POLICIES AND PROCEDURES FOR PROTECTING ANADROMOUS SALMONID HABITAT IN DEL NORTE, HUMBOLDT, MENDOCINO, TRINITY AND SISKIYOU COUNTIES

Field Assessment of Management Practices

Prepared for Five Counties Salmonid Conservation Program

By

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INTRODUCTION

The Five Counties Salmonid Conservation Program (5C) is a conservation strategy initiated by the five northwestern California counties of Del Norte, Humboldt, Mendocino, and Siskiyou, and Trinity. It was created in response to the 1997 listing of the coho salmon as a threatened species under the federal Endangered Species Act (ESA). The goal of 5C is "To strive to protect the economic and social resources of Northwestern California by providing for the conservation and restoration of salmonid populations to healthy and sustainable levels and to base decisions on watershed rather than county boundaries." Some overarching program objectives include:

- Evaluate options for improving county plans, policies, and practices for the benefit of salmonid habitat and water quality throughout the region.

- Provide training on "best management practices" (BMPs) to county staff engaged in activities that could adversely affect salmonid habitat.

- Improve the quality and quantity of salmonid habitat monitoring and reporting procedures.

One of the first steps taken by 5C in 1997 was to undertake an assessment of member counties' land use management policies and practices insofar as they affected salmonid habitat. The University of California, Cooperative Extension (UCCE) with funding from the State Resources Agency and UC Center for Water and Wildland Resources, conducted the assessment. It had three components:

- A review of all county policies, ordinances and development standards applicable to regulation of land use activities or county infrastructure maintenance potentially affecting salmonid habitat. The focus of the review was on the degree to which policies and regulations recognized and protected salmonid habitat.

- An analysis of the environmental review process results for typical land development projects. This entailed the selection of several case studies, procurement of project files and environmental documents and evaluation of mitigation measures applied to protect salmonid habitat.

- A field evaluation of typical land development and county maintenance activities with the potential to impact salmonid habitat. Interdisciplinary teams comprised of county staff, UCCE researchers, and environmental specialists did this evaluation.

A report was published in 1998 and the results were presented to 5C and member counties (hereafter referred to as the 1998 assessment). It contained a series of findings and recommendations for improving policies and practices, many of which have since guided Program conservation efforts.

In 2008, the first phase of a reassessment began. The policy analysis (first component listed above) and case study review (second component listed above) were repeated and a report was published (hereafter referred to as the 2008 policy analysis). The policy analysis disclosed many improvements in policies and procedures used by the counties to protect anadromous fish habitat. In particular, the analysis found that very substantial policy changes had occurred in the areas of county road maintenance due to the adoption of the 5C "A Water Quality and Stream Habitat Protection Manual for County Road Maintenance in Northwest CA Watersheds"

(2002) (hereafter 5C road manual). In addition, there had been changes at the state level increasing regulatory controls over grading and land development (i.e., extension of the State Water Resources Control Board General Construction Permit (General Permit) to sites one acre or more and requirements for Storm Water Pollution Prevention Plans (SWPPP)). Finally, the policy and case study evaluations showed that the counties had engaged heavily in performing inventories of fish migration barriers and road-related sediment sources. Counties had undertaken numerous projects based on these inventories to restore and improve habitat for anadromous salmonids.

The second phase of the reassessment, to complete the third component of the 1998 assessment was undertaken in 2010. This report describes the approach taken, the sites evaluated and the results. The recommendations outlined at the end of this report are based on observations made in the first and second phases of the reassessment. The principal investigator who conducted the original study led both phases of the reassessment.

This study is not a direct evaluation of the effectiveness of the 5C Program but rather is an assessment of the degree to which the counties have responded to a need for improving salmonid habitat management on the ground. The 5C has however, been a catalyst for many of the beneficial results obtained by the counties in regards to salmon conservation over the past 13 years.

METHODS

Methods used in this assessment generally followed those that were used in the 1998 assessment. A questionnaire was sent to county staff inquiring about the types of projects and land use management activities that have been commonly occurring over the past 13 years. In addition, county and 5C staff were asked to review a proposed field assessment form and provide comments on how county management had changed since the last assessment. In particular, the counties were asked how the conclusions and recommendations of the 1998 assessment had influenced their management.

On the basis of the responses received, the counties were asked to nominate sites where current management activities could be evaluated. For selected sites, the counties provided background information including project descriptions, before and after photographs, and copies of permits received from regulatory agencies.

Field trips to conduct field assessments in each county were done during July and August of 2011. The assessment team included 5C staff, a specialist in hydrology and water quality, county staff, and a graduate student intern. After a preliminary meeting to discuss the goals of the reassessment and field procedures, each selected site was visited. Evaluation consisted of observations and discussion among field assessment team members. Consensus on observations was recorded on field forms.

After completion of fieldwork, the field forms and background information provided by the counties were used to develop the results presented below. Additional information obtained through conversations with county staff and relevant incidental observations at sites not formally evaluated are also reported to help illustrate changes in land use and county policies and management.

QUESTIONNAIRE RESPONSES AND PRE-FIELD VISIT MEETINGS

SISKIYOU COUNTY

In 1998 and today, land development near streams or in watersheds supporting anadromous salmonids (Scott, Salmon, Shasta, and Klamath Rivers) is very limited. Most of the private land within those watersheds is in agricultural, recreational, or resource management uses. Development occurs primarily in the southern part of the county and in the vicinity of incorporated cities. Development pressures, which have been relatively light, generally have declined throughout the county in the past decade.

The county requires any new development that does occur to adhere to CEQA-required mitigation measures related to stormwater pollution control, runoff retention (runoff rates must be maintained at pre-development levels) and riparian setbacks recommended by the Department of Fish and Game (DFG). The county is in the process of adopting a Land Development Manual that contains prescribed setbacks from wetlands and riparian areas, recommendations for grading, and other performance standards. Until the manual is adopted, the county will continue to apply standards to development projects during the CEQA review process. The county has allowed, and encourages, flexible design standards to help avoid adverse environmental impacts. It has recently adopted a new flood damage protection ordinance. As part of this ordinance, a development permit is required for construction activity within a floodplain. Grading and development on sites greater than one acre are subject to the requirements of the Water Board General Permit and SWPPP. The county notes this on any parcel maps that it approves. Staff did state that site clearing conducted prior to the submission of development applications does sometimes occur.

The most important activities in 1998 were related to maintenance and repair of county infrastructure, particularly in response to damage caused by flooding in 1997-98. County staff indicated that today, streambank protection projects, road maintenance, restoration, and emergency infrastructure repair in response to the floods of 2005-6 are most important. The county maintains a “Work Log” of road maintenance that tracks projects involving outsloping, berm removal, critical dip installation and culvert and ditch clearing, which constitute the majority of its routine activities. These projects are undertaken to improve drainage and prevent failure of drainage features. Many projects are located in the Scott River watershed. The Scott River is identified as a sediment-impaired stream wherein efforts to reduce sediment discharge are required under the Total Maximum Daily Load (TMDL) Action Plan (adopted in 2008). The 5C road manual is identified in the Action Plan as the recommended Best Management Practices applicable to sediment reduction associated with county infrastructure.

During 1998-2010 the county removed eight fish barriers. For example, the White’s Gulch and Horse Creek projects entailed the replacement of metal culverts with pre-cast concrete bridges. All of these projects had been identified in the county’s inventory of migration barriers prepared pursuant to the 5C Program. The total costs for these projects were close to $800,000 with funding provided by the county, DFG, FEMA, and Bureau of Reclamation.

In the winter of 2005-2006 there was substantial flooding in Siskiyou County and throughout the region. The flooding caused numerous failures along county roads. Many of these failures were directly adjacent to streams supporting anadromous fish. A report entitled “Update on the Flood of 2005” prepared by county staff lists projects that were undertaken in response to this flood. The report describes the projects, indicates what permits were required and obtained, and provides before and after photographs of project sites. All projects had permits or permit

waivers from the DFG, Army Corps of Engineers (hereafter, Corps), and Regional Water Board. The types of projects included:

- Repair of eroding banks along roads (including re-establishment of road surface)
- Culvert replacement
- Energy dissipation at culvert inlets/outlets
- Bridge repair
- Combinations thereof (e.g., culvert replacement and bank protection, etc.)

In all of the projects, the county followed practices contained in the 5C road manual, including use of combined rip-rap and vegetative bank protection (bioengineering).

As with most counties, Siskiyou County staff indicated that since the original assessment, there has been a huge increase in the amount and level of documentation for road maintenance and improvement projects. Although the workload has increased because of this, the resources available to do so have decreased. Staff is concerned about the ability to maintain the current level of documentation, let alone any increase as a result of any new regulations.

DEL NORTE COUNTY

Activities that were important in 1998 remain so today. Those include hillside development (grading impacts), streambank stabilization, road maintenance, replacement of stream crossings and stormwater management. Projects involving restoration and access to salmonid habitat have increased over the past several years. Since 1998, the county has implemented six projects to improve fish passage.

Del Norte County has limited private land and most new development occurs in and near existing urbanization or in rural areas zoned for residential uses. Infill on existing lots and lot splits are common. The county has an ordinance that prohibits development on slopes greater than 30 percent. On subdivision and parcel maps it includes a notation that a General Permit from the Water Board is required and that a SWPPP must be prepared and available on-site during construction. Inspections are conducted to ensure compliance. The county recently amended its Flood Damage Prevention Ordinance to require developments in floodplains to meet performance standards and avoid downstream increases in flooding. Floodplain development is limited mainly to infill on existing lots.

For projects that are adjacent to a water body or wetland, biological assessments are routinely required. Riparian buffer recommendations of DFG are generally implemented as proposed. Riparian and drainage maintenance agreements are conditions of subdivision approval. On minor subdivisions, this is done through a note on the parcel map and notice of conditions. Staff noted that sometimes the county inherits maintenance duties created by private development for which the county receives no funding support, which is also not uncommon in other counties.

With respect to public works projects, over the past few years the county road division has undertaken a program of surfacing unpaved roads to reduce surface erosion and provide dust control. From 2008-2010 it rocked 0.25 miles of unpaved road, chip sealed another eight miles and paved two miles of road. Other projects completed during this period included the installation of four bridges and replacement of several culverts. It has also implemented drainage improvements (rolling dips) on several roads, following the recommendations of the 5C road manual and “low impact to hydrology” (hereafter LITH) design guidelines. Staff noted that the extent of ditch maintenance practices is sometimes limited by a lack of suitable spoils

disposal sites. This concern seemed most important in Del Norte County as compared with the other counties.

TRINITY COUNTY

In 1998, the principal activities that affected anadromous fish and their habitats included grading, road maintenance and emergency infrastructure repair. Land development activities in Trinity County were minor in 1998 and continue to be relatively infrequent today – particularly in regard to impacts on anadromous salmonids. This is due to market forces and limited available land. Development in and near streams and riparian areas is controlled in part by the county's floodplain ordinance that has been revised twice since 2000 to include provisions for protecting anadromous fish habitat. Staff indicated that pre-planning development project consultation is only advisory and not required.

County staff indicated that since 1998, some additional activities had become relatively important. These include replacement and/or renovation of culverts and bridges to accommodate flooding and fish passage and flood control channel maintenance. County flood control channel maintenance practices conflict with the requirements of the Army Corps of Engineers (this is discussed further in the Results section).

Trinity County staff also commented on an increased amount of marijuana cultivation creating environmental, water quality, and other impacts. In fact, these impacts have led to hiring the county's first ever code enforcement officer. While the officer does not specifically evaluate impacts to natural resources, the creation of the position illustrates the magnitude and effects of this change in land use.

In relation to the conclusions and recommendations of the 1998 assessment, county staff commented that although no formal grading ordinance has been adopted, the relatively limited land development that has occurred in recent years has been subject to Water Board General Permits (on sites over one acre) and SWPPP requirements. During the pre-field meeting, county staff said that they believed that grading was having adverse impacts on water quality.

The 5C road manual and training of county staff in fish-friendly road maintenance has had positive effects. Between 2008 and 2010, the county implemented over 250 drainage improvements on its roads including the installation of over 90 rolling dips, upgrading over 40 culverts, and installing over 30 critical dips. It has created a site for storage and re-use of spoils derived from maintenance activities. Ten migration barrier removal projects were completed since 1998.

MENDOCINO COUNTY

Land development, grading, floodplain development, road maintenance, and emergency infrastructure repair were important activities in 1998. New activities that have become important since then include installation of culverts and other crossings to facilitate fish passage and restoration/remedial actions to reduce sediment production from roads.

