 7.52 and 7.72 to assist in road drainage within this steep 1,056 foot long section of road.

After each site was constructed, all disturbed and exposed soil surface areas were either rocked (as described above) and/or revegetated with native grass seed mix and certified weed-free straw mulch. All final erosion control work was completed prior to October 15, 2008. No excess fill or spoils material was disposed of as a result of this project due to DOT using approximately 280 yd3 of excavated fill to reconstruct the roadway approaches at Site 446 (Milepost 7.52) to safely install a critical dip over the crossing at this location. The native road surface from Milepost 11.04 (uppermost Site) down to Milepost 5.21 (where the road surface changes to chip seal) was re-graded upon completion of treatment construction.

Project monitoring consisted of the pre, during and post photo and construction phase monitoring. Jordan monitored project construction on a weekly basis from July 1 through August 28, 2008. An immediate post-project inspection was completed on

August 29 to inspect if: the appropriate sized culverts had been installed at each site and at grade, rock armoring was sufficient on all sites that required it, rolling and critical dips had been installed correctly and the native road surface was graded and smooth. There were no problems noted with any of the Sites other than the outlet placement of an HDPE smooth bore plastic culvert installed at Site # 454 (milepost 6.3) due to bedrock. Jordan and Lancaster conducted another post-construction inspection on October 6, 2008 and Grant Manager Thompson and Jordan conducted a post-project inspection on October 23, 2008. Between September 1 and October 6, 2008 SPI was conducting a logging operation between Milepost 9.0 and Milepost 11.0 and utilizing part of the road as a log landing and loading area. Damage done to the treated road surface between Milepost 11.0 and Milepost 5.21 (where the surface changes from native to chip-seal) included rutting and flattening of some of the installed rolling dips due to the fact that heavy equipment was transported and operated on the road and full log trucks travelled the road after the early-fall rain events. DOT was notified of the disturbance to the project work and given the lateness of the season; no treatments were implemented to ameliorate the effects.

Monitoring of the roadway condition and treatment effectiveness will continue for three years by the 5C, especially during large storm events. The DOT will continue to maintain the road on a regular basis. 5C staff will inspect the road in spring 2009 to assess any damage done to the road by Sierra Pacific Industries during the 2008 logging operation noted above. If significant damage is observed, 5C staff will work with DOT to insure that SPI implements corrective treatments to restore the road to post-project condition (including securing any permits if necessary).

Many Site treatments, such as stream crossing upgrades and ditch relief culverts, have other treatments associated with them such as installing rock armor or excavating aggraded sediment from upstream of the culvert inlet. All of the treatment sites are included in the project photo log (Attachment 3) with treatment descriptions.

Project Results:

Completion of the project provided the following benefits:

- Eliminating the potential for approximately 3,174 cubic yards of county road related sediment delivery to Indian and Cannon Ball Creeks and the Trinity River;
- Returning the treated road segments to as hydrologically neutral a state as is safe, practical and economical;
- Improving spawning and rearing habitat for juvenile and adult Coho and Chinook salmon and steelhead;
- Increasing the flow capacities of the stream crossing culverts that were upgraded to allow for higher flows and associated bedload and debris;

- Preventing and minimizing the time and funds expended by the Trinity County Department of Transportation on maintenance and emergency efforts during high flow events to remove debris and implement clean-up efforts on the road;

- Implementing the Trinity River Record of Decision (ROD),by providing:

    - Sediment management, including the supplementation of spawning gravels below the Trinity River Dam and reduction in fine sediments which degrade coho salmon habitat;
    - Watershed restoration efforts, addressing negative impacts which have resulted from land use practices in the basin.

Project Costs:

The overall cost of the project totaled approximately $156,613.00. 35% ($53,422) of the total project was funded through this contract, 41% ($64,948) through a matching grant source, and 24% ($38,243) through DOT staff and equipment contributions.

Of this amount about $85,877 (55%) was expended on 5C and DOT staff salaries, with approximately 33% reimbursed through this contract. The personnel hours expended totaled 3,444 and includes 5C Program staff, DOT management and road crew staff time. 5C Program staff worked for approximately 339 total hours (from all sources) to conduct treatment development with DOT staff, permitting, staking, construction site visits, monitoring and managing the grant(s). Approximately $70,736 (45%) of the total project expenditures provided for equipment, materials, permit fees and transportation costs. Equipment used included excavators, backhoes, water trucks, graders, rollers, compactors, and brushers. Assuming that 3,174 cubic yards of potential sediment was treated, the cost savings is ~ $41.11/yd^3, utilizing the on the ground staff time, equipment and materials costs. Table 1 below shows the amounts of grant and match funding expended by Project phase. Other costs not associated directly with the project are administrative costs for the 5C Program and totaled approximately $5,307 from this grant source.

Table 1: Grant Funding Allocation by Project Phase

Partners	Indian Creek Road Sediment Reduction Project Expense By Project Phase			
	Site Design / Permitting	Construction	Monitoring	Total
California Department of Fish and Game Grant (P0510325)	$3000	$48,012	$2,410	**$53,422**
Trinity River Basin Fish & Wildlife Restoration Program (07FC200014)	$2,417	$62,281	$250	**$64,948**
Trinity County Department of Transportation	$5,440	$32,323	$480	**$38,243**
Total	**$10,857**	**$142,616**	**$3,140**	**$156,613**

From January 2008 through January 2009, 17 people worked on this project for a total of 3,444 hours. Table 2 lists personnel and hours worked throughout the entire project (including hours funded by the other grant sources listed in Table 1 above).