As with most of California, the pace of new development in Mendocino County has slowed considerably in recent years. Major subdivisions or large-scale commercial or industrial projects are rare. The majority of land development activity involves minor subdivisions, construction on existing lots, issuance of Certificates of Compliance for patented parcels dating back 100 years or more, and changes to existing uses. Regulatory controls over land development are currently

more stringent in the designated Coastal Zone but the county is embarking on a long-term project to create a more uniform set of development standards in line with recent revisions to the General Plan. County staff stated that DFG staff will be increasing their involvement in the environmental review of projects in the Coastal Zone. The county still does pre-submittal consultations on development applications but has not convened a round table of regulatory agencies recently due to the low volume of applications. The county's ability to do code enforcement has decreased over the last few years due to reductions in enforcement officer and building inspector staffing. Existing building inspectors are not trained in water quality or watershed issues.

Mendocino County has not adopted a grading ordinance but all development over one acre is subject to the Water Board General Permit. A Stormwater Ordinance may go into full effect in the near future. Also, the revised General Plan has policies restricting development in floodplains and impacts on riparian vegetation. The few major subdivisions that have occurred over the past decade have included features such as density transfer from sensitive to less sensitive areas of sites, stormwater pollution controls, and setbacks from streams and riparian areas. There have been no new public road or flood control projects.

All counties within the 5C region are responsible for maintaining and upgrading extensive road systems. In Mendocino County, this system consists of over 1,000 miles of paved and unpaved road, over 1,500 culverts, and over 900 stream crossings. Over the past several years, the county has implemented projects to remove migration barriers and eliminate sources of sediment. Maintenance practices generally conform to the recommendations of the 5C road manual. The county has implemented eleven fish passage improvement projects since 1998.

The 5C road manual and associated training have had positive effects on road and drainage feature maintenance. Examples of improved management include use of energy dissipators at culvert outlets, designated vehicle wash areas, and better control over disposal of spoils materials. The county has completed an assessment of sediment problems on its road system as well as some sediment reduction projects.

HUMBOLDT COUNTY

Of the five counties, Humboldt continues to experience the most pressure from land development. This is reflected in the fact that Humboldt has retained the highest level of planning staff of all the counties. Most development pressure is concentrated in the area of Humboldt Bay but there is a significant amount of rural subdivision activity as well. Growth has slowed over the past several years and is predicted to remain at moderate levels in the foreseeable future. Staff reported that DFG staff are very engaged in project review and do early consultation. DFG is also requiring proof that well water sources are not connected to surface water. One of the current challenges identified is incorporating low impact development standards (LID) into projects. This is becoming a common request from the regulatory agencies. Implementing these can increase the costs of development. Easy to understand LID design standards and specifications are not readily available to project proponents.

Humboldt County Public Works is responsible for maintaining over 1,200 miles of road, a quarter of which is un-surfaced and an estimated 3,000 culverts. Many of these culverts date back to the 1960's and are in poor condition. During the flooding of 2005-06 some of these failed, resulting in sediment discharge to creeks. Between 2001 and 2010, the county removed and replaced 24 large diameter culverts that were at risk of failure.

Since 1998, the county has implemented twenty-five projects to improve fish passage, a major bioengineered streambank protection project along the Mad River, and several improvements to road drainage systems. Numerous other maintenance activities that curtailed erosion and sedimentation also occurred. As with other counties, Humboldt County has experimented with the use of recycled asphalt and permazyme to stabilize road surfaces.

FIELD ASSESSMENT RESULTS

INTRODUCTION

Field assessment encompassed typical activities potentially affecting anadromous salmonids within the five counties. These included activities regulated by the counties (i.e., land development) as well as activities undertaken by the counties themselves to maintain infrastructure. Activities aimed specifically at improving conditions for anadromous salmonids were also reviewed. All projects and activities had been undertaken and completed since the original 1998 assessment. In total, over 30 sites were visited. Observations and findings are presented below by category of activity. Projects listed in italics were observed, but because they were not yet built/completed, they were not considered part of the evaluated sites. They did however contribute to discussions and observations of general trends within each and/or in all counties.

LAND DEVELOPMENT

Land development in general can have short-term and long-term impacts on anadromous salmonids. Short-term impacts are associated with erosion and sedimentation and potential harassment and displacement of fish during construction in or nearby streams. Long-term impacts include loss of riparian or instream habitat, modification of hydrologic processes (increased runoff from impervious surfaces, alteration of natural drainage patterns and channels, alteration of flood regimes), reduced streamflow or groundwater due to domestic use, and non-point source pollution. We evaluated residential, commercial, and institutional developments. Within each project we focused on the approaches taken to: avoid direct, long-term impacts on habitat; minimize construction-related erosion and sedimentation; and ameliorate hydrologic impacts. There was a preference for projects that illustrated changes in land use policies that had occurred since 1998. This was somewhat difficult in that the construction/completion of development projects, particularly larger ones with more potential for impacts to salmonids, often occurs many years after the entitlements are obtained. Therefore some of the development projects observed reflect conditions and policies that were in place prior to 1997. It is anticipated that subsequent reassessments of the 5C Program in regards to land use development will reflect policy changes since 1998 and that continue to occur today.

We did not observe any instances where the water source for a development was derived from on-site sources. This occurs throughout the region, however, and authorized and unauthorized streamflow diversions are considered a serious problem. Anecdotal information indicates that numerous tributaries to anadromous fish streams that may serve as spawning and rearing habitat have highly altered flow regimes, particularly during the low-flow season. In one instance reviewed in the 2008 policy analysis, DFG objected vociferously to a project in Humboldt County where a streamflow diversion was proposed to serve a minor subdivision. Omission of activities involving diversions from this assessment should not be construed as an indication that they are not an important constraint to recovery of listed fish species. As a rule, if alternative sources of

domestic water supply exist, the counties will require developments to employ the one with the least potential for impacting habitat. Recently some counties have reported a significant rise in water diversions and other impacts arising from a boom in marijuana cultivation. For safety and other reasons, no marijuana cultivation land uses were reviewed as part of this assessment. Some counties are already undertaking measures to help minimize the impacts of this recent shift in land use.

Table 1 summarizes the sites where land development activities were reviewed. No development projects were evaluated in Siskiyou or Trinity Counties because there were none in the last several years that have been built or completed. The relatively few projects that have been implemented consist of minor entitlements such as lot line adjustments. It is worth noting that throughout the program region, some proposals never reached the point of undergoing official review because developers abandoned them.

Table 1: Land Development Projects

Project	Location	Key Features
Apartments	Del Norte County	Riparian setback, stormwater retention, wetland mitigation
Minor Subdivision	*Del Norte County*	*Riparian/wetland setback, culvert replacement*
Major Hillside Subdivision	Del Norte County	Riparian setback, unregulated grading, erosion and sedimentation
Major Commercial Development	*Del Norte County*	*Riparian setback, stormwater management*
Low Income Housing, Major Subdivision	Mendocino County	Stormwater management
Major Subdivision	Mendocino County	Floodplain development, riparian setback
Mixed Use Subdivision	Humboldt County	Stormwater management
College of the Redwoods	*Humboldt County*	*Riparian/wetland setback, stormwater management, erosion control*

Projects listed in *italics* were observed, but because they were not yet built/completed, are not considered part of the evaluated sites. They did however contribute to discussions and observations of general trends within each and/or in all counties.

Direct Impacts on Riparian and Instream Habitat

All of the counties have formal or informal requirements for avoiding development impacts on streams and associated riparian habitat. These include ordinances, zoning designations and CEQA-derived standards. In some cases, recommendations for avoidance of riparian areas and streams are provided by DFG. They may be adopted as proposed by the counties or they may be modified during the project approval process. This tends to vary between and within jurisdictions. In areas of counties that are within the Coastal Zone, requirements for avoidance of riparian areas, wetlands, and critical resources in general are more stringent.

Apartments. In Del Norte County, streamside areas and wetlands are designated as Resource Management Areas wherein development is not permitted. The Apartments project we reviewed consists of an 81-unit complex occupying about six acres on an 18-acre site with an intermittent stream on it. No fisheries resources were present within the site boundaries but the site drains to an anadromous fish stream. A biological assessment was prepared for the project, which recommended a 50-foot setback from the stream top of bank. This condition was required by

the county and observed in the field. A fence was installed between the development and the riparian buffer to prevent unauthorized access. There was encroachment on a wetland area to construct a road crossing and extend a culvert. The developer was required to replace the lost wetland as a compensation measure. There were exotic plant species observed within the riparian corridor. The county does not have a policy regarding the use of non-native species for landscaping and regulatory agencies did not discourage their use. A retention basin, designed for a ten-year event per county requirements, was installed to store runoff.

Minor Subdivision. *This Minor Subdivision was a split of a six-acre parcel into two three-acre parcels. A pond and unnamed stream were located on the site. As with all projects in Del Norte County where wetlands, streams or similar resources exist, a biological assessment was prepared. It recommended setbacks of 50 feet from the pond outflow and 75 feet from the pond itself. Comments from DFG recommended fencing to keep horses away from the pond, planting riparian species in the prescribed buffers, removal of a culvert potentially acting as a migration barrier to fish, and replacing an existing undersized culvert with a new one that would permit passage. The county adopted all of these recommendations as conditions on approval. No home construction had occurred at the time of field assessment so fulfillment of conditions could not be assessed. We observed that a new culvert installed on the existing access road was misaligned with the channel, is shorter than it was supposed to be, and appeared to be prone to blockage or potential failure at high flows.*

Major Hillside Subdivision. This project has had a long complex history, most of which concerns construction-related erosion and sediment control. The project consisted of 22 lots on a 133-acre parcel located on hillsides draining to an anadromous fish stream in Del Norte County. Only 16 of these potential parcels were recorded as of the time of the site visit. Delineation of the Resource Management Area on the site (riparian zone along creek) indicated that it was approximately 10 acres. The development utilized density transfer to create a 70-acre parcel encompassing the riparian area wherein no development could occur. DFG recommended an additional 100-foot buffer on this parcel because of concern about anadromous fish and endangered plants. This recommendation was not adopted. The county ultimately required a buffer of 50 feet from the center of the creek. Today's standards would have generally required a 100-foot setback from the edge of the riparian zone. Although no direct impacts on the stream or riparian zone occurred or were observed in the field, sedimentation had a significant effect on the creek and on neighboring properties (see subsequent discussions below).

Major Commercial Development. *The expansion of an existing retail department store on county land near Crescent City triggered the need for a full Environmental Impact Report under CEQA. Documentation of this project was reviewed in the 2008 policy analysis and the site was visited at that time. The site is located adjacent to a creek that is tributary to an anadromous fish stream. As a condition to approval of the original project in 1992, the county required that a 50-foot buffer be established between the development and the creek. As discussed below, this buffer was used to accommodate a variety of devices for managing stormwater. The store expansion had not occurred at the time of field assessment.*

Major Subdivision. In Mendocino County, riparian and stream setbacks and buffers are determined on a case-by-case basis, generally through the environmental review process. This may change in the future, however, since the county will soon embark on a revision of its development codes. In the recently adopted Ukiah Area Plan, riparian buffers are prescribed on the basis of stream classification. This was the only project visited that was on an anadromous fish stream that included a riparian buffer. It was a case study subject in the 1998 assessment

and subsequently built. It is located in the 100-year floodplain of the West Fork of the Russian River. The project consists of over 100 residential lots on a 32-acre parcel. As a condition of approval, the county required a 100-foot buffer between lots and the bank of the Russian River, creating an open space parcel of approximately four acres. The parcel is separated from the development by a six-foot fence. The parcel is owned and managed by the development's homeowners' association. Management does not appear to address encroachment and damage to vegetation and fencing, control of non-native vegetation, or litter clean-up.

Figure 1: This park is located within the prescribed buffer along the Russian River on the Major Subdivision site. The fence at the left of the picture is less than 20 feet from the top of the bank.

Our observations indicated that the buffer was primarily vegetated by ruderal species and that limited tree cover existed immediately adjacent to the river. This probably reflected the parcel's past use for agriculture (Figure 2). Exotic plants, trash and other debris were present.

Figure 2: The riparian buffer parcel on the Major Subdivision site. There were no indications that it was being managed to enhance riparian

values. The county lacks staffing and resources to do long term project monitoring to ensure compliance with development conditions.

College of the Redwoods. *In Humboldt County, a comprehensive ordinance governs development involving riparian and wetland resources, soil disturbance, and geologic hazards. "Streamside Management Areas" must be mapped and avoided. We evaluated one project where wetland resources were involved. In addition, we obtained documentation indicating the number of projects where the ordinance had affected development.*

The proposed expansion of the College of the Redwoods triggered a requirement for modifying its Coastal Permit. Expansion included demolition of one building and construction of three new buildings. Wetlands, man-made ponds, and other watercourses with riparian vegetation are present on the site. In an initial application, the College proposed to encroach on a designated Streamside Management Area and compensate for that by riparian restoration elsewhere on the site. That proposal was withdrawn and the College revised its plans to completely avoid impacts on the Area. As presently approved, no new development is permitted to occur within 100 feet of riparian or wetland resources. Project construction is underway. During the site visit, some disturbed areas did not appear to be adequately treated with sediment controls (see subsequent discussions).

Humboldt County has not experienced a substantial amount of development activity within designated Streamside Management Areas since adoption of the ordinance. Data provided by the county indicates that only two proposals within designated areas were approved in 2008-09. Four were in process at the time of the field visits (August 2011).

Conclusions. On the basis of this review, we conclude that all counties have required buffers or setbacks from riparian areas and streams regardless of whether they have formal regulations in place. The size and effectiveness of these buffers may vary; and a concern that we had in 1998 about long-term management of these areas is still pertinent. In particular, at the Major Subdivision in Mendocino County, we saw no indication of management or enhancement of the set-aside riparian parcel.

Construction Related Erosion and Sedimentation

When the initial assessment was done in 1998, the impacts of construction-related erosion and sedimentation were of concern, particularly since only one county had a grading ordinance. The regulation of grading has increased substantially over the past 13 years both at the county level and at the regional and state levels. Consequently, it is standard practice of county road departments throughout all the counties to avoid wintertime grading and require erosion control measures at all construction sites. This is not true at private development or construction sites, particularly in counties with no grading or similar ordinance. Unauthorized and unregulated grading are causes of concern in regards to water quality and fish habitat. For development projects that pursue permits, erosion control measures will commonly be prescribed in a SWPPP and reinforced as county conditions on project approvals. We did not conduct our assessment during the winter and consequently we cannot comment on the implementation and effectiveness of controls over grading. We did, however, observe erosion control devices in place at several locations and evidence of erosion and sedimentation where these measures were either not installed or had failed to perform.

Major Commercial Development. *Requirements for erosion control at this site in Del Norte County appeared comprehensive. In addition to requiring a SWPPP, the county required that no*

disturbed areas could be left without erosion control measures in place during the winter or spring. On-site sediment retention was achieved through use of basins, runoff treatment devices, traps, or other measures. The project will require the addition of underground treatment devices within the existing outfalls and the submission of a stormwater management plan. Revegetation is supposed to occur as soon as practical after disturbance (Figure 3).

Figure 3: At this commercial site in Del Norte County staked straw rolls and a silt fence were in place along the entire boundary between an adjacent creek and the development (August 2011). We also observed similar measures in place at stockpiled soil.

Major Hillside Subdivision. The Major Hillside Subdivision in Del Norte County represents a case where controls were available and implemented but ineffective. Moreover, the developer chose to proceed with grading without authorization from the county. This project was first proposed in 1991. Its approval was reinstated in 2002 subject to several conditions. These conditions included no development on slopes greater than 30 percent, no development on slopes between 20-30 percent that had high to very high erosion potential, and a requirement for submittal of engineered grading and drainage plans to the county prior to any earth disturbing activities. Additional required measures included provisions for dissipating runoff velocities in ditches and installation of catch basins. All disturbed areas were to be revegetated.

In 2003 the county alerted the Regional Water Board to unauthorized grading at the site. Upon inspection by Board staff and DFG, it was determined that sediment discharge to the creek had occurred. Erosion control measures that had been installed were not functioning. The Board issued a Cleanup and Abatement Order. Erosion problems persist to this day (Figure 4). At the time of field review, substantial areas of individual lots were still barren and eroding, contrary to a condition on the development that required revegetation.

Figure 4: This drainage ditch along one of the roads in the Major Hillside Subdivision had eroded and incised, creating a potential for plugging the ditch relief culvert. There had been attempts to stop the incision by installing concrete in some locations.

Other Observations. Potentially ineffective controls were observed at the college construction site in Humboldt County during the summer season. This included improperly maintained silt fences, lack of silt barriers and use of straw mulch to intercept sediment (an inappropriate application). Based on a supplemental site visit in October, it appeared that corrections were made (Figure 5).

Figure 5: The corrected measures included addition of a coir roll along the disturbed site (above) and on the edge of the road across from the site (not shown).

Unregulated grading we observed in Trinity County displayed a complete lack of controls (Figure 6). Trinity County does not require a permit for grading. We observed unregulated and illegal grading (grading in violation of local or state regulations) in other counties as well. The extent of this activity and its significance to anadromous fish is not known. Counties lack the staff or resources to monitor for illegal and/or improper grading.

Figure 6: Unregulated grading near Weaverville, Trinity County. This site has been of considerable interest to the Regional Water Board.

Conclusions. We conclude on the basis of these observations that there are regulatory controls over grading at the regional and state levels and in Del Norte and Humboldt Counties, at the county level. Actual performance varies however, and although impacts may be avoided if land development complies with regulations and implements provisions for erosion control, there are still instances of unregulated grading, poor implementation of erosion control devices, and lack of enforcement. Some of this undoubtedly impacts local streams, water quality, and potentially anadromous fish habitat.

Modification of Hydrologic Processes

In 1998, we observed some approaches to minimizing development impacts on hydrology. In addition to restrictions on development in floodplains, these included the use of on-site retention basins and conditions requiring that new development not change downstream flood regimes. Since 1998, all of the counties have required that new developments not increase runoff rates or downstream flooding. The use of on-site detention to reduce development-induced runoff has become commonplace throughout most of the region. In addition, for some of the developments we evaluated there were other innovative approaches used such as pervious pavement and vegetated drainage swales. For other developments, however, conventional methods were used for disposing of runoff. And, although the counties all have regulations governing development in floodplains, we observed one case where a project was built directly in the floodplain of an anadromous fish stream. As documented in the 1998 assessment, this project was approved amid much political controversy.

Apartments. At the Apartments project in Del Norte County we observed one basin that served both to collect non-point source pollutants and detain development-induced runoff. According to county code, it was sized to accommodate the 10-year storm event. The inlet of the culvert at the lower stormwater outfall featured a 45-degree elbow that could increase the potential for plugging. No provisions for on-site detention were observed at other Del Norte County development projects. In the Major Hillside Subdivision, no conditions on approval were found relating to on-site detention.

Major Commercial Development. *At the commercial site in Del Norte County runoff from the development was directed to a grassy swale with underground treatment facilities that appeared to ultimately discharge via three outfalls to acreek. The swale and treatment facilities were designed to both remove pollutants and delay runoff to the stream (Figure 7). The county also required that a stormwater management plan include provisions such as porous pavement, green roofs, vegetated swales, retention basins, etc. to the degree feasible.*

Figure 7: The swale on the left in the photograph conveys runoff from the development to three outfalls to an adjacent creek. In the top center of the photograph the entrance to an in-line treatment device is visible.

Low-Income Housing, Major Subdivision. The low-income housing project in Mendocino County we reviewed exhibited several features that provided on-site stormwater retention. Storm drainage was conveyed to a minor watercourse bordering the site by means of vegetated swales lining the streets and paralleling property boundaries. No specific design standards for these swales were required. The effectiveness of the placement and design of those used in this project is uncertain (see Figures 8 and 9).

Figures 8 and 9: These show the inlets of the street side swales. Based on the placement and topography, it is uncertain how much runoff would enter or bypass the swales.

The minor watercourse bordering the site had been enhanced by plantings of willows, cattails, and other wetland and riparian vegetation. Eventually, drainage from the site enters the Russian River. Houses were equipped with porous pavement driveways and roof runoff was directed to street-side vegetated swales. Although no retention basins were located on the site for temporary storage of storm runoff, the system of swales in itself could act to store runoff and mitigate off-site increases in flood peaks.

Major Subdivision. At the Major Subdivision in Mendocino, conditions on approval stipulated that building pads be raised to a level above the predicted 100-year flood elevation. This required importation of up to 30,000 cubic yards of fill to raise pads approximately two feet. Roads and undeveloped areas were not filled. Additional conditions included incorporation of flood attenuation basins or other facilities to mitigate impacts on downstream flooding.

No retention facilities were observed at the Major Subdivision. The drainage system appeared to be conventional curb and gutter with storm drains spilling to the Russian River. House pads were filled to an elevation above the 100-year flood plain but the internal storm drainage system was built to accommodate 10-year recurrence interval flood flows. Hydrologic analysis prepared during the project approval process indicated that the development would not increase downstream flooding in the Russian River. That analysis was questioned however, and its accuracy is unknown.

Mixed Use Subdivision. The approach to stormwater management in the Humboldt County Mixed Use Subdivision was not obvious during the site visit. The site and roofs appeared to be draining into two separate systems: a drain leading off-site at the rear of the parcel and the existing stormwater system at the main access road. This was based on the site topography and the lack of pipes on the original plans directing stormwater from the front to the rear of the property. The system design was clarified after the site visit by the project's lead planner based on his conversations with the county Public Works division. The planner conveyed that the site directs stormwater to an underground retention facility that consists of pipes sized to retain the runoff thought to be generated by the site in the two-year pre-construction storm event. While these pipes drain off-site, there is no detention facility at the outfall. No stormwater is directed into the existing drain system in the street via conventional curb and gutter.

College of the Redwoods. *At least one retention basin is located within the College of the Redwoods complex in Humboldt County. Additional retention facilities will be built in conjunction with new construction. Two existing ponds and wetlands may also serve to retain runoff. County conditions on the project require that site impervious surfaces be limited to 25 percent of the gross area, that development not increase runoff discharge rates to adjacent wetlands and that Low Impact Development Features (LID) features such as vegetated swales be incorporated into the development. Construction was still in progress and the new buildings that were being actively constructed were cordoned off for safety.*

Conclusions. Based on the projects we reviewed, we conclude that all of the counties where land use development was assessed require or at least encourage developments to minimize impacts on runoff rates. For example, Humboldt County requires post project runoff rates to be within 10 percent of pre-project rates. This is accomplished mainly through the use of detention basins either on or off site. Other methods such as infiltration and evapo-transpiration are also allowed. Counties also encourage LID techniques for reducing hydrologic impacts and some have adopted the "Green Building Code" which stipulates some of these measures. Development in floodplains, exemplified in the Major Subdivision in Mendocino County, would appear to be anomalous at least according to county planning staff. The counties have recently changed policies to prevent such development in the future. The lack of detention facilities at the Major Subdivision also appears to be a relict especially when that project is compared to the low-income housing project located across the street. This is one example of the lag in time between land use development entitlements and actual construction as discussed above.

Non-Point Source Pollution

As previously discussed, non-point source pollution associated with erosion and sedimentation from construction sites is regulated, albeit the effectiveness of preventative measures may vary. Long-term non-point source pollution from developed areas may include sediment but it also includes petroleum products, pesticides, trash, fertilizers and other residues from day-to-day living. Reducing impacts of non-point source pollution on anadromous salmonids generally involves two components; source reduction and interception. Source reduction, such as minimizing fertilizer and pesticide use, requires behavioral changes. Use of native and drought tolerant species in project landscaping would likely reduce the need for fertilizers and pesticides and have the added benefit of conserving water. Interception involves installing facilities between the source and watercourse that trap the pollutants. We observed several devices installed on development sites for that purpose.

Apartments. At the Apartments in Del Norte County, a retention basin lying between the development and the creek serves as a sediment and pollutant trap. We did not determine whether or not storm drains in the project were equipped with trash racks or traps for pollutants. We observed a storm drain in the street that directly discharged runoff into the stream adjacent to the development.

Major Hillside Subdivision. We did not observe any provisions for controlling non-point source pollution at the Major Hillside Subdivision. Chronic erosion from un-vegetated graded surfaces continues to be an issue there. Conditions on development approval included incorporation of catch basins for sediment and pollution control but these conditions were apparently not implemented.

Major Commercial Development. *The commercial site in Del Norte County had the extensive facilities for reducing non-point source pollution associated with the building and parking lot.*

These included underground in-line treatment facilities to filter stormwater runoff. Grease traps are supposed to be installed in tree wells. Additional treatment is achieved by directing runoff into a grassy swale and buffer lying between the parking lot and the adjacent stream.

Low-Income Housing, Major Subdivision. The low-income housing project in Mendocino County was equipped with devices to intercept and filter stormwater draining from each home site. Additional filtration was provided by vegetated swales that convey runoff to a natural watercourse. As previously discussed (see Figures 8 and 9) the effectiveness of some of these features is questionable. The vicinity of the watercourse itself had been planted with wetland and riparian species, affording further filtration capability.

Major Subdivision. Conditions on approval of the Major Subdivision in Mendocino County included the incorporation of bio-filters and other facilities to filter storm drainage before it entered the Russian River. The only treatment devices observed at this site were trash racks in storm sewer inlets. It is possible that a filtration pond is located on the site at the outfall of drainage to the Russian River, but we were not able to access the riparian parcel to determine if this was the case.

Mixed Use Subdivision. The Mixed Use Subdivision parking lot had grease traps installed to filter stormwater before it entered the storm sewer system. It is unclear whether the underground retention piping system could also serve to filter pollutants.