Table 2: Dates Worked and Person Hours Expended

Phase 1 – January 2008 – June 2008	**Hours Worked**
1 Program Director – 5C	17
1 Program Manager – 5C	3
1 Assistant Program Manager – 5C	57
1 Natural Resources Technician – 5C	54
1 Transportation Department Director – DOT	5
1 Environmental Permitting Official – DOT	4
1 Road Superintendent – DOT	8
Phase 2 – July 2008 – August 2008	**Hours Worked**
1 Program Director – 5C	12
1 Assistant Program Manager – 5C	106
1 Transportation Department Director – DOT	4
1 Road Superintendent – DOT	80
10 Road Crew Members worked for 30 days, 10 hrs/day – DOT	3,000
Phase 3 – September 2008 – January 2009	**Hours Worked**
1 Program Director – 5C	18
1 Assistant Program Manager – 5C	72
1 Transportation Department Director – DOT	4
DOT=Trinity County Department of Transportation; 5C=Five Counties Salmonid Program Staff with Trinity County Natural Resources Department	**Total Hours: 3,444**

Acknowledgements:
Trinity County Department of Transportation staff's commendable work on this project builds upon many other 5C efforts including the implementation of the Roads Manual. Their experience in completing this project adds to their familiarity with road treatments that have not yet been fully incorporated into their routine road maintenance and improvement practices. The feedback from the crew assigned to this project indicates that it was a good learning experience that also contributed to their understanding of the 5C program and its goals.

Attachments:

1) Project Location Map
2) Project Treatment Site Descriptions including GPS Information
3) Project Photo Log

References:

Boberg, J. & C. Kenyon. 1979. Stream Inventory: Trinity County. California Department of Fish and Game.

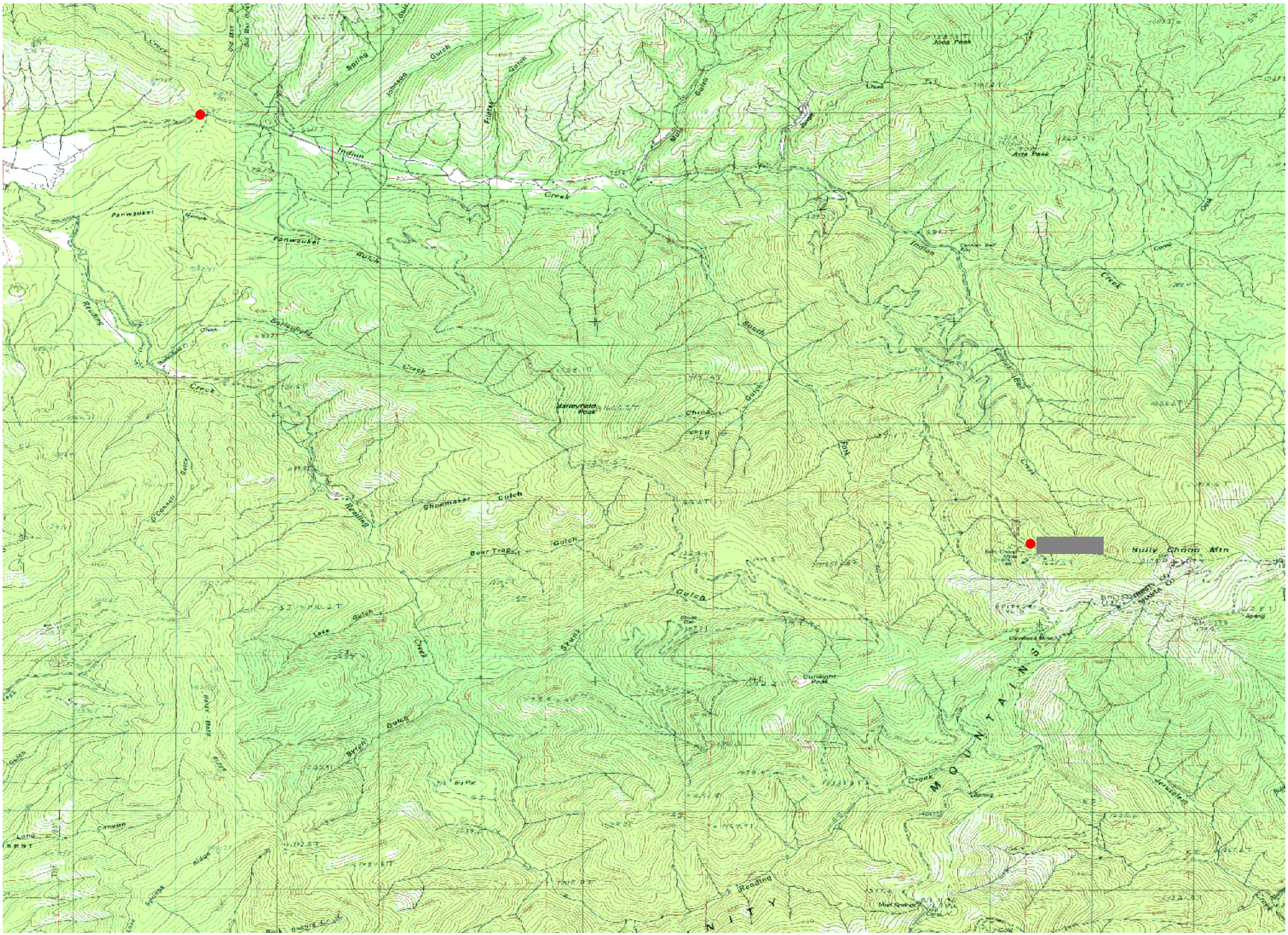
Parkinson, Douglas & Associates. 1991. Trinity River Basin Restoration Program Indian Creek Fish Habitat Assessment: Final Report.

Recovery Strategy for California Coho Salmon. 2004. Report to the California Fish and Game Commission. 786 pp.

United States Department of Agriculture (USDA) Soil Survey. 1998. Trinity County.

United States Environmental Protection Agency (USEPA). 2001. Trinity River Total Maximum Daily Load for Sediment. USEPA, Region IX. San Francisco, California. 142 pp.

United States Fish & Wildlife Service (USFWS). 1999. Trinity River Flow Evaluation: Final Report. Prepared by USFWS, Arcata Fish and Wildlife Office and Hoopa Valley Tribe. Arcata, California. 513 pp.