College of the Redwoods. *The conditions on expansion of the College of the Redwoods included incorporation of LID techniques to minimize non-point source pollution. These included temporary and permanent sediment basins and vegetated swales. We observed one existing retention basin that would serve this purpose.*

Conclusions. On the basis of our review we conclude that the counties may require project proponents to use devices for reducing non-point source pollution. These requirements are not consistently applied, however and behavioral provisions such as restricting use of pesticides and fertilizers are not within the regulatory authority of the counties. As previously noted, some of the counties have adopted the Green Building Code and additional LID measures may be implemented in the future.

BRIDGES

Each of the counties is responsible for maintaining numerous bridges, some of which date back 100 years. Old, deficient bridges are being replaced and new bridges are being constructed to improve streamflow, conveyance of materials, and fish passage as well as to reduce potential sedimentation. When bridges are replaced or new bridges are built, there are potential impacts on anadromous salmonids. These can include habitat destruction, vegetation clearing, erosion and sedimentation, and harassment of fish. Old bridges may be contaminated with hazardous substances such as creosote or lead based paint that can enter the stream. Equipment staging and operations have some risk for hazardous spills.

Maintaining existing bridges can also have impacts. Replacing decking, painting, maintaining and protecting abutments, and installing devices to control erosion and sedimentation may all directly affect fish and their habitats.

We looked at several bridge replacement and maintenance projects. None of these was specifically constructed to improve fish passage. Fish passage improvements are described in a following section. The bridges that were replaced were structurally deficient. Maintenance activities we evaluated included installation of new decking, installation of rock slope protection, and sediment removal. Table 2 lists the sites.

Table 2: Bridge Projects

Project	Location	Key Features
Canyon Creek Bridge	Siskiyou County	Bridge replacement
Shackleford Bridge	Siskiyou County	Bridge replacement
Baechtel Creek Bridge	Mendocino County	Bridge deck replacement
Bucktail Bridge	Trinity County	Rock slope protection
Widow White Creek Bridge	Humboldt County	Foot bridge, ditch management, re-vegetation and channel restoration
Jacoby Creek Bridge	Humboldt County	Sediment removal at bridge to maintain capacity

Canyon Creek Bridge

The Canyon Creek bridge project consisted of the replacement of a structurally unsound bridge with a rail car bridge (Figure 10). The project was initiated in 2002 but was not done then because of funding limitations. Permits from DFG, the Water Board, and Corps were obtained at that time. In 2007, the county procured a rail car bridge and re-initiated the project. New permits were received from all regulatory agencies and the Forest Service approved the action in 2008.

Figure 10: The new Canyon Creek Bridge

Surveys for red-legged frogs and northwestern pond turtles were required by DFG. In addition, the Forest Service conducted a biological assessment. It was determined that neither frogs nor turtles were present. The only potential impact disclosed by the biological assessment was short-term fright to anadromous salmonids that might be present during construction. Other than standard conditions (e.g., no work to occur in flowing water, implementation of erosion control measures, etc.), no special requirements were included in issued permits. No impacts to the

stream during or after construction were observed. Installation of rock slope protection for the abutments did not encroach upon the channel. Removal of creosote treated timbers that comprised the abutments of the original bridge was considered a positive impact on water quality.

Shackleford Bridge
The Shackleford Bridge project was the replacement of a structurally deficient bridge with a new bridge. It included the relocation and improvement of an existing water diversion used for irrigation on a neighboring private property. The new diversion was equipped with a fish screen. A design modification was made to eliminate a center support pier and therefore avoid any direct impacts on the stream.

A biological assessment report was prepared for the project. It determined that three bird "species of concern" were present, including one nesting black phoebe on the underside of the bridge. The old bridge was wrapped to prevent nesting during dismantlement. NMFS was informally consulted and it was determined that there would be no adverse impacts on listed anadromous salmonids if standard measures to protect water quality were implemented. Streamflow was diverted to a settling basin before being discharged back into the stream.

The Regional Water Board issued a 401 certification for the project that required replanting of any area where vegetation was removed, in addition to standard measures to protect water quality. The Corps 404 permit required that no fill be discharged to the stream, no equipment operate in the streambed, and that lost riparian habitat be compensated for at a 3:1 ratio.

The DFG Streambed Alteration Agreement required that no more than 0.015 acre of stream channel and riparian habitat could be impacted and that habitat losses must be compensated at a 3:1 ratio. The period of work was restricted to avoid impacts on nesting swallows. Additional precautions against impacting nests were stipulated. Many other standard conditions were listed to minimize impacts on vegetation, instream habitat, and aquatic life.

Other than installation of rock slope protection to protect the bridge abutments, no permanent changes to instream or riparian habitat were observed. The rock slope protection was installed above the low flow channel to deflect high flows away from abutments. Hydroseeding and some planting were done to revegetate disturbed areas.

Baechtel Creek Bridge
The Baechtel Creek bridge maintenance project involved the replacement of deteriorated decking on a bridge spanning an anadromous fish stream. During the dismantlement of the old deck, a tarp was installed beneath the bridge to capture debris and prevent it from entering the stream. The road was re-chip sealed. No impacts on water quality occurred due to this activity.

Bucktail Bridge
Bucktail Bridge is a county facility located on the Trinity River near Lewiston. In 2006, high flow releases to the Trinity River caused extensive scouring at the bridge, endangering the abutments. Releases can be up to 11,000 cubic feet per second under the new flow management regime dictated for the Trinity River. Although there is a flow bypass channel and culvert located upstream from Bucktail Bridge, it failed during the high flows in 2006. Anticipating that subsequent high flows could further jeopardize the bridge, Trinity County undertook a project to restore rock slope protection at the bridge that had been scoured away by the high flows.

Informal consultation with NMFS revealed a concern that placing the rock slope protection would adversely affect a large pool at the bridge that served as holding habitat for coho salmon. NMFS favored addressing the problem by enlarging the culvert in the bypass channel. The county did not consider this option feasible since it could not be implemented before the next year's high flow events. Therefore, the county pursued its proposal.

It was ultimately determined that the placement of rock slope protection would just replace rock that had been scoured away with larger rock and that there would be no net loss of instream habitat. Also, a jump was installed at the outlet of the overflow channel to prevent migrating salmon from becoming stranded when flows recede. The project was implemented during low flow conditions. It required the construction of a ramp to the stream for equipment and the removal of an alder and a willow tree. No equipment operations occurred in flowing water. Large, angular rock was used to minimize the chance of rock rolling into the adjacent pool. Fish were observed in the pool before, during and after construction. After completion of the project, the ramp was rocked and blocked to prevent erosion and vehicle access (Figure 11).

Figure 11: Rock slope protection placed at downstream end of Bucktail Bridge. The access ramp in the center of picture was rocked and blocked off to prevent vehicle access.

Widow White Creek Bridge

Widow White Creek in the McKinleyville area is a stream that supports anadromous fish. The project involved the construction of a pedestrian bridge and sidewalk extension at and near an existing crossing on Central Avenue. A bridge was installed rather than a culvert to ensure that fish passage was not adversely affected. In conjunction with the project, the county expanded and enhanced drainage ditches in the vicinity of the crossing. This included replacing pipe with open ditch, placing check dams in ditches and allowing ditches to revegetate naturally. The work on the ditches had positive effects on non-point source pollution and sediment discharge to the creek (Figure 12).

Figure 12: This drainage ditch that empties into Widow White Creek was equipped with check dams to catch sediment in conjunction with the pedestrian bridge project. Maintaining full vegetative cover in the ditch also reduces sediment delivery.

There were problems during construction that necessitated remedial treatments. The contractor doing the work did unauthorized clearance of riparian vegetation beyond the low-flow period and sediment was discharged to the creek while fish were present. To reverse this damage, the channel was reshaped, the banks were re-vegetated, rock slope protection was applied, and sediment basins were installed in the ditches. The costs for repairing the damage were shared between the contractor and the county. We did not observe any permanent damage to the stream. County staff indicated that their work on similar projects in the future will be modified as a result of the lessons learned on this project.

Jacoby Creek Bridge

Sediment is removed from streams at several locations in Humboldt County and in other 5C counties. It is generally done to ensure against plugging at stream crossings and to increase channel capacity. We observed one sediment removal project at a bridge on Jacoby Creek, where the county has a 10-year permit from the Coastal Commission to perform sediment removal. Conditions on that permit include a required annual sediment management plan. The plan must address operations, disposal of sediment, fish relocation (if necessary), riparian vegetation protection, streamflow diversion, and erosion control. A Streambed Alteration Agreement, 401 water quality certification, and Nationwide 404 Permit from the Corps are also in effect. NMFS issued a Biological Opinion on the project that includes mandatory conditions to minimize incidental take.

We observed sediment removal operations that took place in 2009-2010. Approximately 350 cubic yards of sediment were removed over a period of a few days each year. The first year sediment was only removed from a bench above the stream under the bridge and there were no effects on the stream. The second year sediment was excavated from the channel. Excavation was done during low flows and streamflow was diverted around the site to avoid sedimentation. Fish relocation was not necessary for these operations. Exclusionary fencing was placed upstream and downstream of the bridge to prevent fish from entering the excavation area. The excavated material was spread on adjacent fields and used by the county in road maintenance. DFG favored the project because it removed a potential source of downstream sedimentation.

Temporary disruption of habitat was offset by this benefit. We did not observe any permanent damage to habitat.

Conclusions

On the basis of our observations at bridges, we conclude that bridge replacement and maintenance activities have relatively limited effects on anadromous fish and their habitats. This conclusion does not necessarily apply to construction of new bridges, which except for fish passage projects we did not evaluate. Where bridges were replaced, the work occurred outside the stream channel to the degree possible and provisions for preventing sedimentation were installed (Figure 13; see discussion under Fish Passage Improvements for other cases). The area disturbed by the original structures was not increased by the new structures in the cases we observed. Bridge maintenance procedures, including sediment removal, also appeared to be relatively innocuous or even beneficial when compared to historic practices. For example, we found that counties currently do not paint their bridges, if possible, to avoid potential spills. Some projects such as the Widow White Creek Bridge illustrate the importance of maintaining close supervision on contractors. County responses to inadequate or incorrect contractor performance are typically rapid, as in this example.

Figure 13: Silt fence installed at a bridge replacement site to prevent sedimentation in the stream.

STREAM BANK STABILIZATION

Stream bank stabilization consists of the placement of rock, structures (e.g., gabion baskets), vegetation, or combinations thereof on stream banks to reverse existing erosion or prevent new erosion. Bank stabilization with gunnite or concrete, as commonly practiced in earthen channels, is not usually done in natural channels in the 5C region. It has been done in the past, however, and there is a legacy of concrete channels, some of which are reverting to natural channels due to lack of maintenance.

Stream bank stabilization is most often associated with the protection of infrastructure or buildings in cases where bank retreat threatens them. This was the case for the projects that

we observed (Table 3). The impacts of stream bank stabilization on anadromous fish and their habitats vary depending on the practice and the extent of the project. Use of gabion baskets and rock is considered potentially harmful to fish if the wire tears underwater. Their use can also displace riparian vegetation, reducing habitat quality. The 5C road manual and other sources advocate use of bioengineering practices that may include rock, vegetation, vegetative structures, and various combinations to achieve stabilization.

Table 3: Stream Bank Stabilization Projects

Project	Location	Key Features
Scott River Road 1 Mile 7.6	Siskiyou County	Bioengineering
Scott River Road 2 Mile 19.1	Siskiyou County	Engineered retaining wall
Scott River Road 3 Mile 28.4	Siskiyou County	Engineered retaining wall
East Weaver Creek Road	Trinity County	Rock slope protection
Mad River	Humboldt County	Bioengineering

Scott River Road 1 – Mile 7.6

The first project on the Scott River Road consisted of the installation of about 110 linear feet of slope protection along the north bank of the Scott River between the road shoulder and toe of the high flow bank. It required permits from DFG, Corps, and the Regional Water Board. In addition, NMFS issued a Biological Opinion on the project after formal consultation with the county via the Corps pursuant to the Endangered Species Act.

The DFG Streambed Alteration Agreement specified certain conditions to avoid impacts on anadromous fish and their habitat. A temporary bypass channel around the work site was constructed. Any fish present were to be “encouraged” to leave the work site or be dip netted and relocated. Work was generally restricted to areas outside of flowing water during the low flow season, though equipment did have to cross the stream during low flow. In addition to the use of rock rip-rap, live willow poles were installed at the base of the slope (Figure 14).

Figure 14: Bank stabilization on the Scott River Road utilizing a bioengineering approach. The site has remained stable for the past four years.

The Water Board 401 Certification and Corps 404 permit did not include any conditions other than the standard ones requiring best management practices to reduce the potential for erosion and sedimentation.

NMFS's Biological Opinion indicated that the project was not likely to jeopardize coho salmon or result in the destruction or adverse modification of coho critical habitat. The Biological Opinion stated that the following measures would be incorporated into the project:

- Adherence to 5C road manual best management practices
- Construction during low flow conditions
- Isolation of the work area from the active channel through use of a diversion barrier
- Fish would be encouraged to move out of the work area
- Installation of silt fences at the downstream end of the work area
- Removal of excess sediment and spoils from the site
- Confine equipment to work areas outside of the channel
- Use of combined rock and vegetation slope protection

In evaluating the project, NMFS indicated that the project area was a migratory corridor unsuitable for coho spawning. Furthermore, the work would occur outside of the peak coho migration and spawning period. Some potential impacts on juvenile salmon were predicted but would be offset by encouraging fish to move out of the work area. Other effects, such as reduced pool quality in the project area and temporary increases in turbidity were not expected to be significant. No special conditions were required by NMFS.

Our observations at this site indicated that the project had been highly successful in stabilizing and adding a riparian component to the bank. Before treatment, it had been a severely eroding cut bank that threatened the integrity of the road.

Scott River Road 2 – Mile 19.1
The second project on the Scott River Road was similar to the third. It was the installation of an engineered gabion retaining wall to prevent bank erosion and restore the road width for driver safety. The DIRT inventory identified the site as a sediment source with high priority for treatment. Another culvert prescribed for replacement was not treated due to financial limitations. The installation was done entirely from the road and there were no long-term impacts on the Scott River. A small amount of erosion occurred during construction. A silt fence was part of the planned BMPs but the solid rock onsite prevented its installation. An additional component of the project was the enlargement of a ditch relief culvert and armoring of its outlet.

Scott River Road 3 – Mile 28.4
The third project on the Scott River Road consisted of the installation of a welded wire retaining wall on the west bank of the Scott River. The site had failed in part due to diversion of ditch flow from across the road. The project included installation of rock slope protection at the base of the slope above the low flow channel. An access ramp was constructed within the area of the retaining wall to facilitate construction. Additional project elements included confinement of work to the low flow period, no work occurring within the stream, use of silt fences or other devices to prevent sediment discharge to the river, seeding and mulching of disturbed soils, and planting willows upstream and downstream of the construction site.

A biological assessment and design memorandum was prepared for the project. NMFS informally consulted on the project and determined that it would have no adverse impacts on coho salmon. The Water Board issued a waiver of waste discharge requirements and water quality certification. The Corps 404 authorization did not include any specific conditions. This was also true for the DFG Streambed Alteration Agreement. In general, the design that was ultimately adopted for the project was environmentally superior to a previous design that would have required construction within the streambed (Figure 15).

Figure 15: Retaining wall along Scott River Road above Scott River. Note rock slope protection applied at base of wall that also serves to dissipate energy from the culvert outfall.

Two issues arose during our discussion of this project. As can be seen in Figure 15, an area of erosion located next to the treated site still remains a source of sedimentation in the Scott River. Secondly, the problem that caused the slope failure has not been addressed. The steep cut slope across the road from the treated area is unstable and delivers rock and soil to the ditch that is capable of plugging the cross drain. This could cause a diversion to another location that has not been stabilized. Regarding effects on anadromous fish and their habitats, the entire project is located outside of the low flow channel and no work occurred within flowing water. None of the regulatory agencies considered the project to have significant adverse impacts.

East Weaver Creek Road

The project on East Weaver Creek Road involved treating a scalloped road fill failure along East Weaver Creek, an anadromous stream. The failure threatened both the road as well as a nearby private bridge. It was a relatively minor project and the need for a Streambed Alteration Agreement was waived by DFG. A 401 Water Quality Certification was received. Rock slope protection was placed in the cavity from the road during the low flow season. No work was done in the channel. No vegetation removal occurred other than clearing some blackberry bushes to

allow access to the failure site. Temporary erosion control measures were installed until the project was completed. Equipment was staged at a road pullout. No adverse impacts on fisheries were identified by the regulatory agencies. The project, which was conducted in one day, curtailed an existing source of sediment discharge.

The East Weaver Creek Road project did not include bioengineering practices. The rationale for just using rock was that additional planted trees on the bank could trap debris and cause a jam beneath the nearby private bridge.

Mad River

The slope stabilization project on the Mad River is acknowledged as perhaps the largest bioengineering project undertaken in Humboldt County. It is located near the mouth of the river near McKinleyville. The project was done to prevent further erosion and bank retreat that was threatening to undermine several nearby houses. The design evolved over time from a conventional rip-rip to a bioengineered solution incorporating rock, large wood, and willows (Figure 16).

Figure 16: Bioengineered bank stabilization on the Mad River.

The project required extensive design and engineering analysis. This included hydrologic modeling to determine if the project would have any adverse upstream or downstream effects (none were noted during field review). Permits were required from the Coastal Commission, and DFG. The Regional Water Board issued a waiver of discharge requirements and the Corps qualified the project for a Nationwide Permit under 404.

The design that was implemented included extensive planting in combination with rock slope protection. Large logs were placed in the toe rock perpendicular to the bank to increase habitat complexity. The project is not viewed as a permanent solution since the mouth of the Mad River is subject to movement and the stream can experience avulsions.

Precautions were taken during construction to minimize potential effects of sedimentation and harassment of fish. Construction occurred during the summer and no machinery operated in flowing water. A permeable barrier was placed in the river to prevent sediment from entering the

stream or fish and wildlife from entering the construction area. Equipment staging was confined to areas away from the stream. Areas disturbed during construction were seeded to revegetate them. During construction there were minor releases of sediment to the stream and a minor spill of oil upslope that was quickly contained and did not reach the creek. Construction also resulted in the destruction of a small area of wetland. The need for compensation for lost wetlands is being evaluated.

Conclusions

On the basis of our review we conclude that bank stabilization projects, although primarily aimed at protecting infrastructure and buildings, have the added benefit of reducing sediment delivery to anadromous fish streams. Where feasible, the counties now employ bioengineering approaches that enhance riparian habitat and reduce the habitat losses associated with standard rip-rap and similar practices. The use of bioengineering has increased greatly since the 1998 assessment, partly due to the concerns of regulatory agencies and partly due to education and training provided to county staff by the 5C program. Projects typically are done during low flow conditions and equipment operations are not permitted in flowing water. Provisions for fish relocation and diversion of stream flow away from construction sites are applied as necessary. Any temporary increases in turbidity and disruption of habitat caused by these projects are probably balanced by the positive effects of long term reductions in sedimentation.

STORM DAMAGE REPAIR

In 1998, a considerable amount of effort was expended in reviewing the responses of the counties to damage caused by floods in 1997-98. The counties lost roads, culverts, bridges and other infrastructure during those floods that were replaced under emergency conditions. Our observations at that time indicated that these repairs were somewhat constrained by emergency funding provided by FEMA. Nevertheless, we saw examples where the counties had attempted to improve conditions for anadromous fish while replacing or repairing damaged facilities.

The counties experienced another serious flooding episode in 2005-06. Although the intensity of the episode varied from county to county, all suffered some level of damage. Consequently, we included some storm damage repair projects in this assessment (Table 4).

Table 4: Storm Damage Repair Projects

Project	Location	Key Features
Bar Road	Siskiyou County	Bioengineering
Bertsch Avenue	Del Norte County	Repair of culvert
Requa Road	Del Norte County	Landslide removal
North State Street	Mendocino County	Replacement of culvert
Scenic Drive	Humboldt County	Treatment of unstable road section

Repairing damage caused by storms has some unique attributes not associated with other activities. Storm damage commonly causes disruption of service, such as road closures, which cannot be tolerated if no alternative access exists. Storm damage repair therefore has an immediacy that other projects, carefully planned and evaluated in advance, do not have. Emergency response projects also may be exempt from some permit requirements that would apply to similar projects if undertaken under ordinary circumstances. Environmental review and consideration of mitigation measures may not be as thorough. For projects involving

anadromous fish streams, storm damage repair projects may have short-term construction-related impacts such as vegetation removal, disruption of instream habitat, and sedimentation. They may also have long-term impacts if installed facilities such as bank protection are not "fish-friendly". We were able to determine if long-term impacts occurred in the projects we evaluated. We had to rely on documentation such as photographs and county staff accounts to ascertain if short-term impacts occurred. One of the projects had the usual permits from DFG, Corps, and Regional Water Board. Three did not require permits.

Bar Road

Bar Road is located adjacent to Horse Creek, a tributary to the Klamath River. During the winter storms of 2005-06, high water in Horse Creek uprooted trees that diverted creek flow directly at the road. As a result, approximately 390 feet of road was washed out (Figure 17).

Figure 17: Damage to Bar Road caused by flooding in Horse Creek, January 2006.

The county's initial response was to place a temporary soil berm between the stream and the road to deflect flow. This did not succeed and the berm, consisting of loose soil and rock, was washed out by subsequent high flows. The county then installed a steel beam at the channel bank to deflect flow. This prevented further losses of the road and allowed the county to reconstruct the roadway in isolation from the active channel. That concluded the emergency work (Figure 18). To accomplish the permanent work, the county obtained a permit from the Corps and water quality certification from the Regional Water Board.

Figure 18: Bar Road at the completion of emergency road repair. Note the barren condition of the stream bank.

The failure of the earthen berm installed during the initial emergency repair work had short-term impacts on the stream including disruption of habitat and sedimentation. The flood itself caused substantial damage as well such as losses of riparian vegetation and channel erosion.

During August and September of 2006 the county took steps to permanently stabilize the road fill. It excavated a toe trench along the road in which willow cuttings, geotextile fabric and rock was placed. At the time of our field assessment, this stabilization was densely vegetated to the extent that the rock was not noticeable (Figure 19).

Figure 19: Rock slope protection and willow revegetation along Bar Road, one year after installation.

Bertsch Avenue

Del Norte County responded to a culvert failure with a temporary solution that included excavating accumulated sediment and armoring the outfall and bank. We did not observe any adverse impacts associated with the initial phase of this project. For a long term fix, the county will retrofit the culvert, which has a corroded bottom, with a new plastic pipe. In some instances

such as this, replacing a failing culvert may either be too expensive or otherwise impractical. The project will be done on a small intermittent stream and the reduction in capacity caused by inserting the new pipe is considered acceptable particularly in view of the costs and impacts of removing and replacing the culvert.

Requa Road
During the storms of 2010-11 a large landslide was triggered along Requa Road at Klamath River Road, causing a road closure. Emergency work was necessary to clear the soil and debris. The material was moved to two locations, across the road in a widened area and to another site in a field near the road, but away from streams and wetlands. Erosion control measures were installed at both locations to prevent movement of sediment. Barriers were also installed at the edge of the cutbank below the failure to prevent any additional slide material from moving into the road. A long-term solution for stabilizing the landslide has not been determined. Implementation of a solution cannot occur before the county receives FEMA emergency relief funds. Our observations indicated that treatment of the debris had negligible effects on the adjacent watercourse.

North State Street
In the 2008 policy analysis, a project involving the loss of a culvert due to winter storms and its replacement was reviewed. During the field assessment, the site of this project was evaluated. The culvert is located on a tributary to the Russian River on North State Street. Replacement of the culvert required removal of road surface, excavation of the remaining fill, removal of the damaged culvert, and replacement with a new pipe. After the initial installation, seepage around the new pipe caused the road surface to collapse. This problem was addressed by sealing the inlet to the new pipe to prevent seepage.

The inlet to the new culvert was flared to increase its capacity to move sediment and debris. It was sized to pass a 100-year flood and placed such that it would not be a migration barrier to fish. The inlet and outlet were both armored to prevent erosion. Our inspection of the channel upstream and downstream of the culvert did not indicate substantial channel adjustments. The tributary downstream is incised in response to the incision occurring in the Russian River. There may have been some evacuation of sediment from the upstream channel due to enhanced culvert capacity. The culvert was replaced when there was no flow in the channel so there was no potential for erosion and sedimentation during construction. No vegetation removal was required.

Scenic Drive
Storms of 2005-06 caused the failure and year-long closure of a section of Scenic Drive in Trinidad, Humboldt County. Scenic Drive is the former Highway 101 that was conveyed to the county. The location that failed is known to have unstable slopes and unconsolidated soils. When it failed, the road surface slumped making it impassable. This section of Scenic Drive is located immediately above the ocean and is not near an anadromous fish stream.

The project entailed grading, resurfacing the road, and installing a ditch relief culvert (Figure 20). Erosion control measures applied to the disturbed area included jute matting, hydroseeding, and straw wattles.

Figure 20: Section of Scenic Drive where failing road surface was repaired.

Our review disclosed a potential problem associated with the ditch relief culvert installed as part of the project. Extending into the slope below the road, it terminates at a stub outfall that is accumulating debris and sediment. Unless properly maintained, the culvert may plug in the future. It should be noted that during the coastal development permit review, the Coastal Commission recommended a pipe elbow design for the downdrain outlet rather than the rock energy dissipater originally proposed by the county.