Indian
Creek
Panwauket
Gulch
Reading
Creek
Shoemaker
Gulch
Bear Trap
Gulch
Study
Gulch
Burch
Gulch
Creek
Spring
Gulch
Johnson
Gulch
Joes Peak
Arta Peak
Indian
Creek
South
Fork
Creek
Barleyfield
Peak
Sully Chief Mtn
Shasta Co.
Cleveland Mine
Dunlight
Peak
MOUNTAINS
Reading
Peak
Mad Rock
Canyon
Ridge
Spring
Creek

Attachment 2
Indian Creek Sediment Reduction Project–Contract No. P0510325
Treatment List

Note that all culvert replacements for stream crossings below were installed at or as close to channel grade as is possible – channel grades measured during the initial inventory are inserted below in respective treatments.

CMP = corrugated metal pipe
DS = downspout
RSP = rock slope protection
XING = crossing
DRC = ditch relief culvert
DI = drop inlet
SBP = smooth bore plastic pipe

Mileage starts at MP 0.00 for Indian Creek Road. UTM in NAD27.

Site 498 – UTM: 510242 / 4494974
1.52 miles
Surface: Chip seal
Current: Crossing with an undersized pipe (18" x 40' CMP) that is too short for the fill and causing outboard fill erosion.

Treatment: - Replace with a 24" x 60' CMP at bottom of fill
- Install at channel grade of 15%
- Rock OL channel: 4' w x 10' l using "Apple box" rock which is 5" to 8" diameter rock (40 sq ft)

Site 496 – UTM: 510489 / 4494879
1.69 miles
Surface: Chip seal
Current: Crossing with an undersized 18" x 35' hydraulic mining pipe that is separated, has sunk into the road fill, is split at the top, and is causing road fill erosion.

Treatment: - Replace with a 24" x 50' CMP at or close to bottom of the fill
- Install at channel grade of 19%
- Rock OL channel: 4' w x 25' l using "Apple box" rock (100 sq ft)

Site 493 – UTM: 510679 / 4494854
1.80 miles
Surface: Chip seal
Current (from observed site conditions): 24" culvert CMP with bottom rusted through. Buried cable. DIRT Site 493 Description: 24" x 35' CMP with plugged inlet. Class 3 xing at a flat grade. Cannot get much steeper slope on pipe. Has overtopped but road is down in channel/low point. Very little fill. Treat site#492 as an overflow. Sites #494 and #495 (class 3 fill xings) are flowing into ditch that is delivering to the outlet of this site and the ditch length from site#496 (643'). This site would need an arch culvert or bridge to handle flow from the combined sites. Need an E-check. No road

prism. The right chronic surface erosion is from the ditch length from site 494 to the outlet of this site. **There is a 30" upslope on pvt & fill depth limitation so staying with 30".

Treatment: - Replace with 30" x 80' CMP aligned with channel & at bottom of fill
- Install at channel grade of 8% if possible
- Rock armor OL channel: 10' w x 75' l to OL of Site 492
750 sq ft

Site 492 – UTM: 510690 / 4494839
1.82 miles
Surface: Chip seal
Current: 12" x 30' CMP. Undersized DRC acting as an overflow for site#493. It's carrying 528' of ditch with a class 3 fill xing dumping into it. Pipe is in the best location. No road prism.

Treatment: - Replace with 18" x 40' CMP in same location

Site 490 – UTM: 510845 / 4494817
1.92 miles
Surface: Chip seal
Current: 5' x 1' xing that has a 40' culvert that consists of: a 24" x 30' hydraulic mining pipe to which 10' of CMP was attached. It appears to carry a large volume of water and material and has a high plug potential.

Treatment: - Replace with 36" x 60' **SBP** aligned with channel & at bottom of fill
- Install at channel grade of 15%
- Rock armor IL channel: 6' w x 5' l with "Apple box" rock (30 sq ft)
- Rock armor OL channel: 6' w x 5' l with "Apple box" rock (30 sq ft)

Site 487 – UTM: 511052 / 4494726
2.07 miles
Surface: Chip seal
Current: Crossing with a 30" x 40' plastic pipe installed at a flat grade with the potential to divert.

Treatment: - Rock armor OL channel 5' w x 5' l with "Apple box" rock (25 sq ft)

Site 485 – UTM: 511238 / 4494667
2.19 miles
Surface: Chip seal
Current: 2' x 0.5' Crossing with an undersized 22" x 50' HYD at a flat grade that is separated at the bottom at mid-length.
Treatment: - Replace with 24" x 40' **SBP** at bottom of fill
- Install at channel grade of 8%
- Rock armor OL channel: 5' w x 10' l with "Apple box" rock (50 sq ft).

Site 473 – UTM: 513251 / 4494156
3.56 miles
Surface: Chip seal
Current: A diverted stream: the undersized 12" x 40' CMP crossing is placed 75 feet downslope of the Class III channel in an area that was previously heavily mined. Moving the crossing to the stream channel would result in even more erosion.

Treatment: - Replace with an 18" x 60' CMP at the bottom of the fill
- Install at channel grade of 15%

Site 465 – UTM: 513251 / 4494156
4.76 Miles
Surface: Chip seal
Current: Class 3 fill xing located where the road is too steep to install a dip. Need to STOP sidecasting in this drainage.

Treatment: - Install 24" x 40' CMP at bottom of fill & aligned with channel
- Install at channel grade of 24%
- Rock armor OL channel: 3' w x 3' l with "Apple box" rock (9 sq ft).

Site 463 – UTM: 515470 / 4494342
5.07 miles
Surface: Chip seal
Current: Crossing with an undersized 18" x 50' CMP and a long ditch length.

Treatment: - Replace with a 30" x 60' CMP aligned with channel & at bottom of the fill
- Install at channel grade of 40% if possible
- Install new CMP with OL 12' down left of existing OL location
- Rock armor OBFF 20' across x 10' down (200 sq ft) with 0.75 to 1' diameter angular rock

Site 461 – UTM: 515692 / 4494311 **ROAD SURFACE CHANGE**
5.21 miles
Surface: Native
Current: Crossing with an undersized 18" x 40' CMP that appears to have diverted in the past. It receives a lot of runoff from a private driveway. The road changes from a chip seal to a native surface at this site.

Treatment: - Replace with the arched 30" x 40' CMP at the bottom of the fill
- Install at channel grade of 12% if possible
- Rock armor OL channel: 3' w x 3' l with "Apple box" rock (9 sq ft).
- Add Road Base and Surfacing:
    - Rock armor the road surface from 470' up left of the Site to conform to existing surfacing
    - Apply Asphalt Grinding surface to road: 16' w x 470' l

Site 460 – UTM: 515910 / 4494327
5.36 miles
Surface: Native
Current: Crossing at Joseph Creek with a plugged 36" x 50' CMP that is partly filled with sediment and mineral deposits and also has a 6" mining pipe running through it.

Treatment: - Excavate material from OL area (~5 cyds)
- Clean the existing culvert & assess condition
- Install critical dip with the filter fabric & large rock:

Site 459 – UTM: 516155 / 4494307
5.54 miles
Surface: Native
Current: Undersized DRC that was poorly placed is trying to handle site #458's diverted class 2 stream.

Treatment: - Clean culvert IL
- Cut off the last 2 feet of the OL **OR**
- Rock armor the OL gully: 3' w x 6' l with "Apple box rock" for 18 sq ft

Site 457 – UTM: 516620 / 4494003
5.91 miles
Surface: Native
Current: Crossing on Upham Creek with an undersized 46" x 80' CMP that has sediment and mineral depositing inside. R. Martin states that the pipe plugged in past and IB filled up with water.

Treatment: - Inspect the large rock already in the roadfill to see how far back into the road it is installed
- If the rock is not at least ½ width of road, install a proper critical dip with filter fabric & large rock – *ROCK WAS ALREADY INSTALLED IN THE ROAD SO THIS WAS NOT TREATED FULLY!*

Site 454 – UTM: 516957 / 4493610
6.3 miles
Surface: Native
Current: Crossing with an undersized 18" x 60' plastic pipe that has evidence of past overtopping. There is a berm that is directing runoff into a gully in the outboard fill. Also a sediment fan upstream of culvert IL.

Treatment: - Excavate upstream sediment fan to channelize the stream to the new culvert inlet: 22' up x 8' w x 2' deep (13 cyds)
- Replace culvert with a 30" x 80' SBP at the bottom of the fill & aligned with channel
- Install at channel grade of 32% if possible
- Install a critical dip with the filter fabric & large rock
- Remove 75' of berm from down left & the 50' of berm from down right

Site 452 – UTM:
6.74 miles
Surface: Native
Current: Class III fill crossing about 155' from the bridge over Indian Creek.

Treatment: - Install a rolling dip 67' down left of the fill xing
- Rock the dip

Site 449 – UTM: 517670 / 4492962
7.02 miles
Surface: Native
Current: Crossing with an undersized 18" x 40' CMP at a flat grade CMP that has a diversion potential. The downstream area and channel are very disturbed.

Treatment: - Remove the 50' berm on the OB
- Clean the pipe IL & OL
- Redefine the rolling dip that is 82' down left of the xing
- Rock the dip

Site 446 – UTM: 517454 / 4492392
7.52 miles
Surface: Native
Current: Crossing with a 30" x 100' plastic pipe at a steep and tight curve in the road that appears to have been installed about six years ago with rock armoring on the inlet and outlet. However, the inlet is partly crushed probably due to heavy maintenance. The entire area has been heavily logged and disturbed. There is a large amount of water going into the pipe compared to the size of the mapped watershed.

Treatment: - Install a critical dip with filter fabric & large rock:
  - Need to drop the road elevation from up right to conform it into the dip at the crossing:
  - Starting from ~160' up right of the xing, cut the road surface down to the dip
  - Rock the road after dip is installed: 160' long x 14' wide for 2,240 sq ft with shale or other suitable, accessible rock type

Site 444 – UTM: 517477 / 4492239
7.72 miles
Surface: Native
Current: A diverted stream: the undersized 18" x 30' CMP is placed 15' down the road from a Class II stream. It has the potential to divert down the road. Channel size appears modified, probably because of a road above.

Treatment: - Replace existing culvert with a 24" x 40' CMP aligned with the channel
- Install at channel grade of 32% if possible

- Attach 45° Elbow to OL of 24" CMP
- Attach 24" x 60' ROUND CMP Downspout to Elbow
- Attach a metal "T" to the 24" ROUND CMP Downspout OL
- Hold-downs for the downspout sections & elbow were ordered

Site 442 – UTM: 517620 / 4491951
8.27 miles
Surface: Native
Current: Crossing with a 30" x 45' CMP that drains into Cannon Ball Creek and receives two Class III streams. Thirty feet of downspout has been placed outside of the stream channel.

Treatment:
- Install a rolling dip 15' down left of xing
- Rock the dip
- Down left of the xing ~134' there is an 8" plugged DRC at the toe of a spring; leave this culvert installed.
- Install a 12" x 40' CMP 144' down left of the xing

Site 438 – UTM: 518275 / 4489366
11.04 miles
Surface: Native
Current: Crossing with an undersized rusty and plugged 18" x 30' CMP that has the potential to divert and is located next to Bully Choop Mine in a disturbed area. It receives runoff from the mine landing and has a pond at the inlet.