Conclusions

We concluded that in the instances we reviewed, county responses to storm damage did not have significant adverse effects on anadromous fish. On the contrary, the Bar Road project reduced the potential for continued erosion and sedimentation in Horse Creek and enhanced the riparian vegetation considerably. The treatment of landslide debris at Klamath River Road prevented possible delivery to an adjacent channel. The North State Street project improved the capacity of the culvert, potentially preventing future failure. Our findings contrast to some degree with the findings of the 1998 assessment. It should be acknowledged, however, that the 1998 assessment looked at several storm damage projects that directly affected anadromous fish streams.

FISH PASSAGE IMPROVEMENTS

As disclosed in the 2008 policy analysis, all of the counties have undertaken surveys of barriers to fish passage and prioritized removal of barriers. Between 1998 and 2010, 60 barriers were removed providing access to over 140 miles of habitat. Barrier removals take many different forms. In the 1998 assessment we evaluated treatments such as installation of jump pools at culverts and installation of baffles within culverts. Barrier removals undertaken recently are more comprehensive. Many include replacement of culverts with bridges and channel engineering. These projects may have significant impacts during construction and although generally considered in a favorable light, they also receive intense regulatory scrutiny. County staff members have indicated that fish passage projects may be delayed substantially by regulatory processing.

We looked at three fish passage improvement projects (Table 5). In all cases, formal consultation with NMFS was required along with Streambed Alteration Agreements from DFG, 401 certification from the Regional Water Board and 404 permits from the Corps. These permits generally included extensive provisions for preventing adverse impacts during construction. Oftentimes these projects are extensively monitored after project completion. For these reasons, review of these types of projects focused more on actual construction effects and relevant BMPs.

Table 5: Fish Passage Improvement Projects

Project	Location	Key Features
Freshwater Creek Fish Ladder	Humboldt County	Installation of a fish ladder on a seasonal dam, bioengineered bank stabilization, non-point source pollution control
Clark's Creek	Del Norte County	Replacement of a culvert with a bridge
Little Brown's Creek	Trinity County	Replacement of a culvert with a bridge, bioengineering, constructed channel

Freshwater Creek Fish Ladder

The Freshwater Creek fish ladder is on a dam that is installed seasonally to create a swimming hole. The dam is in a county park and has operated since 1922. In 2001, the county was required to provide for fish passage at the dam due to the federal listing of the coho salmon under the Endangered Species Act. A temporary fish ladder was installed in 2002. The permanent concrete ladder was installed in 2009 (Figure 21).

Figure 21: Seasonal dam on Freshwater Creek. The entire structure is installed every year in June and removed in late August. The fish ladder is on the left of the picture. The side channel connecting the ladder to the main channel is at the base of the dam.

The fish ladder was installed to facilitate upstream and downstream passage by juvenile salmonids. Its effectiveness is evaluated through yearly monitoring by DFG and Humboldt County's natural resources and parks divisions. Monitoring to date has shown that fish are

freely moving both upstream and downstream via the ladder. A constructed side channel connects the outlet of the ladder with the main channel (Figure 21).

Installation of the ladder was included in the process for issuance of 5 year permits from DFG and the Corps to install and remove the seasonal dam. Every year the dam is installed in June and taken out in late August. Installation involves some grading in the channel to level the surface. An unknown minimal flow release is required below the dam via the fish ladder. The dam does not affect peak flows or sediment discharge. Under the terms of the DFG Streambed Alteration Agreement, any large wood removed from the pool behind the dam must be returned to the stream and placed in a stable position. Gravel removed during grading must be used to armor eroding banks. Any water intakes must be screened to prevent fish capture. Informal consultation with NMFS concluded that the temporary impacts associated with dam installation and removal were insignificant in light of the improved passage and habitat conditions. Other than the grading necessary to make this connection, installation of the ladder and its operation had no significant adverse impacts. Monitoring in the swimming pool created by the dam has indicated that it provides excellent cool water habitat for salmonids.

There are several other features at the park that are beneficial to anadromous salmonids. Downstream from the dam, four bioengineered bank stabilization projects were installed to reduce erosion and enhance riparian conditions. They incorporate large woody debris and rock along with plantings. Also, a portion of the levee along the stream was breached to allow reconnection to the floodplain. Runoff from the parking lot is intercepted by straw rolls to reduce non-point source pollution.

Clark's Creek

This project was the replacement of a box culvert that was a barrier to fish migration with a pre-manufactured steel bridge. The crossing was one of two on Clark's Creek, a tributary to the Smith River that supports all four anadromous salmonids. Removal of the barrier opened up access to approximately one mile of upstream spawning and rearing habitat.

The former culvert was a complete barrier to juveniles and a partial barrier to adult fish because it was perched above the stream. In the county's inventory of barriers, it was prioritized second. To undertake the project, the county was required to formally consult with NMFS via the Corps 404 permit. An incidental take statement issued by NMFS contained numerous mandatory conditions regarding fish relocation, controlling construction impacts. and monitoring. It was expected that juvenile fish would be taken due to relocation and harassment.

During construction, which took place from September to October, a gravel coffer dam was placed upstream to divert flow into a pipe. Silt fences were also placed upstream and downstream from the construction site. Fish were evacuated from the work area and exclusionary fencing was placed above and below the site to prevent re-occupation. In the latter phases of the work, no flow was present in the stream. Equipment was staged away from the stream.

The bridge abutments were placed 10 feet above the low flow channel. The channel was re-shaped to match the existing stream and washed gravel was placed on the new channel bed. A rock sill was installed to prevent incision. Our observations did not indicate any significant channel adjustments after construction. A large debris jam upstream from the bridge probably acts as a partial control on incision. There was no low flow channel defined by the project, which may have adverse impacts on aquatic wildlife. In the future, this condition may change as the stream is expected to adjust on its own.

One innovative component of the project was that existing vegetation, primarily ferns, was removed, stored in containers and then re-planted after project completion. Native soils were stockpiled and re-used. Redwood needles were used as mulch for erosion control.

Little Brown's Creek

The Little Brown's Creek Migration Barrier Removal Project was completed in 2007. It was reviewed in the 2008 policy analysis and first visited in July 2008. The project entailed the replacement of an existing crossing (three culverts) with a bridge to allow full passage for all life stages of coho salmon and steelhead. The project required formal consultation with NMFS through US Fish and Wildlife Service (one of the funding agencies), a Streambed Alteration Agreement from DFG, a Nationwide 27 Permit from the Corps, and 401 water quality certification. In its Biological Opinion on the project, NMFS stated that it did not consider the project to jeopardize continued existence of coho salmon or destroy critical habitat. It did indicate that incidental take would occur. The principal concern was mortality due to fish relocation or dewatering. Potential impacts from sediment discharge were considered minor. The level of incidental take (juvenile mortality) was not determined but was felt unlikely to affect returns. No mortalities were observed during the fish relocation and there were no surface flows during construction. Minor subsurface flows encountered during excavation were diverted downstream of the project. NMFS considered the removal of the barrier and improved access to upstream habitat as a distinct benefit to the fisheries. The Biological Opinion included specific mandatory measures to be taken to reduce mortality during relocation.

The deficient culverts were replaced with a cast in place concrete bridge on pile footings. An engineered "roughened" channel was installed upstream and downstream from the new bridge to facilitate fish passage at all flows. Stream bank stabilization was accomplished using bioengineering techniques. Post-project monitoring is underway and includes out-migrant fish trapping, photo-points, redd surveys, and channel surveys with longitudinal profiles (Figure 22). Salmonids have been observed upstream of the project site.

Figure 22: The channel upstream from the Little Brown's Creek bridge was engineered to promote fish passage and provide habitat structures. Banks were stabilized with rock and riparian plantings.

This project required extensive work in the stream. Fish and amphibian re-location was conducted prior to construction and netting was installed above and below the construction area and at a tributary to prevent in-migration during construction. The relocation did not involve any coho salmon but only coastal rainbow trout (possibly steelhead) and amphibians.

There was no surface flow during the period of construction, which was completed between June 30 and November 1. Therefore, the stream was not dewatered and potential for fish mortality was reduced. Stream flows were not recorded until December 4. Potential erosion and sedimentation were mitigated during excavation of the existing culverts and channel fill by installing silt fences and straw bales. Plastic sheeting was placed over exposed banks. No rainfall events occurred during construction. Sediment that had accumulated upstream of the existing culverts was excavated for 250 feet above from the crossing. This required removal of 0.1 acres of riparian and other vegetation. The re-constructed channel upstream and downstream from the crossing was placed at a five percent grade. It was constructed with rock grade-control structures, “constriction” rock, large wood and streambed material sized to be stable at 100-year flows. Some excavated material was utilized to create the new channel and some was used to improve an existing road that was contributing sediment to the stream. After completion of all construction, bioengineered bank protection was installed on approximately 150 feet of stream bank. Disturbed areas were revegetated. Some plants did not survive and were later replaced.

When we conducted our field assessment in 2010, we found that the project continued to be performing well and that riparian vegetation had continued to expand. Under some low flow conditions, streamflow is subsurface under the bridge. This is considered a flaw in the construction not adhering to the design. More streambed material was jetted and, if future monitoring indicates a need, further steps may be taken if the problem persists.

Conclusions

On the basis of our reviews, we conclude that fish passage projects have minimal adverse effects on anadromous fish and obvious benefits. Short-tem impacts due to construction are outweighed by improved access to habitat by fish. Monitoring conducted by the 5C program and others has proven the value of barrier removal projects.

It should be noted that projects involving barrier removals and channel restoration may have rather dramatic short-term construction impacts. We observed one project under construction in Mendocino County that involved extensive excavation, diversion of flows from the main stream and tributaries, and considerable vegetation removal. In recognition of these potential effects and the possibilities of incidental take of listed species, the intense scrutiny of regulatory agencies may be justified. However, for those projects that include BMPs to minimize construction-related impacts, permit streamlining might be advantageous.

ROAD MAINTENANCE AND MODIFICATION

Perhaps the most sweeping change in county management practices that has occurred since the 1998 assessment has been the adoption of the 5C road manual as the guide for fish-friendly road maintenance and modifications/improvements. This phenomenon was reported in the 2008 assessment. County roads traverse terrain susceptible to erosion, cross anadromous fish streams and their tributaries, and in some cases, are adjacent to these streams. They have the potential to be migration barriers and sources of sediment and non-point source pollution.

Considering the road prism, the cut slope can chronically generate sediment or be associated with slope instability. The road running surface can generate fine sediment that is conveyed to streams via surface runoff or by drainage ditches. The fill slope may fail due to diversions from drainage ditches, undercutting by streams, or other slope instability, delivering large amounts of sediment into streams. The technique used to drain a road, either insloped or crowned with drainage ditches or outsloped determines whether road runoff is dispersed or concentrated. Drainage ditches are virtual conveyor belts for sediment delivery if directly connected to streams. Finally, stream crossing and ditch relief culverts may plug and wash out. When stream crossings fail, sediment is delivered directly to the stream.

It was the recognition that county roads, which number in the thousands of miles, and stream crossings, which number in the hundreds of miles, are so important to the health of watersheds supporting anadromous fish that resulted in the development of the 5C road manual. Regular training of county staff nearly every year, based on the manual and covering additional topics such as bioengineering, has had a major influence on how the counties manage their road systems. We looked at six road-related projects (Table 6).

Table 6: Road Maintenance and Modification Projects

Project	Location	Key Features
Ashford Road	Del Norte County	Removal of road surfacing material from ditch
Tomki and Muir Mill Roads	Mendocino County	Chip seal and outsloping unsurfaced roads
Rush Creek Road	Trinity County	Road widening and drainage improvements
Scenic Drive	Humboldt County	Road widening and drainage improvements
Low Divide Road	Del Norte County	Road grading and dust control

Ashford Road

Keeping roadside ditches free of obstructions that impair flow is one of the most important routine maintenance activities that counties conduct. Ditches are sources of sediment derived from cut slopes and road surface erosion and convey road runoff to ditch relief culverts or directly to streams. Unless they are kept clear and functioning, runoff may breach the ditch, flow uncontrolled across the road and cause fill failures and gullies. There is a trade-off between excessive clearing of vegetation in ditches and ditch grading to ensure function and allowing vegetation to filter sediment before it reaches a stream. We evaluated one ditch clearing project in Del Norte County but observed ditch management in several other locations. Ashford Road in Del Norte County is an insloped, paved road with a ditch. Portions of the ditch had been lined with concrete to reverse incision and lateral erosion. This project involved removing asphalt road surface material that had sloughed into the ditch. The clearance was done by hand to minimize disturbance to the ditch. Vegetation in the ditch was allowed to remain.

At other sites where we observed ditch management practices, we noted that machine clearing was rarely done so that soil disturbance was minimized. We also observed several instances where vegetation in ditches was allowed to remain. In one case, check dams were installed in ditches to capture sediment. We also noted cases where ditches were disconnected from direct outfall to streams, where outfalls were armored to prevent erosion, and where ditches prone to erosion were placed underground in pipes.