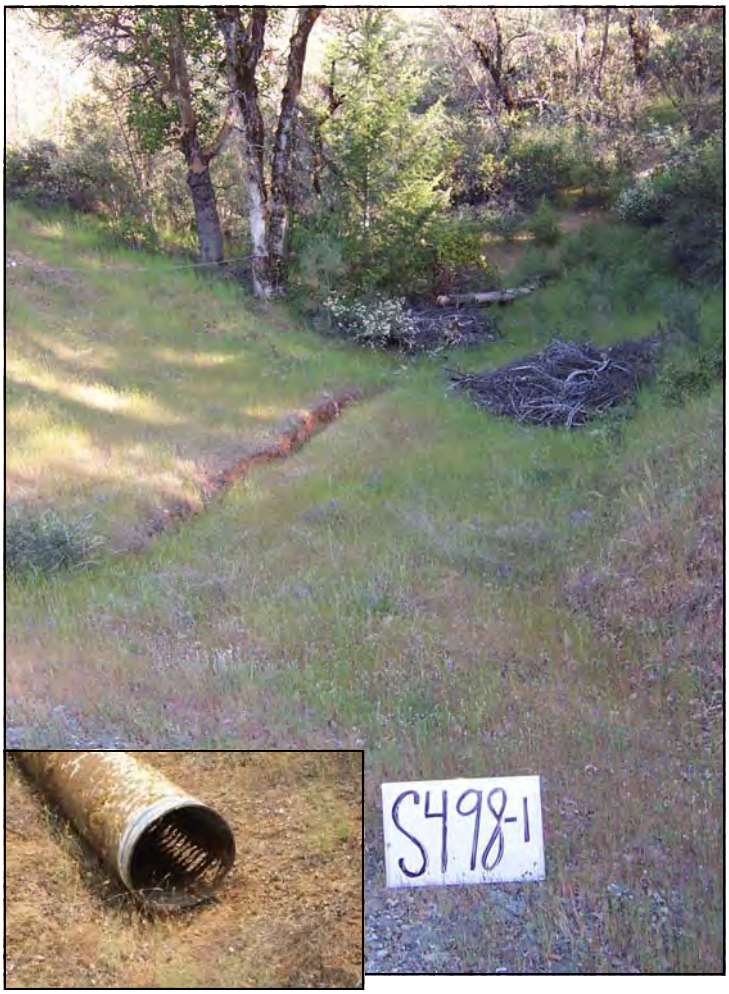
Treatment:
- Replace existing culvert with a 24" x 40' CMP at the bottom of the fill
- Install at channel grade of 21% if possible
- Redefine the rolling dip that is Current 75' down from the xing
- Rock the dip

Indian Creek Road Sediment Reduction Project
Final Project Photo Log & Treatment Descriptions

Contract No. P0510325—California Department of Fish & Game
Fisheries Restoration Grant Program

Work Completed by the Trinity County Department of Transportation & Five Counties Salmonid Conservation Program

Matching Funds provided by:
Trinity County DOT
Trinity River Basin Fish & Wildlife Restoration Program: Targeted Watershed Implementation Program; Grant No. 07FC200014



Site 498—Milepost 1.52—Treated Erosion: ~100 cyds

Stream crossing with undersized 18” x 40’ CMP that was causing outboard fill face erosion due to short length

Treatment: Replace with a 24” x 60’ CMP at bottom of fill, at channel grade & rock the outlet channel

Right photos are upstream channel & old culvert

Bottom & upper right photos are of the new 24” x 60’ CSP culvert installed with the upstream (top) & downstream rock armor (below)

Site 496
Milepost 1.69—Treated erosion: ~100 cyds

Stream crossing with undersized 18” x 35’ hydraulic mining pipe that was separated & causing road fill erosion.

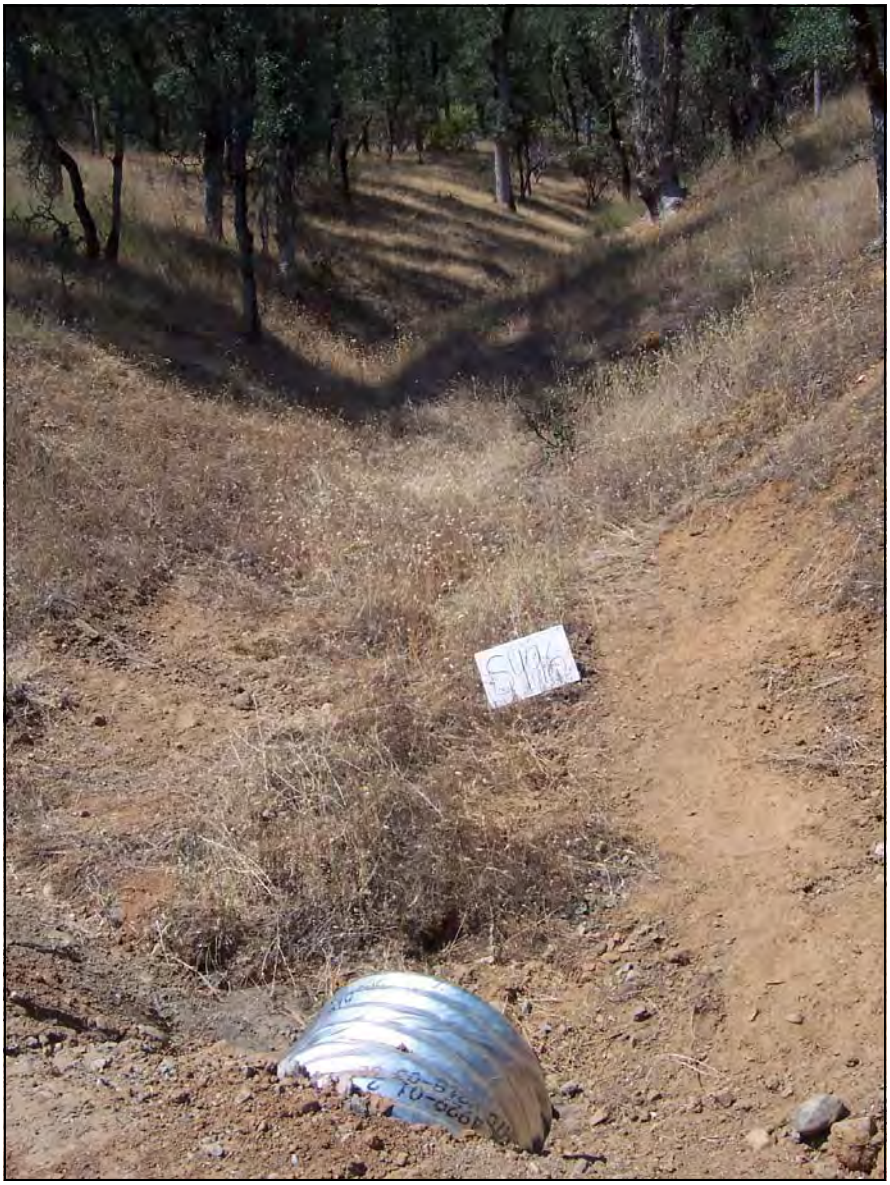
Treatment: Replace with 24” x 50’ CMP at bottom of fill & rock the outlet channel