Given the immense amount of roadside ditch that the counties maintain, it is evident that ditches are still a maintenance problem and sources of sedimentation in streams. Positive approaches to ditch management, as recommended in the 5C road manual have had an effect on county

road maintenance but funding limitations may affect the degree to which some of these approaches can be implemented.

Tomki and Muir Mill Roads
In Mendocino County we evaluated two projects that involved chip sealing to reduce road surface erosion and outsloping to reduce hydrologic impacts (Figure 23). The coupling of these two practices represents something that was not observed in the 1998 assessment.

Figure 23: Chip sealing and outsloping on the Tomki Road, Mendocino County.

We did not observe these projects under construction. On both projects, there were short-term impacts due to grading to convert insloped road sections to outsloping. All work was done during the dry season. Outsloping was not uniformly done and some road sections retained insloping and drainage ditches. Some ditch relief culverts were enlarged or treated to minimize potential for erosion but we did observe “shotgun” culverts that were not armored or equipped with downspouts. Drainage ditches were also retained in some outsloped locations to capture and convey runoff from cut slopes. Neither project had adverse effects on watercourses. The county maintains mapping that indicates what portions of its road system are within 200 feet of blue line streams. Some residual sediment perched at the outboard edge of roads had the potential for movement but direct delivery to a stream was not likely.

Chip sealing has the positive effect of reducing road surface erosion. It has a limited life span, however, and must be maintained and periodically replaced to be effective. Some counties have experimented with other approaches to minimize road surface erosion such as the use of dust palliatives.

Outsloping has the positive effect of dispersing road-related runoff instead of concentrating it in ditches. This reduces the potential for erosion and sedimentation and also reduces potential hydrologic impacts. Outsloped roads generally require less maintenance than insloped roads. As of the 1998 assessment, the counties rarely did outsloping on public roads. The effects of the 5C road manual and associated training have probably caused the counties to consider

outsloping as an alternative to insloping where feasible. Nearly all counties have outsloped some roads since the 1998 assessment.

Rush Creek Road
Rush Creek Road in Trinity County was widened up to six feet and surfaced to provide five feet of paved shoulder. Treatments were also installed to address eroding cutbanks. The treated section of 2.5 miles is located near the confluence of Rush Creek and the Trinity River but in all instances is 300 feet away from the streams. The project required cutting into the uphill bank and placing fill and/or retaining walls on the downhill side. Underdrains were installed to reduce road bed saturation and to convey water to roadside ditches. There were five culvert crossings on ephemeral streams that drained to the Trinity River. The culverts were considered adequate and were not replaced. They were equipped with armoring at their outfalls as part of the project. No fill in wetlands or riparian areas occurred.

The work was performed by a contractor to the county who had to obtain a General Construction Permit and prepare and implement a SWPPP. Erosion control measures included hydroseeding of cut slope and fill faces, though some of these efforts were considered ineffective. Starthistle was introduced to the site as a result of the project. Sediment was removed from check dams in ditches and removed from the site.

Our observations at Rush Creek disclosed a few problems. Cut slopes were not adequately revegetated and were eroding, delivering sediment to the drainage ditch (Figure 24). Also, spoils had been improperly disposed of in a site that was near an ephemeral stream. These spoils had the potential for entering the watercourse. In the latter case, the county had been advised of the infraction. As a result, the county no longer leaves disposal of spoils to the contractor's discretion.

Figure 24: Cut slopes along the Rush Creek Road widening project were not fully revegetated after construction and were eroding, delivering sediment to the roadside ditch.

Scenic Drive
The widening of Scenic Drive in Trinidad, Humboldt County required a permit from the Coastal Commission that stipulated implementation of erosion control measures and revegetation after project completion. The project was about three quarters of a mile long. No anadromous fish stream was nearby and no new stream crossings were installed. Widening and straightening the road required cutting into the uphill slope. A gabion wall was installed at an existing stream crossing to enhance downhill slope stability (Figure 25). Additional features included placing a drainage ditch into a pipe to reduce plugging by sediment, armoring the ditch outfall, and placing rock into a stream to prevent incision. The project required fairly extensive grading that was done during the dry season to minimize the potential for erosion, but there were some short-term impacts.

Figure 25: This gabion wall was installed at stream crossing on Scenic Drive to reduce likelihood of slope failure.

We did not observe any permanent adverse impacts due to the Scenic Drive widening. No substantial areas of exposed soil persisted.

Low Divide Road
Low Divide Road is an unsurfaced road used all year long primarily for recreational access. It is located along a tributary to Peacock Creek, an anadromous fish stream. We did not observe any direct points of sediment delivery from the road to the stream. The 5C DIRT database only shows one delivering sediment source site in this section of the road. Del Norte County spends most of its budget allocated to maintaining unsurfaced roads on this road. The primary activity observed at this site was the application of a soil stabilizer (Permazyme) to control dust and reduce road surface erosion.

Conclusions
We did not review the full range of road maintenance activities performed by the counties such as roadside vegetation management, culvert clearance, road patching, etc. The activities we did review indicate that county road maintenance and management practices have changed considerably since the 1998 assessment. We attribute this to the effects of the 5C road manual and associated training as well as increased general awareness of the potential effects of roads

on anadromous salmonids. The change in practices has undoubtedly resulted in some cumulative reduction in road-related sedimentation and hydrologic impacts to streams. Inadequate revegetation and illicit disposal of spoils at Rush Creek Road were site-specific rather than generic and did inspire the county to modify their contracting practices. Issues such as those do indicate a need for monitoring contractors to ensure compliance with contract requirements and best management practices.

STREAM CROSSINGS

In previous sections we reviewed bridges and provisions for fish passage. In this section we review the installation of a vented ford and replacement of an undersized culvert (Table 7).

Table 7: Stream Crossing Projects

Project	Location	Key Features
Tomki Road at Cave Creek	Mendocino County	Replacement of low water crossing with vented ford
Crannell Road	Humboldt County	Replacement of undersized culvert

Maintaining and replacing stream crossings is one of the most common projects undertaken by county public works and road departments. These facilities have the potential for causing significant impacts to anadromous fish and their habitats when they fail catastrophically, plug and divert road runoff, or deteriorate in place and lose functionality. Therefore, maintaining and replacing crossings is a positive activity for both infrastructure and fish. The emergency repair work at Bertsch Avenue in Del Norte (under Storm Damage Repair above) will be followed up with additional work on the stream crossing.

Maintaining and replacing stream crossings can have adverse effects on fish if channels are disturbed, sediment is released to streams, or riparian vegetation is removed. Some activities, such as removing woody debris from channels upstream from crossings, can reduce habitat complexity. Our interviews with county staff did not indicate that removing woody debris is a common activity. On the contrary, counties are often placing wood in streams in conjunction with other restoration actions e.g., Little Brown's Creek, Freshwater Park. In one case previously reviewed (Clark's Creek) a woody debris jam upstream from a new bridge was actually left in place because of the habitat it provided. The counties have also adopted some designs that minimize the effects of woody debris on crossings, such as full span bridges.

Tomki Road

We first looked at the situation on Tomki Road during the preparation of the 1998 assessment. The situation at that time involved nine low water unarmored crossings of Cave Creek, an anadromous fish stream. In the 1998 assessment we commented that the natural bottomed crossings "create chronic sources of sediment". Other impacts documented for the Tomki Road crossings included non-point source pollution and fish mortality (the crossings typically are at pool tails where spawning may occur or juveniles are present). As of 1998, there were at least 30 low water crossings in the five counties and 24 of them were in Mendocino County.

We further evaluated the Tomki Road issues in the 2008 policy analysis. The history of the controversy was reviewed in detail. We also reviewed all documentation for permitting the vented ford that we evaluated in our field assessment. This design was intended to be a prototype for replacing the eight other crossings.

This project eliminated one low water crossing and replaced it with a bottomless concrete arch that allows fish passage at all life stages. The structure accommodates a 10-year flood without overtopping and 100-year flood via a critical dip without structural damage. According to the project's final report:

"Construction involved excavation for two strip footings located at the approximate limits of the bankfull channel and set below the anticipated scour depth. Once footings cured, the structure components were lowered into place with a crane. Once set, water proofed and grouted, the structure was backfilled with material from footing excavation and import material to the desired finished road grade. The structure embankments and roadway was encapsulated with concrete to prevent erosion during high flow events. The stream channel within the immediate area that was severely impacted by vehicular traffic was reconfigured so as to conform to the anticipated stable channel grade and bankfull dimensions. Upstream and down stream segments were revegetated to help improve stream habitat conditions and provide for bank stability. The existing road alignment was slightly realigned for approximately 200 feet in order to reduce skew for hydraulic considerations, allow for an elevated road elevation for structural and hydraulic considerations, and meet minimum road width and turning radii requirements. No site dewatering and sensitive species relocation was needed because the stream was dry prior to initiation of construction." (Figure 26)

Figure 26: Tomki Road vented ford. The bottomless arch is surrounded by concrete to prevent undermining and erosion.

Installation of the structure was subject to numerous conditions to minimize impacts on stream habitat and construction-related erosion and sedimentation. Avoiding de-watering and species relocation was beneficial and negated the potential for incidental take. A riparian revegetation plan was prepared based on a biological assessment. It included installation of an underground irrigation system, a pilot effort that may be used in the future. Treatments included brush layer bank protection, rock slope protection, and planting willow cuttings (Figure 27). Post-project monitoring was required.

Figure 27: Streambank stabilization and riparian planting at the Tomki Road vented ford.

Our observations at the project site did not indicate any specific adverse impacts caused by the installation. Photographs taken during flood events provided by the county showed that the crossing was functioning as intended. The revegetation program appeared to be successful.

This project is a prototype for replacing the eight other crossings but it is uncertain when or if those crossings will be replaced. The vented ford is an expensive installation and funding is limited. The county could not have implemented this project without financial assistance from the Regional Water Board. It is not uncommon for counties to rely on grant funds for construction of larger restoration projects.

Crannell Road

This project was the replacement of a failing culvert with a larger box culvert embedded in the stream channel. The crossing was located on Bullwinkle Creek, a tributary to the Little River, an anadromous fish stream. In addition to causing sediment accumulations and flooding, the failing culvert was considered to be a partial barrier to all life stages of fish migration. At higher flows, it was a velocity barrier to juveniles.

The project was a collaboration of the county, a neighboring landowner, and a timber company that uses the road for hauling. Planning and permitting the project required formal consultation with NMFS pursuant to the Corps 404 permit, a Streambed Alteration Agreement from DFG, and a 401 water quality certification. The stream was assumed to support coho salmon and other anadromous fish. Permit conditions applied to fish relocation, diversion of flow around the construction site, and exclusion of fish from the site during construction. NMFS required extensive provisions for minimizing incidental take during relocation including documentation of all relocated fish. Provisions for controlling sedimentation were also specified and implemented. NMFS requested that the new facility be capable of passing a 100-year flow but this was not feasible because of the elevation of the channel relative to the road (i.e., there was not enough room for a box culvert larger than the one installed) (Figure 28).

Figure 28: The entrance to the Crannell Road box culvert. Although the streambed was disturbed during removal of the old culvert and installation of the new one, it had completely revegetated naturally.

The culvert is an open box with a natural substrate bottom. During construction there were temporary impacts due to dewatering, turbidity, and fish relocation. There were no permanent impacts on habitat and overall, the project was considered to be beneficial to salmonids. The project met the objective of improving culvert functioning while enhancing fish passage.

Conclusions

In the 1998 assessment we evaluated 15 stream crossing projects, several of which were emergency replacements of crossings lost during the 1997-98 floods. The two projects evaluated in this assessment do not characterize all the crossing maintenance activities of the counties but other projects previously discussed such as fish passage improvements and bridges are relevant. The counties have changed their approach to stream crossing maintenance and replacement over the past 13 years. The changes have been beneficial to anadromous fish. Implementation of the 5C road manual and staff training should receive some of the credit for the changes but there has also been a general heightening of awareness about the potential impacts of crossings over the past decade. Some issues remain unresolved. For example, it is not always feasible to design a crossing to accommodate both fish passage and 100-year flows. This issue was settled in the Crannell Road project but county staff reported stalemates on the issue in other projects.

FLOOD CONTROL CHANNEL MAINTENANCE

We did not formally review any flood control maintenance projects in this assessment. We did, however, review flood control maintenance practices in the 1998 assessment and in other studies we did for FishNet 4C and in Santa Clara County. In general, “fish friendly” flood control maintenance entails managing channels and levees to retain riparian vegetation, minimize grading and channel disturbance, and retain large wood structures. Unfriendly practices include

clearing vegetation and woody debris in the name of maintaining channel capacity and levee integrity and periodic reshaping of channels.