Top left photo is looking upstream at watershed prior to project

Bottom left is same view with the new 24” Culvert installed

Bottom right top photo is the new 24” inlet

Bottom right photo is the rocked outlet channel



Site 493—Milepost 1.80—Treated Erosion: ~40 cyds
Stream crossing with 24” x 35’ CMP with a rusted bottom & plugged inlet
Replace with 30” x 80’ CMP aligned with channel, at bottom of fill & at 8% slope
Rock outlet channel to the new outlet of Site 492
Top photo is of the outlet & outboard channel prior to replacement
Bottom photo is newly aligned 30” CMP at bottom of fill with outlet of DRC replaced at Site 492 in background

Site 493
Milepost 1.80
Stream crossing

Top Left is inlet view prior to 30" culvert being Installed

Note plugging & misalignment with channel compared with newly installed inlet at bottom left

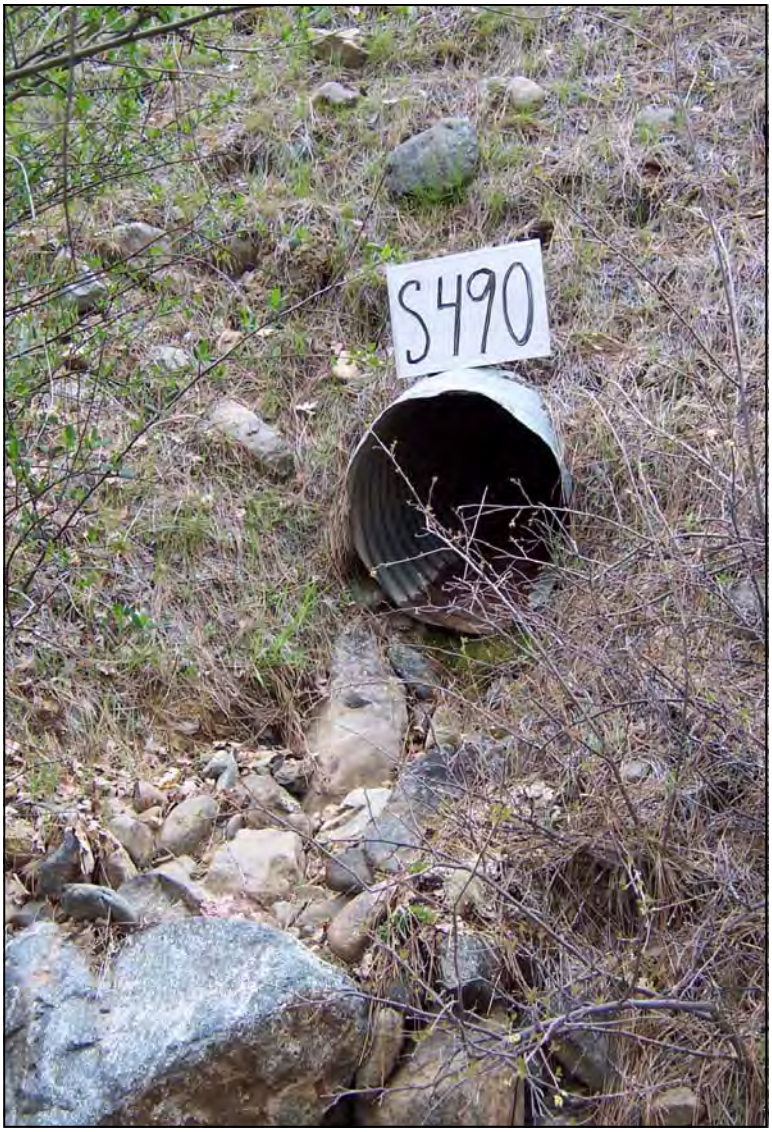
Top Right is inlet view looking down road to Site 492 prior to 30" culvert installation (bottom right)

Site 492—Milepost 1.82—Treated Erosion: ~10 cyds
DRC with undersized 12” x 30’ CMP that is also an overflow pipe for Site 493 up left.

Treatment: Replace with 18” x 40’ CMP in same location and outlet into rocked outboard outlet channel of Site 493

Top left photo is the inlet & right photo is the outlet prior to implementation

Bottom left & right photos are after the 18” DRC installation (note outlet of 30” CMP at Site 493 in bottom right photo)



Site 490—Milepost 1.92—Treated Erosion: ~175 cyds
Stream crossing with 24” x 40’ Hydraulic mining pipe at Inlet & 10’ length of CMP at Outlet

Treatment: Replace with a 36” x 60’ long Smooth Bore Plastic pipe, aligned with channel, at bottom of fill & at channel grade; Rock armor the IL & OL channels

Left photo is the outlet & top photo is the upstream channel prior to project implementation

Bottom photos are the inlet & outlet of the new 36” x 60’ HDPE culvert with inboard & outboard rock armor

Site 487
Milepost 2.07—Treated Erosion: ~60 cyds

Stream crossing with a 30” x 40’ plastic pipe installed at a flat grade that’s eroding the outlet channel (shown in left photo)
Treatment: Rock Armor Outlet Channel (bottom photo)

Site 485—Milepost 2.19—Treated Erosion: ~270 cyds

Stream crossing with an undersized 22” x 50’ Hydraulic mining pipe that is separated mid-length
Treatment: Replace with 24” x 40’ SBP at bottom of fill & at channel grade of 8%; Rock armor the outlet channel
Top photo is of outlet & erosion prior to implementation—Bottom photo is new 24” SBP with rock armored outlet

Site 473—Milepost 3.56—Treated Erosion: ~70 cyds

Diverted stream crossing with undersized 12” x 40’ CMP

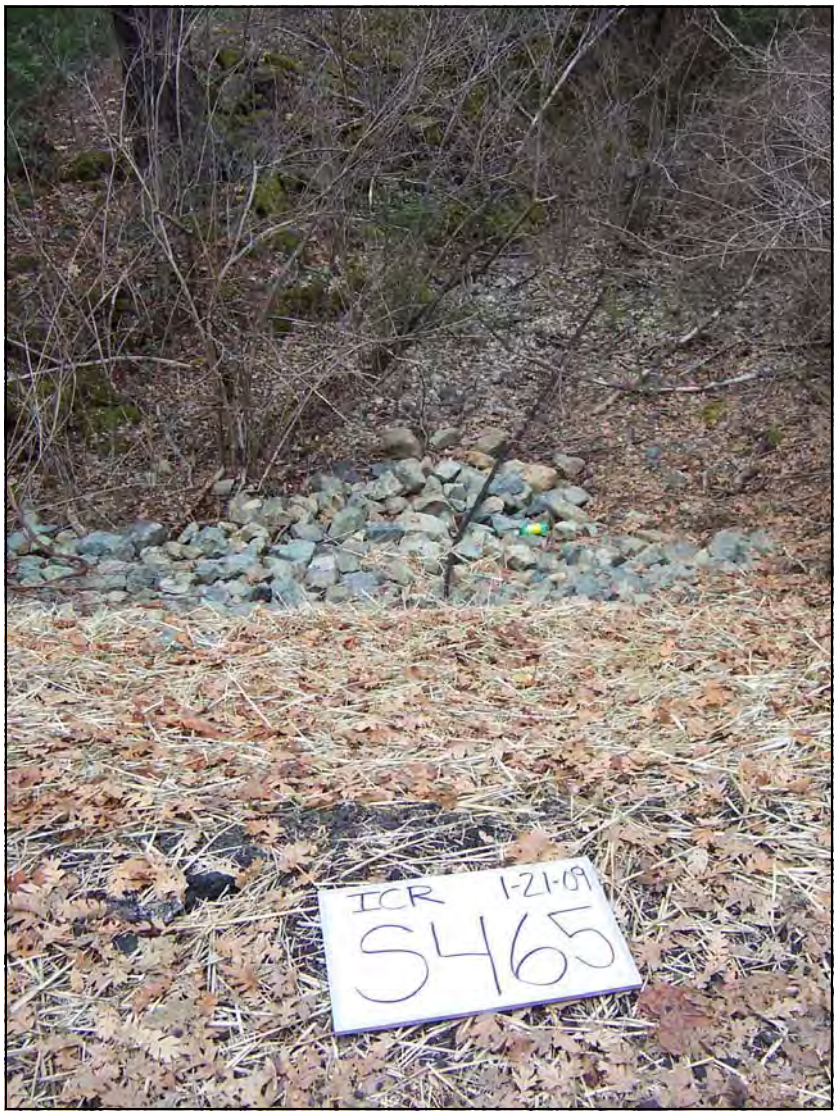
Treatment: Replace with 18” x 60’ CMP in the same place, at the bottom of fill & at channel grade of 15% slope

Top left photo is of the inlet area and 12” pipe prior to implementation & right is of new 18” culvert. Bottom left photos are post-implementation: left is of the outlet & right is the inlet—note proximity to Indian Creek

Culvert was left in the same location as moving to natural channel would result in increased erosion

Outlet at bottom of fill

Site 465—Milepost 4.76—Treated Erosion: ~30 cyds
Class 3 fill/stream crossing with steep left road delivering to Site
Treatment: Install a 24” x 40’ CMP aligned with channel, at bottom of fill & at 24% slope
**All photos are post-implementation as the pre-photos of this Site was taken at the wrong location on the road due to a mileage inconsistency
Top photos are of upstream watershed area & inlet with rock armor; Bottom photo is outlet



Site 463
Milepost 5.07
Treated Erosion: ~100 cyds
Stream crossing with undersized 18" x 50' CMP & long ditch length.

Treatment: Replace with 30" x 60' CMP aligned with channel, at bottom of fill & at channel grade of 40%. Install new CMP with outlet 12' down left of existing outlet location; Rock armor outboard fillface.

Top left photo is the plugged inlet prior to implementation & the new 30" inlet below.

Top right photo is the upstream channel prior to implementation & bottom right photo is same view after new culvert

Site 463—Milepost 5.07

Top photo is the outlet area prior to Implementation. Note erosion/outlet gully formation, short pipe length for road prism & pipe position in outboard fillface (not at bottom)

Bottom photo is the outlet at the bottom of the fill after replacement & rock armoring on the outboard fillface

Site 461—Milepost 5.21—Treated Erosion: ~110 cyds

Stream crossing with undersized 18” x 40’ CMP not at bottom of fill & substantial runoff from private road up left
Treatment: Replace with arched 30” x 40’ CMP at bottom of fill & at channel grade of 12%; Rock armor outlet channel; Surface the County Road for ~470 feet up left with asphalt grindings
This is where the County Road surface changes from chip seal to native surface.
Top & bottom left photos are of inlet & outlet prior to implementation, respectively
Top & bottom right photos are of the inlet & outlet after implementation - note new outlet at bottom of fill, rock armored channel & outboard fillface

Site 461—Milepost 5.21

Top photo is looking up left county road & at private road delivery/runoff from diversion line
The DOT outlsloped & surfaced this section of road from Site 461 to Site 460 (see photos on next page)

Site 461—Milepost 5.21

Treated Erosion: ~ 350 cyds
Top & Bottom photos are the section of outsloped & surfaced roadway between Site 461 & Site 460