Trinity County is responsible for maintaining the levees and flood control channel along East Weaver Creek in downtown Weaverville. This project was initially installed in 1965 under the auspices of the Corps of Engineers and remains within its system. In recognition of the value of the stream to anadromous salmonids, the county negotiated an agreement with DFG on channel maintenance. The essential elements of the agreement are that the county would retain mature riparian vegetation and do vegetation management on alternating 100-foot sections of the levee banks and channel. As a result of these practices, the stream has a dense and vigorous riparian corridor in some segments (Figure 29).

Figure 29: Riparian vegetation on East Weaver Creek in the vicinity of downtown Weaverville.

After the failure of levees due to Hurricane Katrina, the Corps asserted a more stringent set of requirements for vegetation management on its projects. These requirements are set forth in "Guidelines for Landscape Planting and Vegetation Management at Levees, Floodwalls, Embankment Dams and Appurtenant Structures" (Technical Letter No. 1110-2-571, April, 2009). In adopting these guidelines, the Corps essentially immediately put over 30 flood control agencies in California out of compliance.

The Corps guidelines require the removal of vegetation in channels and/or on levees to ensure that floodway capacity and levee integrity are maintained. The presence of vegetation in these areas is considered "deferred maintenance" that does not qualify for Corps funding. The Corps policy and provisions for variances from it, which are considered onerous, are of state-wide concern, particularly on flood control projects where vegetation was integrated into designs to mitigate impacts on fish and wildlife.

Inspections by the Corps of East Weaver Creek in 2008 and 2009 found the conditions "unacceptable". The county is now faced with the dilemma of either losing all potential financial support from the Corps, applying for and obtaining a variance (an expensive and time-

consuming job), or expending scarce funds to remove the extant vegetation to achieve compliance.

This issue is not limited to Trinity County. The Corps of Engineers levee vegetation policy affects three Humboldt County levee systems (Redwood Creek in Orick, Mad River in Blue Lake, Eel River near Fortuna). Inspection by the Corps found that vegetation conditions on the Redwood Creek levees were unacceptable. While the federal policy debate unfolds, Humboldt County's approach to levee vegetation maintenance is designed to balance different considerations based on site-specific conditions. Specifically, the county recognizes that vegetation can have beneficial as well as adverse effects on a levee embankment. It also recognizes the habitat value provided by stream-side riparian vegetation.

The resolution of this conflict between flood protection and anadromous fish habitat is pending at the date of this writing (November 2011). Studies on the effects of vegetation on levee integrity have recently been conducted and will have a bearing on Corps policy. Negotiations are underway between the Corps and local and state flood control agencies to develop a compromise. For the sake of the listed fish species, it is hoped that the benefits of riparian vegetation in and around flood control facilities will be recognized.

SUMMARY OF CONCLUSIONS

The conclusions presented below apply to the projects that we evaluated. This field assessment was constrained to some degree by availability of staff and scheduling. In addition, the assessment was performed during the summer and in some cases, the performance of projects we reviewed had to be inferred from other information such as project reports and photographs. Given these limitations however, our general conclusion is that changes in county on-the-ground practices to protect anadromous fish and their habitats have positively affected virtually every activity that they regulate or undertake. In some instances, contractor practices did not adhere to county standards and created temporary adverse impacts.

LAND DEVELOPMENT

- All of the counties require developments to be setback from streams, riparian zones and wetlands. The mechanisms for accomplishing this include zoning regulations, ordinances, and CEQA. The effectiveness and long-term sustainability of required buffers along streams in protecting anadromous fish is uncertain (see recommendations, below).
- Grading on development sites is subject to regulation by the counties and/or by the State (through General Construction Permits) and Regional Water Boards. Where erosion control measures are properly implemented, potential sedimentation effects are minimized. Unregulated or illegal grading, poor implementation of erosion control measures and lack of enforcement may still have impacts on anadromous fish.
- All of the counties require developments to minimize hydrologic effects such as changes in downstream flooding. All have increased restrictions on development in floodplains. LID techniques are applied to developments in some cases and their application is expected to increase in the future.
- Devices for treating non-point source pollution are routinely required in commercial and industrial developments and in some residential developments. Where retention facilities are

included in a development, they may serve the dual functions of mitigating hydrologic impacts and reducing non-point source pollution.

BRIDGES

- Bridge replacements have relatively limited impacts on anadromous fish. Replacements will commonly provide benefits, including improved passage of high flows, debris, and sediment and improved fish passage.
- Construction-related impacts of bridge replacements appear to be relatively limited.
- Bridge maintenance activities are influenced by the need to protect anadromous fish.

STREAM BANK STABILIZATION

- Stream bank stabilization projects have the dual benefits of protecting infrastructure or buildings and reducing sedimentation.
- Where feasible, the counties employ bioengineering approaches to their stream bank stabilization projects.
- Impacts of installing stream bank stabilization projects are subject to intense regulatory controls. Mitigation measures are required to minimize incidental take of listed species, disruption of habitat, and sedimentation.

STORM DAMAGE REPAIR

- Projects that repair damage to infrastructure after flooding events may have the benefit of reducing sedimentation and improving riparian vegetation cover.
- County responses to flood damage acknowledge the need to protect anadromous fish, even if permitting by regulatory agencies is not required.

FISH PASSAGE IMPROVEMENTS

- The counties have implemented dozens of projects to improve fish passage. As a rule, these projects have minimal adverse impacts.
- Major projects involving barrier removals and extensive channel changes may have short-term impacts, which are generally minimized through the application of Best Management Practices. Impacts are also subject to intense regulatory control by resource agencies.
- Regulatory relief for fish passage improvement projects that are not anticipated to have major impacts could expedite recovery of the listed species.

ROAD MAINTENANCE AND MODIFICATIONS

- The 5C road manual and the training programs offered by the 5C Program inform road management in the counties.
- The counties are undertaking projects to reduce sedimentation and hydrologic impacts of their road systems as time and resources allow.
- Activities potentially affecting anadromous fish such as poor revegetation of construction sites and improper disposal of spoils appear to be the exception rather than the rule. When these events occur, it is generally due to contractor performance. Counties require contractors to reverse or otherwise compensate for inadequate performance.

STREAM CROSSINGS

- Stream crossing maintenance and replacement projects may have the dual benefits of protecting and upgrading infrastructure and improving conditions for anadromous fish.
- The 5C road manual and training offered by the 5C Program have influenced projects involving stream crossings.
- It is not always feasible to achieve objectives for passing 100-year floods plus debris and sediment while ensuring fish passage for all life stages at critical flows. Sometimes the additional cost of building a crossing to meet 100 year flood flows is prohibitive in comparison to simply building it to allow for fish passage.

FLOOD CONTROL CHANNEL MAINTENANCE

- There is a current conflict between Corps levee and flood control channel maintenance requirements and the need to protect and enhance habitat for anadromous fish.
- The conflict has had an impact throughout the state and specifically on Trinity and Humboldt Counties. Non-conformance with Corps requirements can lead to reductions in funding to counties for maintenance.

RECOMMENDATIONS

Our recommendations are presented below in relation to the various activities that we evaluated. It should be noted that some recommendations apply to the counties and some apply to 5C Program staff and/or state and federal agencies. No entity is compelled to adopt or follow these recommendations. Nevertheless, they should be considered. Those pertinent to the state and federal agencies should be presented to them through 5C staff interactions and discussions.

LAND DEVELOPMENT

- It is anticipated that incentives and/or controls to reduce land development impacts will continue to evolve with increasing emphasis on Low Impact Development practices for stormwater control, non-point source pollution control, and minimizing surface water consumption in new development. This will reflect in project designs and measures routinely incorporated into development projects. We have no specific recommendations for changing the procedures used by the counties to process land development permits or approvals.
- Some counties are developing strategies to address the impacts of the recent shift in land use to marijuana cultivation. In doing so, counties are encouraged to consider protections for water quality and wildlife habitat.
- The issue of unregulated grading appears significant in some counties. Also, grading on minor projects that are not subject to regulatory control by the counties or other agencies may have direct and indirect impacts on anadromous fish and water quality. Addressing these issues may require collaborative efforts on the part of the counties and regulatory agencies. But there remains a strong interest by some county policy makers to rely on education over permitting. As a first step, counties should consider assessing the scope of the problem. At the present time, the problem(s) are not well documented.

- The CEQA process in some counties substitutes for ordinances or other regulations in mitigating many impacts of major projects. Where this occurs, planning staff indicate that sometimes adequate resources are not provided by the agencies charged with protecting public resources. Planning Commissions and the public would be better served if staff from these agencies were either more available during hearings on these matters or submitted more specific comments.
- More information is needed in order to assess the cumulative effects of minor projects that do not undergo the same level of environmental review as major discretionary projects. This information could be obtained in conjunction with the assessment of grading impacts suggested above.
- As noted above, the effectiveness of buffers set aside to protect riparian habitat and water bodies is uncertain, but all counties require some form of setback on some or all streams. The issues of buffer size and effectiveness have been subjects of debate for decades. For the counties, aside from having minimum buffer widths, the main issue is ensuring that they function properly over the long-term. As in 1998, we found that the long-term conservation and management of lands set aside as buffers to protect fisheries and riparian habitat is not assured. Education of county staff and reserve owners/managers, rather than regulation or unrealistic expectations of county oversight, may be the best way to address this issue. This education could be delivered through a collaborative effort involving 5C staff and partner organizations and agencies such as Resource Conservation Districts and UC Cooperative Extension.
- There are many policy and regulatory changes occurring now that have not yet had an effect on land development (e.g., land development manual in Siskiyou County, revision of code in Mendocino County, etc.). A future assessment that evaluates the effects of these changes on land development policy and regulation should be considered. Due to the timescale of land use activities, it would likely be many years before they would begin to reflect changes in policy that could be assessed in this manner.

BRIDGES

We did not observe any county practices associated with bridge maintenance or replacement that warrant recommendations for change. On the contrary, the counties are to be commended for the bridge maintenance and replacement practices that they are implementing, particularly in light of severe staffing and budget constraints. In cases of bridge projects aimed at improving fish passage, consideration should be given to providing the counties with relief from time consuming and expensive regulatory procedures (see below under Stream Bank Stabilization and Fish Passage for elaboration on this). Counties are encouraged to maintain close oversight on contractor performance and work to ensure violations such as water quality impairment do not occur.

STREAM BANK STABILIZATION

Although not within the power of the counties, there should be consideration given to providing regulatory relief on projects involving stream bank stabilization using bioengineering, large wood placement, and other biologically based “watershed friendly” techniques. Where restoration techniques provide equal or better stability, regulatory requirements should be reduced in view of the positive effects of these projects on fish habitat. In the cases we observed, standard mitigation measures and best management practices were always applied. We recommend that 5C staff continue their efforts to seek expedited processing of permits by regulatory agencies such as NMFS, DFG, and the Water Board.

STORM DAMAGE REPAIR

There is always uncertainty about potential environmental impacts of projects undertaken in emergency situations. Nevertheless, our observations indicated that sufficient attention was being paid to fish and fish habitat during emergencies and post-storm repairs. We have no specific recommendations for these projects. County staffs have indicated that it would be helpful to have emergency project permitting streamlined or at a minimum have dedicated staff that are familiar with emergency response processes.

FISH PASSAGE IMPROVEMENTS

- The recommendation given above for regulatory relief in relation to bridges and slope stabilization projects applies to fish passage improvements (i.e., these projects generally benefit fisheries and should be provided with some relief from expensive and time-consuming regulatory requirements).
- The recommendation in the bridges section above for contractor oversight also applies to fish passage improvement projects. Particular attention should be paid to making sure contractors adhere to project designs to ensure that the project will perform as intended and does not have any adverse short or long term impacts.

ROAD MAINTENANCE AND MODIFICATIONS

County road management practices improvements were noted in all counties compared to the 1998 inventory. The completion of a roads manual and yearly training offered by the 5C Program staff were cited as an asset to the counties in complying with sediment TMDLs and other regulatory requirements. The only recommendations are:

- Continued implementation and refinement of road maintenance BMPs.
- Adapting trainings to meet participant skill and knowledge needs.
- Encouraging the attendance of as many staff members as is practical at BMP trainings.

STREAM CROSSINGS

In limited instances, there may be design constraints about which counties and one or more regulatory agencies may not agree relative to stream crossing designs. In particular, there may be design issues related to fish passage, flood flow, and debris movement capacity that stifle project permitting. Our observations indicated that fish passage objectives sometimes prevail in such cases. However, there could be instances where restoration projects that are not driven by structural or safety deficiencies could be delayed if resolution on design constraints cannot be achieved. Fish passage objectives should always be met in designs. In all but the most constrained instances, flow and debris objectives should also be met.

FLOOD CONTROL CHANNEL MAINTENANCE

For flood control facilities owned and operated by the counties, it is likely that fish-friendly practices such as retaining riparian vegetation are the rule. This is not the case for facilities where the Corps is the governing entity. The current conflict over management should be resolved. This will require efforts of organizations outside of the five counties.