Site 460—Milepost 5.36—Treated Erosion: ~310 cyds

Stream crossing at Joseph Creek with plugged 36” x 50’ CMP partly filled with sediment & mineral deposits Treatment: Excavate mineral material from outlet area; Clean culvert & assess condition; Install critical dip with filter fabric & large rock. Top photos are of the road prism at the crossing & looking down at the outlet area from the outboard road edge (note thick mineral deposits). Bottom photo is off Inlet area post implementation with culvert inlet cleaned; see following pages for photos of Critical Dip

Site 460—Milepost 5.36

Installed critical dip with filter fabric & large rock

Both photos are of the outboard fill face with C-dip rock & fabric installed. Rock extends approximately 10 feet back into the roadfill

Site 459—Milepost 5.54
Treated Erosion: ~50 cyds

DRC that drains the ditch up left & Class 3 fill crossing from Site 458 up left

Clean culvert & rock the outlet area that is starting to erode & form a gully

Top left photo is of plugged inlet—top right photo is same view post implementation

Middle left photo is of the outlet gully & bottom left is the gully area after rock armoring

Site 454—Milepost 6.3—Treated Erosion: ~200 cyds

Stream crossing with undersized 18" x 60' plastic pipe with evidence of overtopping. Outboard berm directs runoff to a gully on the outboard fillface & there is a sediment fan upstream of the inlet.

Treatment: Excavate upstream sediment fan to channelize to new culvert inlet; Replace with a 30"x 80' Smooth Bore Plastic pipe at bottom of fill, aligned with channel & at channel grade of 32%; Install critical dip with filter fabric & large rock; Remove 75' of berm that down left & 50' of berm down right. Top photo is the outlet prior to implementation; note its position half-way between road surface & bottom of fill. Bottom photo is newly installed culvert with outlet at bottom of the fill - see next page for photos of rocked outboard fillface & critical dip

Site 454—Milepost 6.3

Top photo is of the roadway configuration at the crossing prior to implementation
Bottom photo is the critical dip filter fabric & large rock as well as rock armored outboard fillface

Site 452—Milepost 6.74—Treated Erosion: ~110 cyds
Class 3 fill crossing ~155' down right of the bridge over Indian Creek near Cannon Ball Flat. Stream parallel to an old road bed.
Treatment: Install rolling dip ~67 feet down left of the crossing
Top photos are of crossing channel (black arrow) & the County Road prior to implementation
Bottom photo is the installed rolling dip with a rocked overside drain on the left—photo board is on the crest of the dip

Site 449—Milepost 7.02—Treated Erosion: ~76 cyds

Stream crossing with 18" x 40' CMP set at flat grade & diversion potential. There is ~50' of berm material stored on the outboard edge of the road (marked by black arrow in top photo)

Treatment: Remove the 50 feet of berm from the outboard; clean the culvert; install & rock rolling dip down left

Bottom photo is after treatment implementation with berm removed & dip installed (note rocked outboard fillface).

Site 446—Milepost 7.52—Treated Erosion: ~420 cyds

Stream crossing with 30” x 100’ Smooth Bore Plastic pipe that was installed ~6 years ago with rock armor at inlet & outlet. Upstream is private timber land & past logging activity has resulted in large amounts of material discharge to this crossing. Treatment: Install a critical dip with filter fabric & large rock. Requires re-grading the road up right to conform to the dip a the crossing. Rock the road after the dip is installed.

Top photo is of the crossing from up left prior to critical dip installation. Bottom photos show the upstream channel area & the road up right fro the crossing. See next page for post-treatment photos.

Site 446
Milepost 7.52

Top photo is view of installed critical dip & outboard rock armor

Note existing 30” HDPE culvert outlet at bottom of fill (black arrow)

Bottom photo is taken from ~50’ up left on the outboard edge of road & shows the overall critical dip installed at the crossing

Site 444—Milepost 7.72—Treated Erosion: ~100 cyds

Diverted Class 2 stream with an 18” x 30’ CMP installed down left ~ 15’ from the channel.
Treatment: Replace 18” culvert with 24” x 40’ CMP aligned with channel; at channel grade of 32% slope & attach a 24” x 60’ full round downspout with a “T” on the end to disperse flow.
In the top photo, the cones are lined up on the 18” culvert inlet & outlet & the wood stake marks where the new 24” culvert is to be installed location. Left inset is the upstream channel. Bottom photo is the newly installed 24” inlet & rocked headwall. DOT left the existing 18” culvert in place as an overflow culvert (see next page for additional photos)

Site 444—Milepost 7.72

Top photo shows the new 24” inlet with the existing 18” culvert inlet on the right hinge (black arrow) that was left in place as an emergency overflow culvert.

Bottom photo is the installed 24” x 60’ long full round downspout.

Site 442—Milepost 8.27—Treated Erosion: ~310 cyds
30” x 45’ CMP that conveys two Class 2 stream crossings with a 30’ long section of downspout.
A 100% plugged 8” diameter culvert is at the toe of a spring, ~134’ down left of the crossing.

Treatment: Install a rolling dip ~15’ down left of crossing & rock the dip; Leave 8” culvert & install a 12” x 40’ CMP overflow culvert ~ 10 feet down left of the 8” culvert.

Photo is the crossing prior to implementation with cones lined up on existing 30” culvert.
The wood stake on the inboard marks rolling dip installation location.
Post –project photo is unavailable at time of report submission due to access.

Site 438—Milepost 11.04—Treated Erosion: ~90 cyds

Stream crossing with undersized, plugged 18” x 30’ CMP with potential to divert
Treatment: Replace with a 24” x 40’ CMP at the bottom of the fill & at channel grade of 21%; Redefine the rolling dip that is ~ 75’ down right of the crossing. Top photo is of inlet prior to implementation
Bottom left photo is new 24” culvert inlet with rock headwall & bottom right is the outlet

Site 438—Milepost 11.04

Top photo shows wood stake at existing rolling dip ~ 75' down right of the crossing prior to implementation
Bottom photo is the rolling dip after DOT redefined it & redefined the outsloped shape of the road